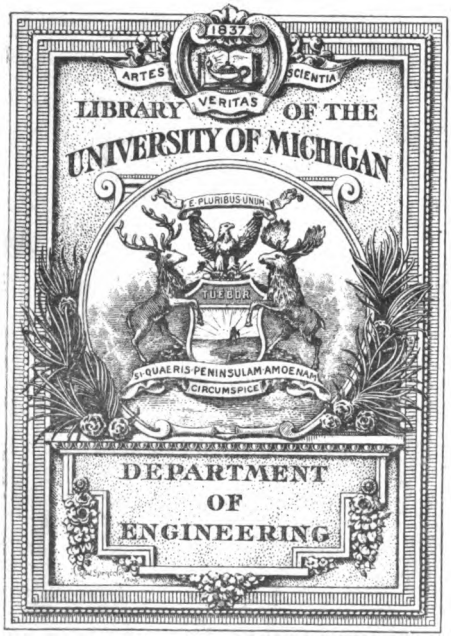
DICTIONARY OF AUTOMOBILE TERMS

ALBERT · L · CLOUGH



A Dictionary

OF

Automobile Terms

BY

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PREFACE

This book represents a serious and painstaking endeavor to arrange alphabetically the mass of terms which current usage applies to the motor car and its accessories, and to define these terms clearly, concisely and in language as untechnical as the nature of the subject permits.

So far as is known, this is the first Dictionary of Automobile Terms to be compiled, and the author has thus not had the advantage of precedent to guide him, the work being of a pioneer character and subject to all the limitations necessarily characterizing a first attempt to systematize the vocabulary of a new art, which is not yet entirely out of the formative stage.

Nearly all the material here presented originally appeared in serial form in the columns of THE HORSELESS AGE, but it has been thoroughly revised and corrected and considerably augmented before being embodied in book form.

During the period covering the development of the motor car industry in this country, a large body of terms has been coined, borrowed from other languages or adapted, with new significations, from the vocabularies of other arts, and it has not only proven a difficult matter for the general public and even the users of motor cars to become conversant with the exact meanings and uses of these terms, but it has been demonstrated that many of these terms have come to be used with indefinite or even contradictory significance by persons technically skilled in the art.

It is with the double purpose of informing the general public and students of the automobile as to the commonly accepted meanings of these terms, and with the hope that, in a general way, the definitions herein suggested for them may be accepted as suitable and standardized by a majority of those identified with the industry, that this book has been brought out.

Many thousands of people each year enter the automobile market with the intention of buying a motor car, or at least of informing themselves concerning automobile technique. In the course of their investigations they read masses of automobile catalogues, couched in technical language, and converse with nu-

merous motor car users and salesmen. While so doing they are constantly confronted with technical terms, the meanings of which they do not understand, but which have a most important bearing upon the problem in hand.

It is hoped that, by reference to this book, the meanings of these terms may be made clear not only to the intending purchaser but to the student of automobile engineering and to all others who take interest in the subject.

A word as to arrangement may not be amiss. Nearly every important component part of an automobile is built in a wide variety of "types" or forms, each one of them known by an appropriate descriptive prefix. Thus there are "air cooled cylinders," "water cooled cylinders," "block cast cylinders," etc. These various types in which a certain component part figures in the industry will, in general, be found grouped together under the name of the part and not under the name of their respective descriptive designations. Thus the types of cylinder mentioned above will be found under "cylinder" and defined under the titles of "cylinder, air cooled," "cylinder, water cooled" and "cylinder, block cast."

The author takes this occasion to express his appreciation of the assistance offered by P. M. Heldt and others of THE HORSELESS AGE staff and by several prominent members of the Society of Automobile Engineers, who have afforded useful hints and suggestions.

ALBERT L. CLOUGH.

MANCHESTER, N. H., December, 1912.

DICTIONARY
OF
AUTOMOBILE TERMS

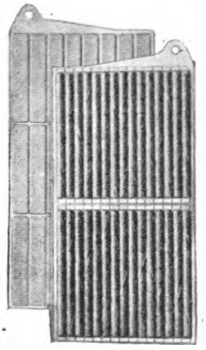
Ability—A term sometimes employed to express the relationship between car weight and engine output, more particularly used in estimating the hill climbing and speed capability of cars. No unit of ability has been agreed upon, but the output of the motor in horse power, or its piston displacement, divided by the weight of the car in hundredweights has been proposed. Thus, a car with a 30 horse power motor, and weighing 3,000 pounds, would possess an ability of 1.0, or would possess one horse power per hundred pounds of weight. Quite commonly the reciprocal of this unit is used by manufacturers, viz., the car weight in pounds divided by the output of the motor in horse power; or, in other words, the car weight per horse power.

Accelerate—To increase in velocity or speed.

Acceleration—The rate of increase in the speed or velocity of a moving body. Strictly speaking, the limiting ratio of the gain in velocity during an infinitely short period of time to the length of the period of time itself. In practice, acceleration is generally measured in feet per second per second. Example: If at a certain instant a car is moving at the rate of 40 feet per second, and a second later is moving at the rate of 45 feet per second, its acceleration is at the rate of 5 feet per second per second.

Accelerator—A device for the direct and rapid control of car speed by opening and closing the throttle. The term is usually applied to the pedal and attached parts which perform this function independently of the hand throttle (which can be set for any desired degree of opening), and of the automatic engine speed governor. Car speed is usually increased by the action of the foot upon the accelerator pedal, and is automatically decreased, to a predetermined point, by the action of an attached spring.

Syn.; Foot throttle.



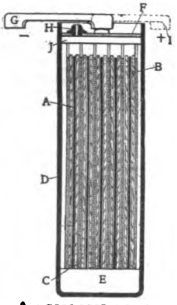
POSITIVE AND NEGATIVE OF EDISON TYPE ACCUMULATOR.

Accumulator—Edison type. An electric storage or secondary cell the positive plates of which consist of nickel plated steel frames containing steel tubes filled with nickel hydrate, the negative plates consisting of similar frames containing pockets filled with iron oxide. The two sets of plates are immersed in a solution of caustic potash contained in a nickel plated steel jar. The method of use and the applications of this cell are similar to those of the lead cell.

Syn.: Secondary cell, storage cell.

Accumulator—Lead type. An electric cell consisting of two sets of plates immersed in dilute sulphuric acid within a containing jar, usually of glass or hard rubber. The plates of one set are known as positives, and consists of grids or frames of specially prepared lead, the interstices in which are filled with lead peroxide. The plates of the negative set are lead grids filled with spongy lead.

When the positive plates of such a cell are connected to the positive pole of a circuit carrying continuous current (and vice versa), chemical changes take place and the cell becomes charged. When so charged the cell itself will furnish current to a circuit until its available chemical energy is exhausted, when recharging becomes necessary. A number of such cells electrically connected constitute a storage battery or secondary battery, which may be used to drive an electric vehicle or to furnish lighting or ignition current.



ACCUMULATOR—LEAD TYPE (SECTIONAL VIEW)

A—Positive Plate;
B—Negative Plate;
C—Separator;
D—Hard Rubber Jar;
E—Bottom Rib;
F—Top Sealing;
G and I—Connectors;
H—Vent Hole;
J—Negative Strap.

Acetylene—A hydrocarbon (C_2H_2) used as an illuminant in automobile lamps. It is produced by the reaction of water upon calcium carbide. In automobile lighting it may be produced, as consumed, in an automatically regulated generator, or may be

drawn as desired from a storage tank in which the gas is carried under pressure dissolved in acetone or some similar absorbent.

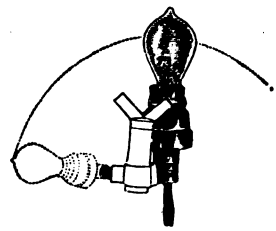
Acetylene Torch—A torch used in heating the pilot light of a steam car, which burns acetylene gas derived from a supply carried upon the car.

Acid Cure—A method of curing rubber quickly, and without the application of heat as required in true vulcanization. It is employed in the securing of patches to inner tubes and in other tire repairs. Chloride of sulphur is supposed to be the agent employed to produce a sort of vulcanizing effect.

Active Material—The material which fills the spaces provided for it in the grids or frames that form the plates of storage cells. This material is the seat of the chemical changes which enable the cell to store and restore electrical energy, the grids themselves acting only as conductors. (See Accumulator.)

Adapter—A device for attachment to a gas or oil lamp to permit the use of an electric light therein, consisting of an electric lamp socket and bulb, with suitable electrical connections attached to a fitting which may be substituted for the gas or oil burner or clamped upon the same. In the latter case the fitting is hinged so that the electric bulb may be swung out of the way when the gas or oil burner is to be used.

Syn.: Converter.



ADAPTER.

Adhesion, Coefficient of—The ratio of the maximum tractive effort (q. v.), which can be applied by a driving wheel, without causing the same to slip, to the weight acting at the point of contact of the wheel with the roadway, both forces being expressed in the same unit, usually the pound. It varies with the kind of tire used and the character and condition of the road surface, having a value in the vicinity of 0.6 for a pneumatic tire on dry, smooth macadam and as low as 0.05 or even lower for such tires on wet snow, or very greasy mud; e. g., a pneumatic tired wheel carrying 800 pounds may be expected to slip on dry macadam if a tractive effort greater than about 480 pounds is exerted by it and to slip on soft snow if the tractive effort exceeds 40 pounds.

Advance—A term used with reference to the point in the cycle of operations (q. v.) at which the igniting spark passes within the fuel charge of an internal combustion engine.

v. To cause the spark to pass at a relatively earlier point in the cycle of operations.

n. (Angle of) advance: The angle through which the crank shaft of a motor turns between the point at which the spark producing mechanism acts and the point at which the piston reaches its extreme position on its compression stroke (its extreme upward position in the case of a vertical motor).

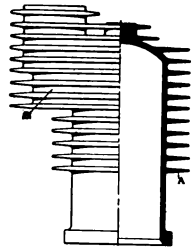
Age (v.)—To lay aside a casting, for a period of time, after it has been roughly machined, in order to permit any changes of form caused by internal stresses in the metal to take place before it is finished to its final form and thus to obviate the possibility of distortion taking place later. Syn.: To season.

To lay aside a permanent magnet, after it has been charged, so that any loss of magnetism may take place at that time, rather than when the magnet is in service. Such ageing is sometimes artificially accomplished.

AIR BOTTLE.

Air Bottle—A receptacle designed to be conveniently carried upon a car, containing highly compressed air or liquified carbon dioxide, to be used in the inflation of tires. Generally a strong steel cylinder fitted with cock, rubber tubing and tire valve connection.

Air Bound, Adj.—The condition created in a system designed for the free flow of a liquid, occasioned by the access of air or vapor to certain portions thereof, by which the flow is checked. Generally applied to the water or fuel feed systems of automobiles.



AIR COOLED CYLINDER.

A—Cooling Flange;
B—Valve Chamber.

Air Cooled, Adj.—Cooled by air. Generally applied to the cylinder of an internal combustion motor, the temperature of which is maintained at a point low enough to enable lubrication to be maintained, and the fuel charges to be efficiently expended, by the direct application of a current of relatively cool air to the external surfaces of the cylinder from which heat is thereby abstracted by convection and radiation.

Air Cooling—The practice of cooling a cylinder by the direct application of air thereto.

Air Damper—A damper inserted in the air intake of a carburetor which is normally kept open, but which, when closed, causes the carburetor to deliver a very rich mixture in order to facilitate starting the motor. Syn.: Starting shutter, primary air shut-off. Also an adjustable valve in the main air intake of the carburetor used in regulating the quality of the fuel mixture.

Air Gauge—A gauge which indicates the degree of pressure which is acting upon the fuel, in a pressure feed system to cause it to flow from the tank to the carburetor. Also sometimes applied to a gauge for measuring the air pressure in pneumatic tires. A tire gauge.

AIR GAUGE.

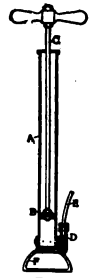
Air Intake, Auxiliary—The orifice through which additional air is admitted to the carburetor to prevent the mixture from becoming too rich under certain conditions. This opening is usually controlled by a valve regulated in some manner by the action of the carburetor itself.

Syn.: Supplementary air intake.

Air Intake, Main—The orifice through which the main air supply for the carburetor enters, and the piping through which it passes. The air thus entering generally passes in close proximity to the fuel jet, and the size of the opening is usually permanently adjusted. Syn.: Primary air intake, initial air intake, fixed air intake.

Air Leak—The accidental entrance of air into the fuel mixture after it leaves the carburetor.

An aperture through which such air can enter and thus weaken the mixture, in some cases interfering with the operation of the motor. E. g., looseness between the intake valve stems and their guides; lack of tightness in intake pipe connections.



AIR PUMP.
A—Cylinder;
B—Piston;
C—Piston Rod;
D—Delivery Ball Valve;
E—Delivery Tube;
F—Stirrup.

Air Pump—A pump operated either by hand or by engine power to produce an air pressure upon the fuel in the supply tank to force it to the carburetor in the case of a gasoline car, and to the burner in the case of a steam car.

Air Resistance—The resistance offered to the motion of a car by the air through which it moves and which is directly proportional to the area it exposes to the air in the direction of motion (projected area) and to the square of the car speed. This resistance expressed in pounds may be taken as $r = 0.0022\ AV^2$ where A is the projected area in square feet and V the velocity of the car in feet per second. To convert miles per hour into feet per second, multiply the miles per hour by 1.466. The horse power absorbed in overcoming air resistance is

$$H.\ P. = \frac{A\ V^3}{240{,}000}\ (Brooks);$$

e. g. at 40 miles per hour, a car of 20 square feet projected area moving against an air resistance of 152 pounds, calls for an expenditure of 16 H. P.

The above formula applies to motion through still air. Under other conditions the velocity of a head wind is to be added and the velocity of a following wind subtracted from the car velocity to obtain the air resistance and the power required to overcome it.

Air Vent—A small aperture provided in a tank or other part of a liquid-containing system to permit the entrance and exit of air, so that the movement of the liquid may not be interfered with. E. g., the small hole usually provided in the filling plug of the fuel tank in a gravity feed system.

Alignment—The state of being perfectly in line. Applied, for example, to the several bearings which support a shaft. When these bearings are exactly in the same straight line they are said to be in alignment, and the shaft can turn in them without binding, and without excessive waste of power or undue wear. Also applied to two connected shafts the bearings of which are exactly in the same straight line, so that no motion between their connected ends is required when the shafts turn. Also applied to a condition of parallelism between the road wheels of an automobile.

Alloy Steel—Steel which, in addition to its carbon content, contains a certain intentional proportion of one or more other elements, such as nickel, chromium, manganese, tungsten, vanadium, silicon, etc. The presence of certain proportions of these elements greatly alters the physical properties of the metal in numerous respects, such as hardness, strength, elastic limit, ductility, ability to withstand repeated shocks, magnetic qualities,

etc. Alloy steels of appropriate qualities are very largely used for the important parts of motor cars. (See steel.)

Alternating Current—An electric current which is produced in a circuit by the action of an electromotive force that periodically alternates in direction. The direction of flow of such a current reverses with each reversal of the electromotive force producing it. The commercial alternating current generally employed for lighting and power alternates in direction 120 times per second. The alternating current is, in general, not adapted to the production of chemical changes, and is thus not directly applicable to the charging of accumulators.

The term is used in contradistinction to the terms "continuous" and "direct," which are applied to currents flowing in a constant direction.

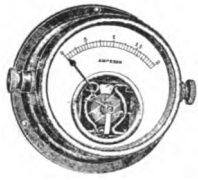
Aluminum Alloy—The following are specifications for aluminum alloys employed for crank and gear cases, housings, cover plates and the like, because of their lightness.

No. 1. Aluminum not less than 90.00%, copper 7.00% to 8.50%.

No. 2. Aluminum not less than 80.00%, zinc not over 15.00%, copper from 2.00% to 3.00% and manganese not over 0.40%.

No. 3. Aluminum 65.00%, zinc 35.00% (a rather brittle, weak metal, inferior to Nos, 1 and 2).

Ammeter—An instrument for the measurement of the rate of flow of electricity in a circuit, or, in other words, for the measurement of the volume of the electric current flowing. Ammeters are usually constructed upon the electromagnetic principle, the electromagnetic effect of the current, and hence the indications of the instrument, increasing and decreasing with the increase and decrease of the current flowing through the circuit into which the ammeter is connected. The readings of such an instrument are in amperes.



AMMETER.

Syn.: Amperemeter.

Ammeter, Coil Testing—A low reading ammeter, usually calibrated to read to 0.1 ampere or lower, which is especially adapted to be conveniently inserted in circuit with the primary of a jump spark coil. It is used to measure the current which a coil passes and in adjusting the several units of a multiple coil to equality in current consumption. It is also employed

to detect excessive demands upon the batteries for current on the part of the coils.

Ampere—The practical unit of current volume. The unit which is employed in measuring the rate of flow of electricity in a circuit. The current which, steadily applied for one second, will deposit 0.00113 grams of silver from a bath of silver nitrate.

Amperage— The volume of an electric current expressed in amperes.

Ampere Hour—The quantity of electricity which passes in an electric circuit when a current of one ampere flows for one hour. The unit of quantity of electricity.

The term is principally used in connection with the charge and discharge of storage batteries; e. g.: A storage battery which is charged for a period of seven hours at the rate of 10 amperes has received 70 ampere hours of electricity. Storage batteries are commonly rated by their capacity in ampere hours; thus a 60 ampere hour (a. h.) ignition battery should be able to deliver a current of 5 amperes for a period of twelve hours when fully charged.

Ampere Hour Meter—An instrument for measuring and recording the ampere hours of electricity which flow through a circuit into which it is connected.

It consists of a small electric motor, the speed of which is directly proportional to the current passing through the circuit. This motor drives clockwork and an indicating dial, the reading of which is in ampere hours.

Such an instrument is sometimes carried upon an electric vehicle, being used to record the ampere hours of electricity supplied in charging the battery and also the ampere hours given out by the battery on discharge. By its use the state of charge of the battery, at any time, may approximately be ascertained.

Angle Iron—A piece of metal in the form of an angle or L, used as a brace for parts which are to be held in a definite angular relation.

Angle Steel—A form of structural steel bars or beams, the cross section of which is an angle or L, sometimes used in automobile frame and sub-frame construction. This form of cross section secures greater rigidity against transverse deflection than afforded by the same amount of metal in a circular or square cross section.

Anneal (v.)—To soften a metal by heating. Annealing usually increases the malleability and ductibility of a metal and reduces its elastic limit. Steel may be annealed by heating it to an appropriate degree and then allowing it to cool gradually.

Annealing is frequently resorted to in order to relieve internal stresses set up in metal parts in the processes of rolling, forging, casting and hardening.

Syn.: To draw the temper.

Anti-Freeze Solution—A liquid used as a substitute for water in the engine cooling system of a gasoline automobile which is capable of remaining fluid at the freezing temperature met with in practice.

Solutions of certain neutral salts, alcohol and glycerine are used for this purpose and also special mineral oils. Particular solutions are treated later under their respective names.

Anti-freeze solutions are also used in acetylene generators, instead of water, during cold weather.

Syn.: Non-freezing solution.

Anti-Skid Device—A device applied to the wheels of an automobile, designed to enable them to obtain more secure footing upon the road surface than is realized by the use of ordinary smooth rubber tires, and thus to decrease their liability of skidding or slipping sidewise. Such devices usually consist of special knobbed or metal studded tire treads or a series of cross chains secured about the tire. (See tire chain, tire protector, tire tread.)

Syn.: Non skid device, traction increasing device.

Apron—A term sometimes applied to extensions of metal, fabric or leather attached to the fenders of a car to further guard the car from road splash. Also sometimes applied to a sort of boot placed under the mechanism to protect it from road dirt.

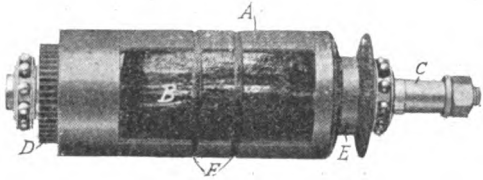
Arc Flame—An electrical discharge which resembles the voltaic arc, in that it is not of an instantaneous, disruptive character, but persists for an appreciable length of time, and is due to the passage of a considerable quantity of electricity at a relatively low pressure through a spark gap which has been rendered conductive by the passage of a high tension, disruptive discharge. The term is applied to the discharge of a high tension magneto in which both primary and secondary windings are under the influence of the same magnetic field.

Armature, Magnetic—A piece of magnetic material the function of which is to assist in conducting the magnetism from one pole of a magnet to the other. In practice, a piece of soft iron movably mounted in proximity to the pole or poles of an electromagnet and adapted to be moved by attraction thereof. E. g., the iron portion of a coil vibrator which is attracted by the pull of the core of the coil and returned to its initial position by a spring

Syn.; Keeper. Also, the soft iron portion of a magneto or dynamo which carries or is enclosed within the conductors in which the current is generated. Usually but not always a rotating part.

Armature Core—The soft iron portion of the armature of a dynamo, magneto or electric motor, upon which are wound the conductors which carry the currents developed by or utilized by the machine. It is built up of appropriately shaped stampings of thin, very soft iron or special steel, insulated from each other and tightly clamped together upon a shaft, so as to form a solid magnetic mass of a generally cylindrical form, slots usually being provided in its surface to receive the conductors.

See core, magnetic, and cut of magneto armature.



MAGNETO ARMATURE.

A, Core; B, Winding; C, Shaft; D, Driving Gear; E, Collector Ring; F, Binding Band.

Armature Pinion—A small gear or pinion fixed upon the shaft which carries the armature or rotating part of an electric vehicle motor and which transmits the power to the rest of the driving mechanism.

Also, a small gear or pinion fixed upon the shaft that carries the armature of a synchronous magneto. This pinion drives the distributor shaft of the magneto.

Armature Shaft—The shaft upon which is mounted the armature of a dynamo, magneto or electric motor.

Armature Winding—The electrical conductors upon an armature in which are generated the currents produced by a dynamo or magneto, and which, in an electric motor, receive the

current used in the machine. Highly insulated copper wire is used.

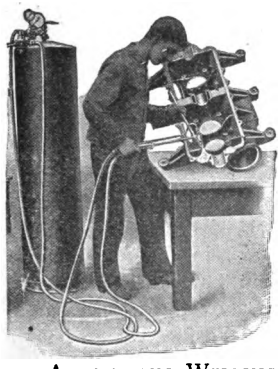
Artillery Box—A box fitted to the rear deck of runabouts to provide extra carrying space for tools, etc. So called because of its resemblance to the boxes used upon field gun carriages.

Aspirating Stroke—The outward piston stroke of an internal combustion motor during which the explosive charge is introduced into the cylinder from the carburetor through the inlet valve, by the suction created by the piston movement.

Syn.: Suction stroke, charging stroke, intake stroke.

Assemble v.—To put together the various component parts of a motor car in their correct relationship.

Assembled Car—A car the important parts of which, such as the motor, gear box, axles, body, etc., are produced by several different makers of these parts and are then brought together at the factory of the manufacturer, whose name the car bears, where they are assembled with other parts into a complete vehicle. The term is employed in contradistinction to that class of cars the chief parts of which are produced by the concern whose name the car bears.



AUTOGENOUS WELDING.

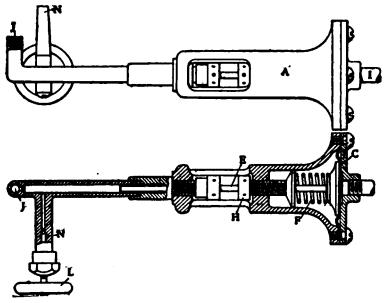
Autogenous Welding—A method of welding or joining metals without hammering or the use of heavy pressures between the parts to be joined. The parts to be welded are correctly brought together and an exceedingly hot, non-oxidizing flame, produced by a blowpipe burning acetylene in an atmosphere of oxygen, is directed upon the junction. The abutting edges of the parts are thus melted and flow together, and a very intimate and strong joint results. Any extra metal which is required to make a smooth weld is supplied from a wire or rod of the same material as the parts, the end of which is held in the flame. The process

is very commonly applied to the joining of the edges of the pressed steel parts of automobiles.

Automatic Cut-out—A device used in connection with a battery charging circuit for the purpose of automatically disconnecting the storage battery from the charging circuit when the current tends to flow back from the battery to the dynamo on account of low dynamo speed or high battery voltage or when the current flowing becomes excessive from any cause.

Syn.: Automatic circuit breaker, reverse current circuit breaker, low voltage release.

Automatic Fire Regulator—A device employed on steam cars to regulate the fire under the boiler, so as to maintain a constant pressure therein, independent of variations in the demand for steam. It usually consists of a flexible diaphragm acted upon by the boiler pressure and a suitable linkage communicating the motion of this diaphragm to a valve in the fuel supply of the burner. When the steam pressure exceeds the desired amount, the diaphragm acts to diminish the fire and vice versa. In the case of "flash" steam generator, the diaphragm is replaced by a thermostat, which is sensitive to the temperature of the metal of the generator. The thermostat acts to maintain the generator at a constant temperature independent of the rate at which water is supplied for steam raising. As the temperature of the generator falls, the thermostat opens the fuel valve of the burner, thus increasing the fire, and vice versa.

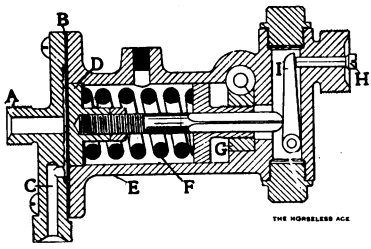


ELEVATION AND SECTION OF AUTOMATIC FIRE REGULATOR.

A, Housing; C, Diaphragn; E, Valve; F, Spring; H, Adjusting Screw; I, Connection to Water Space of Boiler; J, Gasoline Feed; L, Needle Valve; N, Needle.

Syn.: Automatic fuel feed.

Automatic Spark Advance—See timer, automatically advanced.



SECTIONAL VIEW OF AUTOMATIC WATER FEED.

A, Connection to Generator; B, Copper Diaphragm; C, Connection to Steam Gauge; D, Diaphragm Pad; E, Housing; F, Spring; G, Adjusting Nut; H, Poppet Valve; I, Lever Arm.

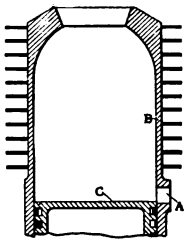
Automatic Water Feed—A device used upon steam cars of the "flash" generator type, which acts to regulate the amount of water pumped to the generator so that the pressure therein is maintained at nearly a constant amount, independent of the rate of demand for steam. A flexible diaphragm, under the influence of the steam pressure, is usually employed, which is mechanically connected so as to actuate a water pump by-pass valve. As the steam pressure drops, the diaphragm partly closes the by-pass, allowing the pump to feed water to the generator at an increased rate and vice versa.

Auxiliary—A term applied to those devices connected with a gasoline engine, which are essential to its operation and driven by it, but which are separate units distinct from the motor itself, such as the circulating pump, the mechanical lubricator and the magneto. The use of the term is sometimes broadened to include the carburetor, radiator, muffler, etc.

Auxiliary Air Valve—The valve which controls the ingress of air through the auxiliary intake (see air intake, auxiliary) of a carburetor. It may, for instance, be in the form of a butterfly valve or shutter, which is mechanically connected to the throttle, so that it is opened and closed correspondingly therewith. It may be a poppet valve which is opened by the suction of the engine against the action of a spring, or it may be a series of balls which are lifted from their seats against gravity by the suction or some other equivalent arrangement.

Syn.: Supplementary air valve.

Auxiliary Exhaust—An arrangement for rapidly clearing the cylinder of a gasoline engine of spent gases, used in addition to the regular exhaust valves. Slightly above the extreme



AUXILIARY EXHAUST
A, Exhaust Port.
B, Cylinder; C, Piston.

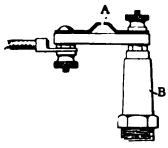
lowest position of the piston head, ports are cut through the cylinder walls, and, as the piston nearly reaches the end of its power stroke, the piston head uncovers these ports. A mechanically operated valve is sometimes used between each auxiliary exhaust port and the exhaust manifold.

Auxiliary Fuel Tank—A tank arranged to be carried upon a car and adapted to hold a supply of fuel in addition to that carried in the main tank, for use in case the main supply has accidentally become exhausted. Such a tank may be a portable one, the contents of which are emptied into the main tank, or it may be a separate compartment built into the main tank, which may be connected to the carburetor supply piping by the opening of a valve, which is normally kept closed.

Syn.: Emergency gasoline tank, reserve gasoline tank.

Auxiliary Oil Tank—A tank containing a supply of lubricating oil in addition to that contained in the lubricating system of a gasoline vehicle motor. It it connected to the engine lubricating system by a pipe fitted with a valve, and when the oil supply in the engine becomes low or vitiated by long use, the valve is opened and the requisite amount of fresh oil is fed to it from the auxiliary tank.

Auxiliary Shaft—A shaft turned by the vehicle motor, which drives the auxiliaries such as the circulating pump, the magneto and the mechanical lubricator.



AUXILIARY SPARK GAP (A).
B, Spark Plug.

Auxiliary Spark Gap—A device employed in connection with jump spark plug circuits, which is intended to insure the passage of a spark even though the plugs are sooted or oily. It is merely a short gap or break, additional to that between the sparking points, which is introduced into each plug circuit. Its function is to prevent the gradual leakage of the sparking current through the sooted spark-plug ends or other electrical defects, and to insure that no current passes until an electrical pressure adequate to produce a spark is attained. This

device is at present little used in separate form, but the principle underlying it is frequently embodied in ignition apparatus.

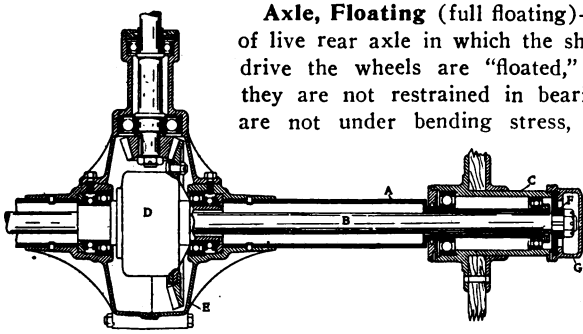
Axle, Cambered—An axle which is so formed or set that its ends, upon which the wheels are carried, are given a slight slant downward from the horizontal. This causes the wheels to converge slightly toward their points of contact with the ground. The camber or set of an axle, if dished wheels are used, brings the spokes which are under load in a truly vertical position, thus utilizing the full strength of the wheel.

Axle, Channel Section—An axle the cross section of which is of a U shape. (See channel.)

Axle, Dropped—An axle so formed that the whole or a part of the portion between its ends is on a lower level than the ends themselves, upon which the wheels turn. The form of such an axle is that of a shallow U.

Axle, Equalizing—A live axle in which is incorporated special mechanism permitting the two wheels driven thereby to freely turn at different speeds when curves are traversed—a substitute for the ordinary type of live axle in which the above result is secured by the use of a differential or compensating gear.

Axle, Floating (full floating)—A form of live rear axle in which the shafts that drive the wheels are "floated," that is, they are not restrained in bearings and are not under bending stress, as they



SECTIONAL VIEW OF FULL FLOATING REAR AXLE.

A, Axle Housing; B, Shaft; C, Hub; D, Differential Housing; E, Bevel Gear Housing; F, Clutch; C, Hub Cap.

support none of the weight of the car, but act only under twisting stress. The axle casing or housing supports all the weight. This result is attained by supporting each wheel bearing upon the outside surface of its end of the casing and by supporting the frame of the differential gear rigidly upon the inside of the casing. The inside ends of the driving shafts are usually squared into the hubs of the main gears of the differential, in a slightly flexible manner, and each outside end of the driving shafts is provided with some form of jaw clutch member which engages with a corresponding clutch member on its respective wheel hub, a slight degree of flexibility to changes of alignment being permitted. Superior strength and the readiness with which it may be taken apart are the chief advantages of this type of axle.

Axle, Flared Tubular—A live axle, the tubular casing or housing portion of which increases in diameter from a point near each wheel to the central portion where the driving and compensating gears are located. This flared form of casing is adopted in order to secure increased resistance to bending stresses.

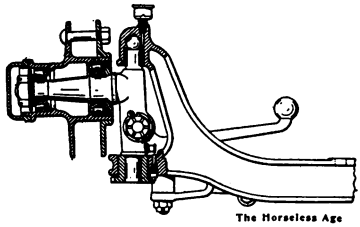
Axle, I-Beam—An axle the cross section of the metal of which is generally forged, but occasionally cast into the form of an I. This form of cross section affords a degree of rigidity, particularly to transverse stresses in a vertical plane, greatly superior to that afforded by the use, for instance, of a solid square or circular section containing the same mass of metal. This form of cross section is generally employed for front axles and sometimes for fixed rear axles.

Axle, Live—A form of axle in which are incorporated the two driving shafts that transmit the motive power to their respective wheels. In the restricted sense, the typical form of non-floating live axle, in which each driving shaft is restrained in two bearings carried by the inside surface of the tubular casing, one near its outer end, under the spring, and the other near its inside end, where it is secured to its respective main gear of the differential. The driving shafts thus carry the weight of the differential and drive gears, any transverse stresses due to the driving effort, and the entire vehicle load which falls upon the axle. This type of live axle is becoming obsolete. All gear or worm driven cars, and all cars driven by a single chain are fitted with axles which are

"live" in the general sense of the term, but not necessarily so in the restricted sense.

Syn.: Divided axle.

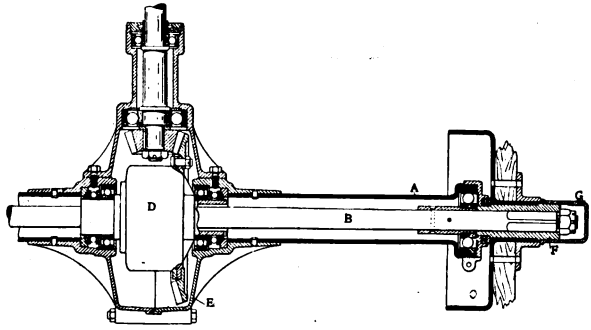
Axle, One Piece—A fixed or solid axle, which is forged, cast or pressed complete as a single piece and not forged in two pieces which are subsequently welded together. Sometimes applied to a front axle in which the axle itself, the spring seats and the steering yokes are formed integrally.



SECTIONAL VIEW OF PIVOTED AXLE.

Axle, Pivoted—A form of axle peculiar to self-propelled vehicles, which carries the steering wheels and is generally the front axle. Each end thereof is vertically forked and a vertical pivot turns in each of these forks. To these pivots are attached the horizontal swinging spindles or axle stubs upon which the road wheels are journaled. By this arrangement the front wheels may be set in any desired vertical plane and steering effected without moving the axle, as a whole, as in horse-drawn vehicle practice. (See steering.)

Axle, Semi-Floating—A form of live axle in which the driving shafts are rigidly restrained in bearings at their outer



SECTIONAL VIEW OF SEMI-FLOATING REAR AXLE.

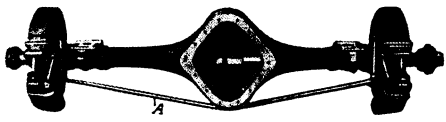
A, Axle Tube; B, Axle Shaft; D, Differential; E. Driving Gear Casing; F, Wheel Hub; G, Hub Cap.

ends only, these bearings being supported upon the inside surfaces of the ends of the tubular casing and the wheels rigidly mounted upon the shaft ends. The inside bearings are supported by the hubs of the differential case, and the inside ends of the axle shafts are somewhat flexibly squared into the main gears of the differential, so that they are relieved from carrying the weight of the differential.

Axle, Solid—An axle which does not revolve, and upon the ends of which the road wheels turn. Similar in principle to the axles of horse-drawn vehicles. The term is used in contradistinction to the term live axle, and is generally applied to the stationary rear axles of automobiles, the wheels of which are independently driven, usually by chains or gears.

Syn.: Fixed, stationary or dead axle.

Axle, Three-Quarters Floating—A form of live axle, intermediate between the semi-floating and full-floating types, in which the inside ends of the axle shafts are somewhat flexibly squared into the main differential gears, as in the semi-floating and full-floating types. The bearings of the outside ends of the axle shafts are upon the outside surfaces of the tubular casing and directly in the wheel hub, so as to relieve the shafts of car weight, but the wheels are rigidly fixed upon the shaft ends instead of being flexibly driven by means of a clutch connection as in the full-floating type.



AXLE, TRUSSED.
A, Truss Rod.

Axle, Trussed—An axle which is strengthened against bending by means of a truss, of which the gear housing usually forms the strut of the truss and a rod adjustably attached to the ends of the tubular casing and centrally secured to the gear housing forms the tension member.

Axle, Tubular—An axle formed of steel tubing.

Axle, Universally Jointed—A form of axle in which the axle shafts consist each of two or three parts connected to

each other by universal joints. These joints are required in axles in which the differential and wheel hub centre lines do not necessarily coincide.

Axle Casing—The portion of a live axle which encloses the axle shafts—sometimes extended to include the metal enclosing the differential and drive gears, which is generally integral therewith. The casing is usually of tubular form of varying diameter.

Syn.: Axle housing.

Axle Shaft—The shaft of a live axle which transmits the driving effort from the differential gear to one of the road wheels. There are two of these driving shafts in each axle.

Axle Shaft Clutch—The clutch or coupling which transmits the driving effort from each shaft of a full floating axle to its corresponding road wheel hub. This clutch may be of the jaw or dog type or in the form of a pair of coarsely toothed gears. One member thereof is carried by the outer end of the shaft and the other by the wheel hub, and in the formation of these members a certain degree of angular flexibility is generally provided for.

Babbitt—An alloy used for the linings of shaft bearings, which possesses excellent anti-friction properties and which is not likely to mar the shafts which run upon it. It is readily melted and cast into the form required to fill the space between the shaft to be supported and the caps and stands of the bearing or journal. Babbitt or some similar alloy is generally used for gasoline engine crank and cam shaft bearings, for connecting rod tip bearings, and elsewhere. Its composition is somewhat variable, but the following is a commonly used formula: Tin, 84.00 per cent.; antimony, 9.00 per cent.; copper, 7.00 per cent. Alloys known as nickel babbitt and white bronze are extensively used in place of true babbitt.

Backfiring.—The communication of the flame of explosion in a gasoline engine cylinder to the gas in the intake piping and that in the carburetor, resulting in an explosion of the same, the noise of which is known as "popping" in the carburetor. It is usually caused by faulty valve action, by very late ignition, or by the use of a slow burning mixture. In practice it is usually a sign that the mixture furnished the engine is too weak, that is, contains too small a proportion of gasoline vapor,

The term is also sometimes applied to the explosion of the mixture in the crank case of a two cycle engine.

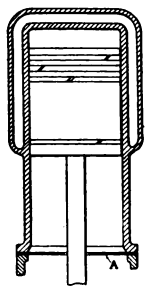
Backlash—Looseness between a driving and a driven part, which permits the former to be moved relatively to the latter without producing the intended motion in the latter. It is usually developed through wear of the acting surfaces of the driving and driven parts, or may be due to their incorrect adjustment.

Syn.: Lost motion.

Back Kick—The starting of a gasoline engine backward or in the reverse direction of rotation. It is caused by an explosion taking place considerably before the piston affected has completed its upward of compression stroke. If such explosion occurs while the motor is being cranked in the normal direction, the operator is likely to be injured thereby. Too early ignition is the cause of this phenomenon.

Back Pressure—The gaseous pressure which acts to resist the piston movement of a gasoline engine while its cylinder is being cleared of burnt gases, on the exhaust stroke. This results in negative work and a reduction of engine output.

Baffle Plate—A plate placed in a chamber containing fluid to restrain the free movement thereof. Examples: An oil baffle plate is a perforated plate placed across the lower end of a gasoline engine cylinder to limit the amount of lubricating oil which is splashed up from the crank case upon the cylinder walls. Baffle plates are sometimes fixed within the fuel tank to prevent the excessive splashing about of the gasoline, when the car is in motion. (Swash plates.) Such plates are also used in exhaust mufflers to cause the spent gases to follow circuitous paths in their passage to the open air.



Oil Baffle Plate (A).

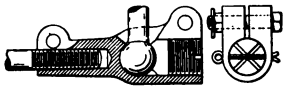
Balance—That quality of a moving part or system of moving parts of a mechanism which enables it to move without jar or vibration and without imposing excessive inertia stresses upon its bearings. (See counterbalance.)

Balance Wheel—A heavy rimmed wheel carried upon the crank shaft of a gasoline engine and rotated thereby, for the purpose of steadying the running of the engine. When once set in motion it tends to continue to rotate and furnishes stored

energy to keep the engine turning during intervals of the cycle when the power required for propulsion exceeds that developed in the cylinders. The balance wheel may also deliver stored energy and assist in driving the car during short periods when an excessive driving effort is called for, as at starting.

Syn.: Flywheel.

Ball Joint—A form of joint for connecting two members of a linkage so as to permit of a considerable range of angular relation between them. The connecting end of one member is in the form of a ball, and that of the other is in the form of a cup or partial sphere, which encircles and holds the former. Such joints are employed in the steering linkages and in the throttle and spark control linkages of motor cars and a similar construction is sometimes used to connect the forward end of the drive shaft housing to its support upon the car frame.



BALL JOINT.

Syn.: Ball and socket joint.

Ball Joint, Spring—A form of ball joint employed in the steering linkage at the forward end of the rod, which connects the steering device with one of the steering knuckles. The cup and ball connection is cushioned by springs contained within the tubular rod, which permit the joint to give slightly when sudden shocks are communicated to it from the road wheels. This prevents the communication of these shocks to the hands of the operator.

Syn.: Spring buffer.

Base Explosion—The accidental explosion of the gas contained in the crank case or base of a two cycle engine, by flames extending from the cylinder through the transfer passage. This generally results from too late ignition or from the use of a slow burning mixture.

Syn.: Crank case explosion.

Battery, Commutated.—An arrangement of the storage cells of an electric vehicle in which the cells are divided into several equal groups. These groups, by means of a special controller, may be connected to the motor, either in multiple or in series, and thus any one of several voltages may be impressed upon the motor at will and several speeds obtained from it without the necessity of much dead resistance being employed.

Battery, Divided—An arrangement of the storage battery of an electric vehicle in which the cells are divided into two groups, carried in the forward and rear parts, respectively.

Battery, Dry—A battery made up by connecting together a number of dry cells (q. v.).

Battery, Interchangeable—An electric vehicle battery so arranged that it is readily removable as a unit from its car when exhausted and which is replaceable by a similar battery that is fully charged.

Battery, Storage—A battery formed by connecting together a number of storage cells or accumulators (q. v.).

Battery, Underslung—A vehicle storage battery, which instead of being carried in the car body, is suspended underneath the vehicle frame.

Battery Box—The box which contains the ignition or lighting battery of a car. It is generally carried upon the running board or under one of the seats and is usually made of pressed steel and lined with insulating material. Some boxes intended to hold dry cells are so arranged that the act of putting the cells in place therein automatically makes the necessary electrical connections. These are called wireless battery boxes.

Battery Gauge—An instrument for roughly testing the condition of dry cells or storage cells. The dry cell gauge is merely a low resistance ammeter, reading up to 30 amperes or so. The dry cell is short circuited through this, the reading indicating approximately the internal resistance of the cell, a high ampere reading indicating a low resistance cell and vice versa.

The storage cell gauge is a low reading voltmeter, calibrated up to 10 v. or so, which indicates the voltage of the cell and thus furnishes some indication of its state of charge.

Syn.: Battery tester, pocket ammeter and voltmeter.

Battery Platform—A platform used in electric vehicle stations to facilitate the handling of interchangeable storage batteries. The platform is of such a height or may be raised to such a height by an elevator that when the vehicle is properly drawn up alongside it the battery may readily be slid into or out of it without heavy manual labor being required.

Battery Tray—A tray in which are assembled the cells which constitute a storage battery or a section of a storage battery, for convenience in handling.

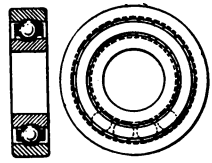
Baumé Scale—An arbitrary scale used to indicate the density or specific gravity of liquids. There are two such scales, one used for liquids heavier, and one for liquids lighter than water, the latter being mainly employed to define the density of gasoline. In this scale, the denser the liquid, the lower the Baumé degree which it tests, and vice versa. Gasoline, as at present obtainable, tests from 62 to 70 degrees Baumé (abbreviation B.). and the following table gives the specific gravity which corresponds to each degree Baumé within this range:

Degrees B.	Specific Gravity.	Degrees B.	Specific Gravity.
60.....	.738	69.....	.706
61.....	.735	70.....	.702
62.....	.731	71.....	.699
63.....	.728	72.....	.695
64.....	.724	73.....	.692
65.....	.720	74.....	.689
66.....	.717	75.....	.685
67.....	.713	76.....	.682
68.....	.709		

Direct determinations of density according to the B. scale are generally made by the hydrometer (q. v.).

Bearing—In general, the support of a moving part within which it moves in a prescribed manner; more specifically, the support of a shaft within which it is so held as to permit its rotation. (See bearing, plain; bearing, ball; bearing, roller, etc.)

Bearing, Annular Ball—A form of self-contained, inadjustable ball bearing, which consists of two concentric, hardened steel rings or annuli, one larger than the other, the internal periphery of the outer ring, and the external periphery of the inner ring being appropriately grooved to form a race which, when the rings are assembled, one within the other, is filled with a series of steel balls, sometimes separated by spiral springs. Such a bearing is specially intended to support radial loads, its capacity to resist end thrust along the shaft being relatively limited.

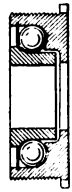


ANNULAR BALL BEARING.

Bearing, Ball—A form of anti-friction bearing in which the rotating shaft and the fixed portion of the bearing are not in sliding contact, but are separated by a series of hardened steel

balls. A hardened steel fitting fixed to the shaft rolls upon the bal's, and the balls in turn roll upon a hardened steel fitting secured to the fixed portion of the bearing. The action is thus nearly a purely rolling one and sliding friction is practically abolished. There is but little loss of energy in such a bearing and it requires relatively little lubrication.

Bearing, Cup and Cone—A form of ball bearing in which a line of balls rolls in a race formed between a hardened steel cone-shaped fitting fixed to the shaft and a cup-shaped fitting fixed in the bearing support. The shaft carried cone rolls upon the balls and the balls roll upon their race in the cup, two, three or four lines of contact being allowed between the balls and their race in different designs. Such bearings are usually made adjustable for wear, by moving the cup and cone closer together. They are well adapted to resist end thrust on the shaft in either direction, as well as to support the radial load.



CONE AND CUP BEARING.

Syn.: Bicycle type ball bearing.

Bearing, Hardened Steel—A form of plain bearing in which the shaft rotates in a glass hard steel bushing ground to a true surface. The shaft is made of relatively soft steel. It is claimed that such bearings operate with little friction, are not likely to rough up their shafts, and require only a small amount of oil. They are not much used.

Bearing, Main—A term applied to the bearings in which the crank shaft of a vehicle engine rotates.

Bearing, Plain—The common, primitive form of bearing in which the rotating shaft is in sliding contact with the bearing which supports it, a considerable area of contact between the two being allowed.

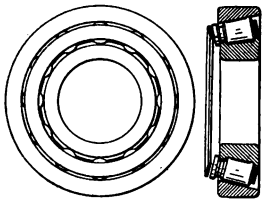
Syn.: Parallel bearing.

Bearing, Radial—A bearing adapted to resist a radial load, i. e., a load in a plane at right angles to the axis of the shaft which the bearing supports, such as the weight of parts carried upon a horizontal shaft or the effort transmitted through the connecting rods to the crankshaft of a motor. In radial ball

bearings the diameter of contact of the balls is perpendicular to the axis of rotation of the shaft. The term is used in contra-distinction to "thrust bearing."

Bearing, Radial Thrust—A bearing capable of resisting both radial load and thrust. In two point contact ball bearings of this type, the diameter of contact of the balls is inclined to the axis of rotation of the shaft, and thus both the inadjustable, annular "two-in-one" bearings, with two rows of balls, and the adjustable cup and cone bearings (q. v.) may be included in this class.

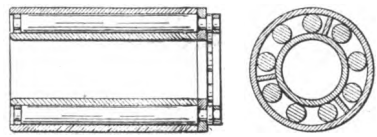
Bearing, Conical Roller—A form of anti-friction bearing in which hardened steel rollers are used to secure rolling contact between shaft and journal. Such a bearing consists of a hardened steel cone carried upon the shaft and a concentric internally coned cup fixed within the bearing support. Such a bearing is adjustable by moving the cup and cone together, and is well adapted to resist both radial pressure and end thrust. Used in axles, steering pivots and wheels, on gear shafts, etc.



CONICAL ROLLER BEARING.

Syn.: Taper roller bearing.

Bearing, Cylindrical Roller—A form of roller bearing with hardened cylindrical bearing surfaces, separated by and rolling upon hardened cylindrical rollers. Adapted to resist radial loads and usually inadjustable.



CYLINDRICAL ROLLER BEARING.

Bearing, Thrust—A bearing adapted to resist pressure parallel with the axis of rotation of its shaft.

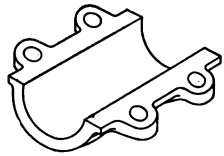
Bearing, Ball Thrust—A form of ball bearing adapted to resist the pressure upon a shaft in the direction of its length—the end thrust. It consists of a hardened steel collar fixed upon the shaft and another corresponding stationary collar fixed in the bearing support. Between these collars is a series of steel balls suitably held in a cage. Used in drive shafts, axles, clutches, etc.

BALL THRUST BEARING.

Bearing Bracket—A projection on a structural part or a specially formed portion of such a part, adapted to support a bearing.

Syn.: Bearing stand, bearing support.

Bearing Cap—The portion of a plain journal which is detachable from the fixed stand or bracket thereof and which serves to secure the bearing bushing and shaft in position. It is usually secured to the stand or bracket by cap screws and may be made adustable by the provision of shims (q. v.).



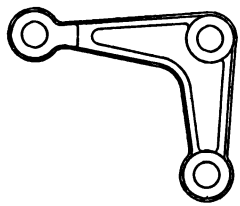
BEARING CAP.

Bearing Shell—A removable, hollow cylindrical, metal lining, adapted to be held within the bracket and cap of a plain bearing, and to the inside of which is applied the actual bearing surface of babbitt or similar anti-friction metal upon which the shaft rotates.

Syn.: Liner.

Bearing Surface—The area of the projection of a bearing on a plane perpendicular to the direction of the bearing pressure. In the case of cylindrical bearings (shaft bearings), it is equal to the product of the length by the diameter.

Bell Crank—A lever with its two arms angularly disposed and pivoted at their point of intersection, adapted to transform a push or pull applied to one arm in a certain direction into a push or pull delivered by the other arm in a different direction, for instance, at right angles. Used in control linkages.



BELL CRANK.

Benzol—Coal tar benzine (C_6H_6), a product of the destructive distillation of coal tar. Sometimes used either alone or in combination with gasoline or alcohol as motor fuel, especially in Europe. Also sometimes used as a rubber solvent in making cements.

Bevel Gear Drive—A method of driving a shaft from another shaft arranged at an angle thereto (commonly at a right angle), by means of a pair of mitre or bevel gears. It is specially employed for transmitting the driving effort of the motor to the traction wheels of motor cars in which the motor

shaft is located lengthwise of the car and thus at right angles to the axle. Such a drive consists of a universally jointed longitudinally disposed shaft driven by the motor and carrying a bevel gear or pinion upon its rear end, which meshes with a corresponding bevel gear secured to the differential frame of the live rear axle, so as to drive the axle and its two traction wheels.

Overhead cam shafts and some of the auxiliaries are sometimes actuated by bevel gear drives.

Bevel Gear Drive, Double—A form of sliding gear (q. v.) change speed (q. v.) device of the direct drive type, sometimes employed to drive the countershaft (q. v.) of a double chain driven car (see chain drive, double) in which two bevel gears, secured to the differential gear (q. v.) housing are used, one of which is in permanent mesh with a bevel pinion upon the end of the layshaft (q. v.) and the other in permanent mesh with a bevel pinion upon a short shaft to which the engine-driven sliding shaft (q. v.) is clutched when the direct drive is in action. When the direct drive is in use the latter bevel pinion drives the differential and countershaft, the layshaft and its bevel gears rotating idly, but on all other speeds the layshaft bevel pinion drives the differential and countershaft and the other bevel pinion and its shaft rotate idly, the direct drive clutch being disengaged.

Binding Post—A part of a piece of electrical apparatus to which attachment of the external circuit is made. Usually some form of clamping device adapted securely to hold a wire in electrical contact. The binding post is the point of connection between the electrical conductors forming a part of the apparatus itself and the conductors forming the external circuit.

Bleeder—A cock inserted in the wall of a pipe, the opening of which indicates whether or not liquid is present or moving therein. A bleeder is sometimes inserted in an oil delivery pipe in order to permit a test to be made as to whether lubricant is or is not being forced therethrough.

Blister—A tire defect which results from the separation of the tread from the fabric to which it should be secured. Sand frequently enters the space between tread and fabric, through a cut in the former, lifting the tread and causing an external swelling upon the tire, the appearance of which justifies the term.

Syn.: Sand boil, sand wart.

Blower Cooled—A term applied to a motor cylinder which is cooled by air positively circulated about it by means of a blower. The air is usually definitely confined in ducts surrounding the external surface of the cylinder.

Used in contradistinction to "fan cooled" which usually implies that the air is less positively circulated and less definitely directed upon the cylinder walls.

Blow Off—A tire accident characterized by the edge of the bead of the tire freeing itself from its fastening to the rim at some point and the inner tube protruding through the space there formed, usually resulting in the bursting of the tube and sometimes in the whole tire leaving the rim.

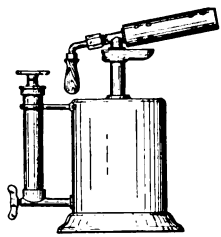
The safety valve of a steam boiler or the valve through which the boiler may be emptied of water.

Blowout—A tire accident occasioned by a rupture of the casing and the extrusion of the inner tube therethrough with a resultant bursting of the same.

Blowout Patch—A sleeve made of canvas, rubber fabric, leather or some similar material, designed to stop the hole in a tire casing and to prevent the inner tube from blowing out therethrough. Such a patch may be applied between the tube and the inner wall of the casing (an inside blowout patch), or it may be strapped or laced over the outside wall of the casing.

Syn.: Emergency tire sleeve.

BLOWOUT PATCH.

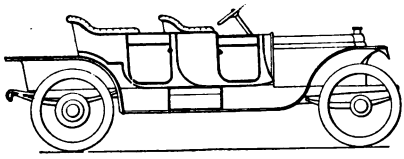


BLOW TORCH.

Blow Torch—A portable torch, usually burning gasoline or alcohol, used to heat the pilot light of a steam car's burner, and also used in soldering operations.

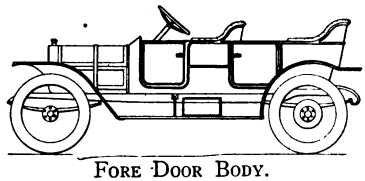
Body—The degree of viscosity, applied to lubricating oils. A thick viscous oil is said to possess more body than a thin oil.

Body, Close Coupled—A form of four or five passenger body in which the rear or tonneau seat is located somewhat further toward the front than usual, frequently well forward of the rear axle, and the front seat is located somewhat further back than usual. Both seats are thus included between the axle lines and are rather close together, allowing no room for folding tonneau seats. A trunk platform is sometimes placed at the rear of the tonneau seat.



CLOSE COUPLED BODY.

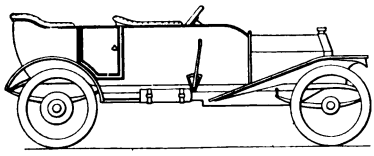
Body, Fore Door—A body which, in addition to the ordinary side doors that give entrance to the tonneau, is equipped with similar side doors closing the entrance space between the front seat and the dash. These fore doors protect the front seat passengers from dust and cold draughts.



FORE DOOR BODY.

Syn.: Fore door body; vestibule body.

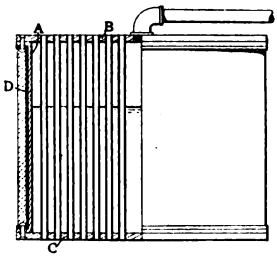
Body, Gunboat—A form of tonneau touring body characterized by the use of fore doors and very high sides, the upper edges of which form a nearly straight horizontal line, nearly coincident with or slightly higher than the top of the hood. A rearwardly sloping dash is often used and the lines of the rear of the tonneau may be curved so as to resemble the stern of a gunboat.



GUNBOAT BODY.

Syn.: Torpedo body; flush-sided body.

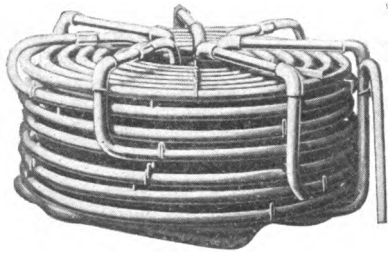
Boiler, Fire Tube—A form of tubular steam boiler, the end plates of which are connected by a multiplicity of thin metal tubes with open ends. The space around the tubes is filled with water and the hot gases from the furnace pass through the tubes on their way to the external air. The inside surfaces of the tubes being in contact with the hot gases, and their outside surfaces in contact with the water, a free transference of heat to the water is permitted.



FIRE TUBE BOILER.

A, Boiler Shell; B, Upper Tube Sheet; C, Lower Tube Sheet; D, Wire Winding.

Boiler, Flash—A form of steam generator in which there is practically no storage of water or steam, steam being generated by it in accordance with the demand of the moment. It generally consists of a rather massive system of connected pipes or sections which is maintained at a steam raising temperature.



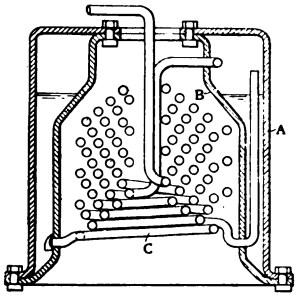
FLASH BOILER.

Into the passages thereof water is pumped at rates dependent upon the momentary call for steam and is almost instantly vaporized and furnished to the engine usually in a superheated condition.

Syn.: Flash generator.

Boiler Tube—One of the thin walled tubes through which the furnace gases pass in a tube boiler.

Boiler, Water Tube—A form of steam boiler in which the water is confined in coils of pipe or communicating cast sections, which are surrounded by a casing through which the furnace gases circulate. Not much used.



WATER TUBE BOILER.

A, Outer Shell; B, Inner Shell; C, Water Tube Coil.

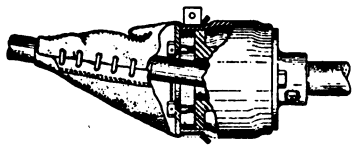
Boiler, Wire Wound—A fire tube boiler the cylindrical shell of which is tightly wound with steel wire in order to give it greater strength against bursting.

Boiler Sheet—The steel plates which form the ends of a fire tube boiler, the upper one being called the crown sheet and the lower one the bottom sheet. The ends of the tubes are expanded into holes drilled respectively in these two sheets.

Boiler Shell—The cylindrical portion of a fire tube boiler into the ends of which the crown and bottom sheets are fastened.

Bonnet—See hood.

Boot—A covering designed to afford protection from road dirt and water, usually made of waterproof fabric; e. g., the cover placed about a magneto or that hung under the car mechanism.



GREASE BOOT.

Boot, Grease—A bag-like receptacle of leather or similar material designed to contain lubricant and to fasten tightly around working parts, thus keeping the same enveloped in lubricant and free from dust. Such a boot permits of some relative motion between the parts enclosed.

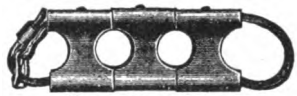
Bore, Cylinder—See cylinder bore.

Boss—A thickened or otherwise enlarged portion of a mechanical part designed to afford a point of sufficient strength for the attachment of a related part; e. g., the inside of a piston is provided with two diametrically opposite bosses, which are

drilled out to receive the ends of the piston pin. They afford sufficient thickness for bearings and serve to distribute the stresses at the pin ends to the relatively thin piston walls.

Bottom (v.)—Gears which run together without clearance, the points of the teeth of each touching the bottoms of the tooth spaces of the other, are said to bottom. Such gears are pitched too closely and operate with excessive noise and friction.

Bow Separator—A device for holding the bows of a top (q. v.) out of contact and preventing their chafing when the top is folded, consisting of a series of rubber spacers or distance pieces interposed between the bows and strapped in place or of doweled (q. v.) metal distance pieces attached to the bows, which come into contact when the bows are folded and strapped together and hold them apart.

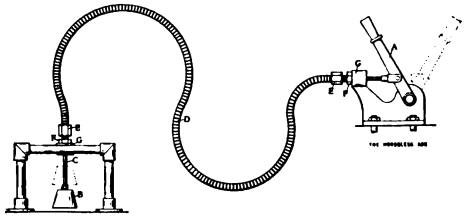


Bow Separator.

Bow Supporter.

Bow Supporters—A forked, leather lined iron, one of which is attached to each side of the rear of a car body to form a rest into which the bows of a folded top fit and are secured by straps.

Bowden Wire—A mechanism used to transmit motion from a controlling device to the part to be controlled thereby, which dispenses with levers, rods and any kind of linkwork. The direction of motion at the control lever may bear any relation to that of the part moved, and the connecting mechanism may pass around intervening obstacles and take almost any convenient form, being stationary externally. It consists of two parts, a closely coiled,



Bowden Wire Mechanism.

A, Operating Member; B, Device Controller; C, Wire; D, Flexible Casing; E E, End Fittings; G G, Stationary Supports.

incompressible spiral spring, known as the outer member, and a practically inextensible steel wire cable, threaded through the outer member, which forms the inner member. If the ends of the outer member are fixed so that the distance between them is invariable, a pull applied at one end of the inner member will be transmitted as a pull to its other end, and if both ends of the inner member are fixed, a push applied to one end of the outer member will be transmitted to its other end. It is used to operate spark timers, throttles, carburetor, air controls, muffler cut-outs, etc.

Brake, Air Cooled—A brake, the shoes, drum or band of which are so arranged as to facilitate the transference to the surrounding air of the frictional heat developed in service. The parts are usually ribbed or otherwise formed so as to present a large convecting surface to the air.

Brake, Differential—A brake which acts upon the differential gear of a car. Such a brake may consist of a band which contracts upon a drum forming a part of or secured to the pinion frame of the differential, or it may be a double brake, consisting of two straps or two pairs of shoes, which act respectively upon two drums that are attached respectively to the two main gears of the differential.

A form at present not much used.

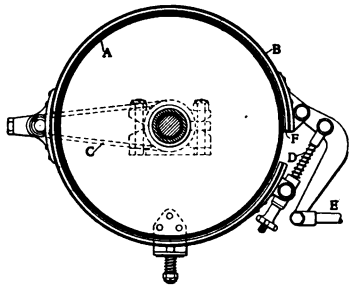
Brake, Double Acting—A brake, the band or shoe of which exerts nearly the same holding power upon its drum, irrespective of the direction of rotation thereof. Such a brake is thus nearly as effective in checking backward as in checking forward motion of a car.

Brake, Electric—A form of brake sometimes used upon electric vehicles, the principle of which consists in temporarily converting the vehicle motor into a dynamo, and dissipating in electrical heat the energy of motion possessed by the vehicle. In order to apply the electric brake, connections are made by the controller, which short-circuit the motor and the electromagnetic reactions of the induced currents set up therein hold back the armature and, through the transmission gearing, slow down the vehicle.

Brake, Emergency—A brake primarily intended to be used in making sudden stops. The term is used in contradistinction to "service brake." In practice the name is applied to the pair of brakes which is operated by a lever, usually ratchet retained,

and which is used to hold a car at rest as well as to stop it in an emergency. In current practice the emergency brakes are usually internal expanding hub brakes.

Brake, External Contracting—A form of brake the external surface of whose drum is encircled by a band anchored to some fixed part of the car. By means of a toggle or similar mechanism, the band can be contracted upon the drum and thus tend to hold it from turning.



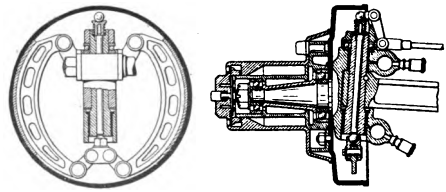
External Contracting Brake.

A, Drum; B, Contracting Band; C, Spider; D, Brake Spring; E, Pull Rod; F, Lining.

Brake, Foot—A brake or pair of simultaneously acting brakes which are applied by a pedal operated by the driver's foot. The foot brake is the brake commonly used for slowing down and stopping, in ordinary driving.

Syn.: Pedal brake.

Brake, Front Wheel—One of the two simultaneously acting brakes which act upon the front wheels. Little used in this country at present, but being introduced in Europe. The application of brakes to the front wheels as well as to the rear wheels nearly doubles the braking power of a car, and the use of front brakes tends to diminish danger from skidding when a sudden stop is made. As the front brakes turn with their wheels in steering, their operating mechanism is necessarily somewhat complicated.



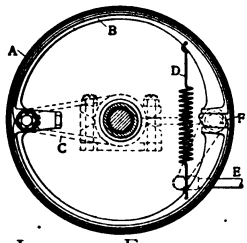
Front Wheel Brake.

Brake, Hand—The brake or pair of simultaneously acting brakes which are applied by means of a hand lever, which is usually provided with a ratchet locking device.

Syn.: Lever brake.

Brake, Hub—A brake which acts upon a drum secured to one of the wheels, the drum being usually an integral part of the wheel hub and frequently bolted through the spokes. Such brakes are employed in pairs; in ordinary practice one on each rear wheel hub, both being simultaneously actuated by means of a single pedal or lever and a suitable connecting linkage.

Brake, Internal Expanding—A brake which consists of a drum secured to a wheel hub or upon a transmission shaft against the inside periphery of which can be applied a band or a pair of shoes that are anchored to a fixed portion of the car. The band or shoes are expanded into frictional contact with the inside of the drum by means of a toggle, cam, wedge or other equivalent mechanism.



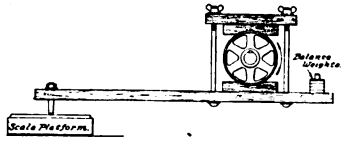
INTERNAL EXPANDING BRAKE.

A, Drum; B, Shoe; C, Spider; D, Brake Spring; E, Pull Rod; F, Cam.

Brake, Metal to Metal—A brake in which a metal band or metal shoes act against a metal drum, the metals being chosen so as to possess a high frictional effect and a low degree of mutual abrasive action. Oil is often used between the frictional surfaces.

Brake, Motor—A form of brake used upon electric vehicles, which acts upon a drum carried upon the armature shaft of the motor.

Brake, Prony—A form of absorption dynamometer (see dynamometer), used in determining the output of motors, consisting of a brake band or a series of brake shoes clamped, with adjustable pressure, upon the face of the motor flywheel and a counterbalanced arm of known effective length, upon which weights can be hung. When the motor is in operation weights are added to the arm until the moment of friction exerted by the brake exactly balances the torque (q. v.) developed by the motor and the horse power delivered is computed by the formula H. P. $=0.0001904\ LIWS$; where L is the effective length of the arm in



PRONY BRAKE.

feet, W the weight acting on the arm in pounds, and S the speed of the motor in revolutions per minute.

Syn: Friction dynamometer. See horse power, brake.

Brake, Ratchet Retained—A brake, the operating lever or pedal of which is provided with means for locking it in any position in which it is set, so that the brake may be left in a more or less applied condition (especially when the car is left standing).

Brake, Service—The brake, or simultaneously operated pair of brakes, which is adapted to be used in the slowing down and stopping of a car in ordinary driving. The term is used in contradistinction to "emergency brake." The service brake is usually a pedal brake, operated by the driver's right foot.

Brake, Transmission—A brake which acts not upon a wheel hub drum, but upon a drum secured upon a transmission shaft, which is in motion so long as the car is moving. The effect of such a brake is transmitted to the driving wheels and the road through the intervening transmission mechanism. In practice the transmission brake of a shaft driven car is applied to a drum carried by the driving shaft, located inside of or outside of the gear box. In a double chain driven car, a pair of simultaneously operated brakes act upon drums, usually applied to the two front sprockets.

Brake, Water Cooled—A brake through channels in the shoe or drum of which water is passed from a tank carried upon the car, to prevent the parts from overheating under very severe service.

Brake Anchor—That part of a brake mechanism which acts to prevent the rotation of the band or shoes when they are forced into contact with the rotating drum. The anchor is a rigid support usually fastened at one end to the axle casing (in the case of a wheel brake), and at the other to the operative portion of the brake.

Brake Band—A more or less flexible band, anchored at its ends to fixed supports and adapted to be contracted upon the external surface or expanded against the internal surface of a brake drum, so as to tend to prevent by friction the rotation of the drum. Such a band may have a metallic frictional surface, or it may be faced with fibre or special fabric.

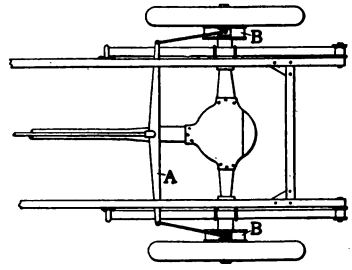
Brake Beam—An equalizer bar. (See brake equalizer.)

Brake Cable—A flexible wire cable, sometimes used to transmit the pull exerted at a brake lever or pedal to the mechanism at the brake itself that forces the band or shoes against the brake drum.

Brake Cam—A cam, forming a part of a brake mechanism, which acts to force the band or the shoes into frictional engagement with the drum.

Brake Drum—A hollow cylindrical metal part, secured axially upon a transmission shaft or upon the wheel hub of a car, adapted to be frictionally engaged by a band or by shoes contracting upon its outside cylindrical surface or expanding against its internal surface.

Brake Equalizer—A device which is applied to brakes that are simultaneously operated in pairs from a single lever or pedal (hub brakes, for instance). Its function is to insure that each brake of the pair shall, under all conditions, be applied with equal force, so that one wheel may not be braked more violently than the other. A common form consists of a freely supported horizontal lever, to the centre of which is attached the pull rod from the operating lever or pedal, and to the ends of which are attached the pull rods, which act respectively upon the two brakes.



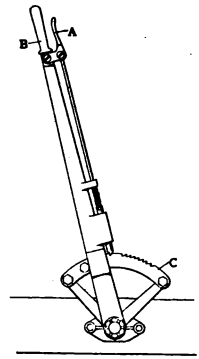
BRAKE EQUALIZER.

A, Equalizer Bar; B B, Brakes.

Brake Horse Power—See horse power, brake.

Brake Housing—The casing which encloses the mechanism of a brake, thus protecting it from water and road dirt, and permitting of its effective lubrication. The housing is usually a thin casting or metal stamping attached to the axle casing (in the case of hub brakes), and closing the opening of the brake drum.

Brake Latch—That portion of a brake that is capable of being locked in position, which engages with a ratchet and holds the brake lever or pedal set in the desired position. It consists of a thumb or toe piece, connected with which is a spring actuated linkage acting to hold the detent in engagement. Syn.: Brake detent.

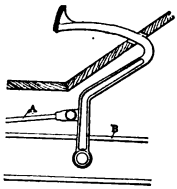


A, Brake Latch; B, Brake Lever Handle; C, Brake Quadrant.

Brake Lever—The operating lever by which a brake or pair of brakes is applied.

Brake Lining—A thin strip of material riveted to the working surface of a brake band or shoe, which forms the actual frictional surface that bears upon the drum. Some flexible material, capable of resisting abrasion and heat and possessing a high coefficient of friction with the metal of the drum, such as vulcanized fibre, belting or a special non-combustible fabric consisting of asbestos fibre woven on metal gauze, is generally used.

Brake Linkage—The mechanism which transmits the motion of a brake operating lever or pedal to the brake shoes or band. Syn.: Brake rigging.



BRAKE PEDAL.

A, Pull Rod; B, Chassis Frame.

Brake Pedal—The operating foot lever or pedal which actuates a brake or pair of brakes.

Brake Pull Rod—The rod or rods which transmit the pull set up at a brake operating lever or pedal to the mechanism at the brake itself which applies the band or shoes.

Brake Quadrant—The fixed sector shaped guide within which moves the operating lever (or pedal) of a brake and on which the locking ratchet is usually mounted.

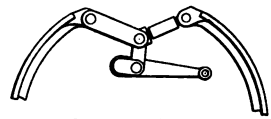
Brake Shoe—A block, more or less segmental in form, anchored to a stationary part of the car mechanism, which is adapted to be forced against a revolving brake drum to retard vehicle motion. Brake shoes are usually operated in pairs, through a toggle, cam or wedge action and are generally of metal. They are used chiefly in internal expansion brakes.

Brake Spider—The support for the band or shoe and for the operating mechanism of a brake, generally consisting of a hub secured to the axle casing within or adjacent to the brake drum, provided with several arms arranged to give rigid support to the various operative parts.

Brake Spring—A spring which acts in opposition to the force which applies a brake and removes the band or shoes from contact with the drum when the operating pedal or lever is released. Generally a spiral spring.

Brake Test—See dynamometer test.

Brake Toggle—A linkage somewhat of the toggle joint type, used in a brake to multiply the force exerted by the pull rod so that a very heavy pressure shall result between the band and the drum when the brake is applied.



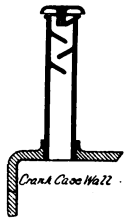
BRAKE TOGGLE.

Braking With the Motor—The employment of the resistance offered by a vehicle motor, when it is not rotating under its own power, but being rotated by the kinetic energy stored in a moving car, to reduce the vehicle speed. The resistance offered is due to the friction of the motor and to the irrecoverable work done by the motor pistons upon the gases in the cylinders. Ordinarily, braking by the motor is accomplished by interrupting its ignition and retaining the clutch in engagement, the lower the gear which is in use the greater the braking effect obtained. Some motors are fitted with special intake and exhaust cams, the use of which temporarily converts a four cycle motor into a two stroke cycle air compressor with variable compression, thus increasing the braking effect, a valve being provided for shutting off the carburetor and admitting air only to the cylinders, with resulting economy in fuel.

Braking Surface—The actual surface of contact between a brake drum and the band or shoes which are applied to it; c. g., if a brake drum is 12 inches in external diameter and the width of the band which contracts upon it is 2 inches, the braking surface will be $12\pi \times 2 = 75$ square inches, assuming that the band completely encircles the drum.

Brass—The fixed bronze or composition lining of a bearing support which forms the actual surface upon which the supported shaft rotates or slides. A bearing bushing (q. v.).

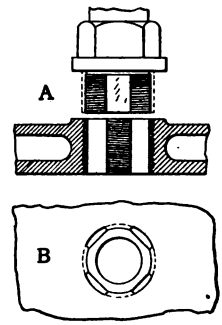
Braze, v.—To join by brazing, which process consists of closely abutting the cleaned edges of the parts to be joined, heating them intensely, usually by means of a blast lamp flame, freeing the abutted surfaces of oxide by means of a suitable flux (usually borax), and melting into the junction a special brass or spelter, usually furnished in a granular form, or in that of wire. The spelter unites with the surfaces of the parts and forms a joint of considerable strength. The process was formerly largely used for uniting parts to the steel tubing used for axles.



BREATHER PIPE.

Breather—A vent tube introduced into the enclosed crank case of a gasoline engine to permit of the equalization of the air pressure therein, which would otherwise fluctuate considerably with varying positions of the pistons, absorbing some energy and perhaps interfering with lubrication. The breather rises vertically from the crank case, and its open upper end is usually provided with baffle plates to prevent the escape through it of lubricating oil from the crank case. It is often used as a filler tube.

Breech Block Joint—A special form of threaded joint, sometimes applied to parts that require to be screwed into or onto each other quickly. Four segmental portions of both the male and female thread are cut away so that the pieces may be slid into their final engaged positions, one upon the other, by matching the cut away portion with the uncut portion of the other and then rotating one relatively to the other through one-eighth turn, which brings all the threads in engagement and locks the parts securely together.



BREECH BLOCK.

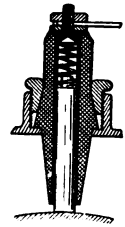
A, Sectional view in position about to be locked; B, Bottom view in locked position.

Bronze—A reddish alloy, of variable composition, used for bearing bushings (see bushing bronze) and minor structural parts, differing from ordinary brass in its large copper and tin and low zinc content. The following may be taken as an average bronze specification: Copper, 84.0 per cent.; tin, 12.0 per cent.; zinc, 3.0 per cent. and

lead, 1.0 per cent. The term bronze is frequently applied to any red brass, a typical specification for which is: copper, 85.0 per cent.; tin, 5.0 per cent.; zinc, 5.0 per cent.; lead, 5.0 per cent.

Brush, Contact—A conducting part used to complete the electrical circuit between a stationary and a moving element of an electrical device. Brushes are used to convey the current between the windings of the rotating armatures of magnetos, dynamos and electric motors, and the stationary portions of such machines, and for making connection between the rotating and non-rotating portions of timers and distributors. Brushes are usually made of wear-resisting metal or of copper-plated carbon.

Brush Holder—A device adapted to hold one end of a brush securely but somewhat flexibly in contact with a moving element of an electric circuit, and supplied with a binding post or other means by which a relatively fixed portion of the external circuit is connected to it and thus to the brush. In ignition practice it is usually a fixed brass tube, in which a cylindrical carbon or metal gauze brush is closely fitted, but capable of sliding therein, under the influence of a spiral spring, so that wear between the end of the brush and the rotating part may automatically be taken up and a reliable contact be secured.



BRUSH HOLDER.

Brush Spring—A spring employed to press a brush holder into positive contact with the moving element with which it is to maintain electrical connection.

Buckling—The bending or deformation of a plate of a storage cell, generally caused by the discharge of current through it at an excessive rate or by its over-discharge. Under these conditions the active material in the interstices of the grid swells and shrinks excessively, and this causes the buckling of the grid.

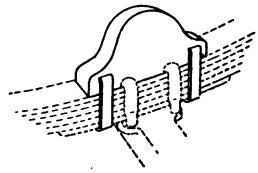
A permanent set or deformation produced by excessive pressure, in frames, boiler tubes, headers or in any other plate, tube or member.

Build Up (v.)—To attain a magnetic condition under the influence of an electric current. A small but appreciable period

of time elapses between the commencement of flow of an electric current through the winding of an electromagnet and the attainment of full magnetism by its core. In the case of spark coils, for instance, current must be allowed to flow through the primary winding for an adequate length of time before each ignition is called for, or otherwise a full discharge will not take place in the sparking circuit and only a weak spark occur, because of the failure of the magnetism fully to build up in the time of contact allowed.

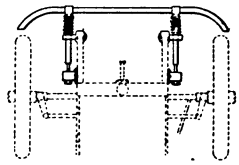
Bumper—An elastic member, placed between two members which may strike one another when in action, in order to cushion the resulting shock when this occurs. A metal spring or a properly shaped piece of rubber, leather or similar material is generally used, it being fastened to one of the parts so as to be interposed between the two.

Syn.: Buffer.



BUMPER.

Bumper, Collision—A strong horizontal bar, carried crosswise of and at a little distance from the front or rear end of a car, which is guided so as to be capable of a limited movement along the car's axis of length, and which is kept pressed away from the car by heavy springs. In event of collision between the car and another vehicle or fixed object, the energy of the collision is partly absorbed in compressing the springs and the liability of breakage of car parts is reduced.



BUMPER, COLLISION.

Burn Out (v.)—To destroy the conductivity of or to break down the insulation of a conductive portion of an electrical device by an accidental electrical discharge, or by the accidental application of excessive electrical heat. As applied to coils used in ignition, a burnout usually results from a puncturing of the insulation and a consequent short circuit or from the passage

of an excessive current, which either melts off the conductors, or melts or chars the insulation, resulting in a breakdown and short circuit.

To loosen the tube ends from the sheets of a steam boiler by the application of a fire to it when it is insufficiently supplied with water.

Burner—The device which produces the gas fire for heating the boiler of a steam car. It consists of a means for vaporizing the pressure fed liquid fuel, of mixing the fuel vapor with air and of distributing the flame produced over the exposed area of the boiler.

Burner Casing—A metal housing surrounding the burner of a steam vehicle and the space between it and the boiler, confining the heat to its proper channels and protecting the flame against air currents.

Burner Jet—The jet of a steam vehicle burner, through which the liquid fuel is sprayed, under pressure, in a finely divided condition, previous to its mingling with air to form a perfectly combustible mixture.

Burner Plate—A perforated metal plate, placed under the boiler of a steam car, through which the combustible mixture rises and burns in a multiplicity of flames.

Burner Valve—A valve usually of the needle type, inserted in the fuel feed pipe and used to regulate the flow of liquid fuel to the burner jet of a steam vehicle. Such a valve may be manually operated or under the control of an automatic fire regulator (q. v.).

Bushing, Bearing—A lining, fixed in a bearing support and in which a rod or shaft slides or rotates. It is usually made of anti-friction metal and is generally capable of renewal or adjustment after wear has taken place, so that looseness between the rod or shaft and its support may be corrected.

Syn.: Bush.

Bushing, Babbitt—A bushing made of babbitt metal, which may either be cast on the shaft in the bearing support, and scraped to fit the shaft, or which may be cast separately and applied to the bearing support and shaft, or cast in a bronze liner which is applied to the bearing support.

Bushing, Bronze—A bearing bushing made of bronze, which metal, if of proper quality, possesses a high degree of wear

resisting and anti-friction qualities, when used to carry steel shafts.

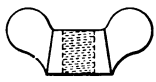
Bushing, Composite—A bushing, the bearing surface of which is composed of alternate segments of a soft and of a harder anti-friction metal, usually babbitt and bronze.

Bushing, Compressed—A bushing the metal of which has been rendered dense and wear resisting by compression, usually by hammering of its surface.

Bushing, Die Cast—A babbitt bushing, the metal of which has been rendered dense, hard and smooth by casting it under pressure in a die or mold. A very fine finish is thus attained and the bushings thus produced are interchangeable.

Bushing, Insulating—A lining or thimble of insulating material threaded over an electrical conductor and fixed in a support through which the conductor is to pass, so that leakage of current from the conductor to its support may be prevented.

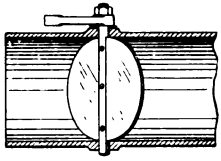
Bushing, Split—A bushing which, instead of being a complete hollow cylinder, is longitudinally split into halves. This construction allows of ready removal of the shaft and of some adjustment for wear of the bushing by filing away the abutting edges of the bushing halves, or by the removal of shims (q. v.) which have been placed between the edges so as to keep them slightly separated.



BUTTERFLY NUT.

Butterfly Nut—A form of thumb-nut intended to be turned without a wrench, having two wing-like projections formed integrally with the threaded centre, convenient to be grasped by the fingers.

Syn.: Wing nut.



BUTTERFLY VALVE.

Butterfly Valve—A form of valve applied to a pipe, consisting of a circular damper capable of nearly or quite filling the pipe bore and a spindle secured to a diameter of the damper, which passes diametrically through the walls of the pipe and bears therein. A common form for throttle valves and carburetor air valves.

By-Pass—An alternative path for a fluid which is being circulated in a system, used as a means of regulating

and directing the flow, e. g., in a pumping system supplying water to a boiler, there is inserted in the pump delivery pipe, between the pump and the boiler, a pipe which leads back to the suction side of the pump. This pipe can be entirely closed, in which case all the water pumped flows to the boiler, or it can be partly or fully opened. If the by-pass is partly closed, a portion of the water will go to the boiler and the remainder will pass back to the pump through it. Used on steam cars and in pressure lubricating, and fuel supply systems, in which a pump is operated continuously.

By-Pass Valve—A valve inserted in a by-pass to regulate the degree of obstruction to flow there existing and thus to regulate the rate of supply of fluid from a constantly operated pump to some point in the system.

Calcium Carbide—A compound (CaC_2) produced by the reaction of carbon and quicklime in the electric furnace. It is the source of acetylene gas (C_2H_2), when water is applied to it, according to the reaction $CaC_2 + H_2O = C_2H_2 + Ca\ O$ (quicklime). The quicklime is hydrated into whitewash by the excess of water.

Calcium Chloride—A salt ($CaCl_2$) a neutral aqueous solution of which is sometimes used as an anti-freeze mixture. if the solution used contains sufficient of the salt to make its specific gravity 1.22 it will freeze at about —15 degrees Fahr. Its boiling point is higher than that of water and, when its volume is reduced by evaporation, pure water only need be added.

Cam—A mechanism employed to transform rotary into reciprocating motion. As applied to automobile valve mechanisms, the cam consists of an irregular cylinder eccentrically fastened upon a shaft which rotates it. The cam is so shaped that the distance from the shaft axis to the cylindrical cam surface along different radii varies in a predetermined manner. Pressed upon the cam surface by means of a spring or gravity, is a movable, guided part (the cam follower), which as the cam rotates is reciprocated. The full stroke of the follower is equal to the difference in length of the longest and shortest radii of the cam and the rate and direction of the reciprocation at any point in the rotation is proportional to the rate and direction of change of the cam radii at that particular angular position.

Cam, Exhaust Valve—A cam, fixed to a shaft rotating at one-half engine speed, which acts to open and close an exhaust valve of a four cycle engine cylinder.

Cam, Ignition—A cam which acts to operate ignition mechanism, for instance, to actuate the make-and-break device of a contact spark igniter. Such a cam is rotated at one-half engine speed in the case of a four cycle motor and at full engine speed in that of a two cycle motor. Used in timers to operate the primary circuit controlling contacts and in magnetos to operate the make and break mechanism included in the primary circuit of the armature.

Cam, Inlet Valve—A cam which acts to open and close an inlet valve. In a four cycle motor it is fixed to a shaft rotating at one-half engine speed.

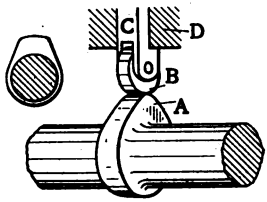
Cam, Integral—A cam which is formed integrally with its shaft and not made separately and pinned, keyed or screwed upon the shaft.

Cam, Spiral—A cam the elements of the working surface of which instead of being straight lines are helices. It may be imagined to be formed by uniformly twisting an ordinary cam around its axis, through a small angle. All cross sections of such a cam are identical, but each one is somewhat displaced angularly with respect to its neighbor. The follower is adjustable so as to be actuated at will by any cross section of the cam and thus the reciprocating motion produced can be made to vary in its time relation to the rotary motion. Used to advance and retard ignition.

Cam, Uniform Acceleration—A form of cam sometimes used for operating motor valves, the profile of which is such that, upon both the outward and inward strokes, the motion of the follower is first uniformly accelerated and then uniformly decelerated, so that the follower starts and stops gently. A reduction in the liability of the follower to jump from the cam surface at high speed, and a consequent reduction in noise as well as the attainment of a satisfactory speed and duration of opening are secured by this design.

Cam Profile—The section of a cam taken in a plane at right angles to the cam shaft and passing through the point of contact of the follower.

Cam Follower—The mechanical element which is held in contact with the working surface of a cam, obtaining a reciprocating movement from the cam's rotary movement and transmitting the same to other mechanical parts. A valve cam follower is usually a roller, or is mushroom or V shaped, and affixed to the end of the push rod. (q. v.).



CAM AND CAM FOLLOWER.
A, Cam; B, Cam Follower; C, Push Rod; D, Push Rod Guide.

Cam Lever—A single armed lever, pivoted at one end, the free end of which is interposed between a cam (q. v.) and the end of its push rod (q. v.) in a gas motor poppet valve (q. v.) gear to reduce the side thrust otherwise exerted by the push rod in the push rod guide (q. v.) occasioned by the cam action. The cam acts upon one specially formed face of the cam lever end, the other specially shaped face of the cam lever end acts nearly axially upon the end of the pushrod, nearly all the side thrust exerted by the cam being resisted by the pivot of the cam lever.

Cam Shaft—The shaft upon which a cam is fixed and by which it is rotated. The cam may be pinned, keyed or screwed upon the shaft in the direction opposite to its rotation, or it may be formed integrally with the shaft. If the cam shaft is supported in ball bearings it is known as a ball bearing cam shaft.

Cam Shaft, Enclosed—A cam shaft which is housed to protect it from dust and to insure its continuous lubrication. In

CAM SHAFT AND CAM SHAFT GEAR.

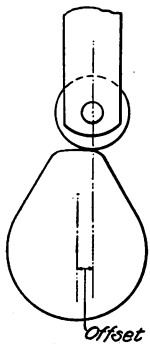
practice, inlet and exhaust cam shafts are located within the enclosed engine crank case or in a compartment of the same upon their respective sides of the motor.

Cam Shaft, Exhaust—The shaft that carries the cams which operate the exhaust valves. In a four cycle motor this is a shaft rotated at one-half the speed of the crank shaft and positively driven therefrom. This shaft is supported parallel to the crank shaft in suitable bearings and located in such relation to the exhaust valves that they may readily be operated by it.

In motors with cylinders (q. v.) of L type both exhaust and inlet valve cams are mounted upon the same shaft.

Cam Shaft, Inlet—The shaft which carries the cams which operate the inlet valves. In a four cycle motor this is a shaft rotated at one-half the speed of the crank shaft, and positively driven therefrom, The shaft is supported parallel to the crank shaft in suitable bearings and located in such relation to the inlet valves that they may readily be operated from it.

Cam Shaft, Offset—A cam shaft so positioned with respect to its cam followers that the axes of the latter (extended) do not intersect the cam shaft axis, but fall upon the advancing side of the shaft. Side pressure of the followers in their guides and the resultant wear, due to cam action on the outstroke, are reduced by this construction.



Offset Cam Shaft.

Cam Shaft, Overhead—A cam shaft adapted to the operation of valves located in the cylinder heads of a motor. It is usually supported just above the cylinder heads in bearings attached thereto, being driven from the crank shaft by means of a vertical shaft and two pairs of bevel or helical gears or by means of a chain and sprocket arrangement.

Cam Shaft Gears—The gears which drive a cam shaft from the crank shaft of a four cycle motor. A spur gear fast to the crank shaft meshes with a corresponding spur gear, having twice as many teeth, fast upon the cam shaft. The two gears may not mesh directly, but through an interposed idle gear. Gears with helical teeth and of non-resonant materials are used to reduce noise and the gears are generally housed in an extension of the crank case for protection.

Syn.: Half time gears, distribution gears, front gears.

Capacity, Electrostatic—A term used in connection with a condenser, such as forms a part of a magneto or jump-spark coil, to denote the quantity of electricity which such a condenser contains when charged by a unit electromotive force. The unit of capacity is the microfarad = 10^{-13} absolute units of capacity.

Capacity (of Accumulator)—A term used in rating storage cells, representing the amount of electricity which may be expected to be obtained upon the discharge of such cell from a fully charged condition. It is expressed in ampere hours, e. g., a 60 ampere hour cell may be expected to deliver a current of one ampere for sixty hours, or a current of 5 amperes for twelve hours.

Cap Screw—A screw to be used in fastening a bearing cap to its bracket or stand. In general, a machine screw with a head adapted to be turned by a wrench.

Carbon Deposit—A deposit which forms upon the piston heads and the internal parts of gasoline engine cylinders which are exposed to the combustion. It is composed of more or less hard and adherent carbonaceous materials, deposited from the lubricating oil and from overrich fuel mixture and of dust drawn in through the carburetor.

Carbonization—The collection of carbon deposits, as above, resulting in the reduction of the clearance space and a consequent increase in compression pressure; in the retardation of the escape of heat through the cylinder and the heating of the carbon deposit to a point at which it causes pre-ignition (q. v.) and knocking (q. v.) with a consequent reduction of motor output.

Carburation—The process of charging air with such a proportion of the vapor of a combustible liquid that the resulting vaporous mixture becomes suitable for fuel in an internal combustion engine.

Carburetor—A device for carbureting air, the delivery orifice of which is piped to the inlet ports of the cylinders of an internal combustion engine and which is the agency by which vaporous fuel is prepared as required for use by the engine. It is essentially a means by which a current of air, usually drawn through the device by the suction of the engine itself, is brought into intimate contact with a properly proportioned supply of liquid fuel (usually gasoline) supplied from a storage tank. The liquid fuel is exposed to the air current in such a

manner that the latter becomes impregnated with fuel vapor to such an extent as to become properly combustible.

Syn.: Vaporizer.

Carburetor, Atomizing—A carburetor in which the liquid fuel supplied thereto is broken up into a very fine mist or spray by being ejected, under pressure, through one or more very fine, specially formed orifices contained in a fuel standpipe, which is located in the midst of the current of air passing through the carburetor to the engine. The atomized condition of the liquid exposes a very large surface of it to the moving air and its thorough evaporation is facilitated thereby.

Syns: Spraying carburetor; jet carburetor.

Carburetor, Automatic—A carburetor so arranged that its air supply or both its air and gasoline supplies are automatically so regulated as to cause the proportion of gasoline and air in the mixture to be constant irrespective of the rate at which the motor is drawing gas through the carburetor. Non-automatic spraying carburetors tend to produce mixtures too rich in gasoline when the demand for gas is high, which tendency the automatic carburetor in a measure corrects. An ordinary automatic carburetor has a main air inlet below the spray nozzle and an auxiliary air inlet above or beyond the spray nozzle, controlled by a suction actuated valve, which admits air in proportion to the strength of the suction, to mingle with the gaseous charge formed by the air from the main air inlet and the gasoline from the nozzle.

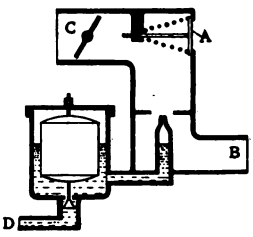


DIAGRAM OF AUTOMATIC CARBURETOR.

A, Auxiliary Air Valve; B, Main Air Inlet; C, Throttle Valve; D, Gasoline Inlet.

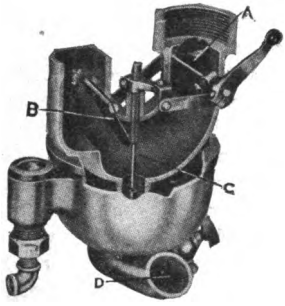
Carburetor, Constant Level—A carburetor, the level of the gasoline in which is automatically maintained at a constant height, irrespective of the demand therefor, usually by means of a float, which rises and falls with the gasoline within the carburetor and closes and opens a valve shutting off or admitting the supply from the gasoline tank, as occasion demands. Nearly all carburetors are of the constant level type, the gasoline level being automatically maintained nearly as high as the spraying orifices

in the standpipe, so that gasoline flows therethrough whenever any rarefaction exists around the spraying orifices.

Syn.: Float feed carburetor.

Carburetor, Exhaust Jacketed—A carburetor, the vaporizing passage or mixing chamber of which is enveloped by a jacket through which circulates hot gas derived from the exhaust of the motor. The hot gases keep the vaporizing passage warm and assist in furnishing the heat necessary to evaporate the liquid fuel which is passing through them in the form of spray.

Carburetor, Mechanical—A form of carburetor, usually of the float feed spraying type, in which it is sought to maintain uniform mixture quality at all rates of supply, by mechanically controlling the air supply or both the air and gasoline supplies in accordance with the movement of the throttle. A mechanical connection is provided between the throttle and the air admitting valve so that they open and close at the same time, or there may be provided a mechanical connection between the gasoline jet valve and the throttle so that the two open and close somewhat at the same time. Both of these expedients may be applied in combination.

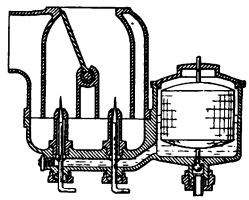


MECHANICAL CARBURETOR.

A, Throttle Valve; B, Auxiliary Air Valve; C, Spray Nozzle; D, Air Inlet.

The term is used in contradistinction to "automatic carburetor" in which uniformity of mixture is attained by actions caused by the fluctuations of pressure within the carburetor.

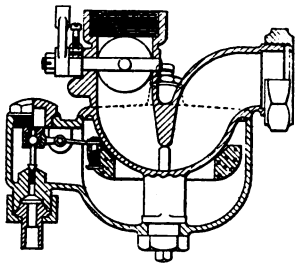
Carburetor, Multiple Jet—A carburetor of the constant level, atomizing type, in which more than one spraying jet is employed (generally two), One jet is constantly open and exposed to the suction of the incoming air and suffices to furnish the gasoline required properly to carburate the air entering at small



DOUBLE JET CARBURETOR.

and moderate gas demands. As the demand becomes greater the second jet, and finally the third jet (if any), is opened by means of a mechanical connection with the throttle, and additional gasoline sufficient in amount to carburate the progressively larger amount of entering air is sprayed through the additional jets. Carburetors of this type possess high flexibility and usually offer a low resistance to the incoming air.

Carburetor, Puddle Type—A float feed spraying carburetor, (see carburetor, constant level and carburetor, atomizing) in the bottom of the mixing chamber (q. v.), of which is maintained, by a suitable adjustment of the fuel level (q. v.), a shallow pool of gasoline, so located that the entering air passes over it at high velocity. Under conditions of low gas demand (nearly closed throttle), when the action of the carburetor spraying nozzle (q. v.) is weak, on account of the low vacuum acting upon it; sufficient fuel is taken up by the air from the puddle, by surface evaporation, to insure a properly rich mixture. At larger gas demands, the fuel is principally supplied through the spraying nozzle.



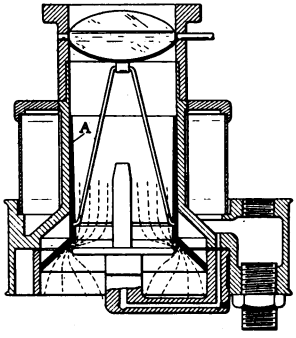
PUDDLE TYPE CARBURETOR.

Carburetor, Simple—A carburetor having no special provisions for securing uniformity of mixture quality at different rates of gas demand. A means for hand regulation of mixture quality is usually provided.

Syns.: Non-automatic carburetor; non-compensating carburetor.

Carburetor, Surface—A carburetor of the non-spraying type in which the entering air is caused to take up the requisite quantity of gasoline by being passed over large exposed evaporating surfaces kept moistened with gasoline and usually kept warm by heat derived from the motor. This type is practically obsolete, as it is not adapted to the use of the heavy grades of gasoline in present use.

Carburetor, Strangling Tube—A form of automatic carburetor in which the spraying jet is surrounded by a freely



STRANGLING TUBE CARBURETOR.

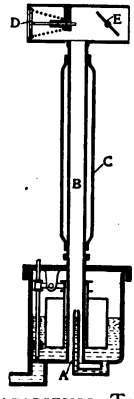
A, Strangling Tube.

guided tube or cage, which restricts the air passages, and increases the speed of the air around the jet. The tube or cage is capable of rising progressively from its seated position, under the influence of the upward air pressure upon it due to increasing suction at large gas demands and, in so doing, progressively increases the amount of air admitted as required to maintain a uniform mixture quality, by increasing the area of the air passages.

A stationary tube which restricts the air passage about a spraying jet is sometimes called a "strangling tube."

Carburetor, Vaporizing Tube—A type of carburetor in which special means are provided for completely vaporizing the sprayed fuel by heat applied to a vaporizing passage of extensive surface which generally carries a very richly carbureted mixture. The fuel bowl, spraying jet, and atomizing chamber are joined to the throttle and auxiliary air intake by a long, vertical, thin walled tube (the vaporizing tube), the entire external surface of which is hot jacketed. The additional air required to produce a correct mixture is added at a point above the vaporizing tube, near the intake manifold.

Carburetor, Water-Jacketed—A carburetor, the vaporizing or mixing chamber of which is wholly or partly surrounded by a jacket through which is circulated warm water obtained from the water cooling system of the engine. The warm water furnishes heat to assist in the evaporation of the liquid fuel.

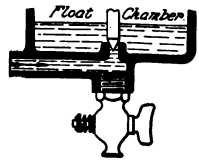


VAPORIZING TUBE CARBURETOR.

A, Main Air Inlet; B, Vaporizing Tube; C, Water Jacket; D, Auxiliary Air Valve; E, Throttle.

Carburetor Banking Stop—An adjustable stop which limits the degree of closing of the throttle valve and thus determines the minimum rate of gas admission. It is usually a screw, against the end of which a lug carried by the throttle valve makes contact as the valve closes.

Carburetor By-pass—A passage of very small cross-section, leading from the float chamber into the intake pipe (q. v.) just beyond the throttle valve (q. v.), through which, when the throttle is nearly or quite closed, gasoline is drawn directly into the intake pipe, and a rich mixture is thus produced for very slow speed running and to facilitate the starting of the motor.



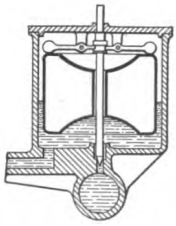
CARBURETOR DRAW-OFF.

Carburetor Draw-off—A cock or removable plug placed at the lowest point of a carburetor float chamber, the opening or removal of which permits the chamber to empty itself of fuel and of any foreign matter which may be present.

Syn.: Carburetor drain.

Carburetor Flange—The flange at the outlet of a carburetor which is bolted to a similar flange formed upon the end of the intake pipe.

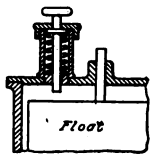
Carburetor Float—A freely moving, buoyant part of a carburetor, contained within the fuel bowl or float chamber, the function of which is automatically to maintain a constant fuel level therein, independent of the rate of demand. It is usually a thin walled, liquid tight cylinder, annulus or sphere of copper, or a solid piece of shellacked cork of the same form, that floats in the fuel which partly fills the bowl, rising and falling with the level of the same. It operates, either directly or through a suitable linkage, a valve (usually of the needle type) which controls the admission of fuel from the supply tank, the valve closing as the float rises and opening as it falls, an approximately constant fuel level thus being maintained in the bowl.


CARBURETOR FLOAT.

Carburetor Float Chamber—The chamber or bowl of a carburetor from which fuel is supplied through a passage or passages to the spraying nozzle or nozzles.

Syn: Fuel bowl.

Carburetor Float Depressor—A device arranged to depress a carburetor float below its natural level in the fuel and thus cause the fuel valve to open and the fuel level to rise above the spraying nozzle. This permits the fuel to escape therethrough into the vaporizing chamber, which facilitates the formation of the rich mixture required in starting a motor.



FLOAT DEPRESSOR.

Syn.: Carburetor primer; carburetor flooding device.

Carburetor Float Valve—The valve which admits fuel to the float chamber of a carburetor and which is under the automatic control of the carburetor float.

Carburetor Needle Valve—The valve which controls the rate of flow of fuel to the spraying nozzle or jet of a carburetor. It is usually an adjustable, taper seated needle valve in the passage from the fuel bowl to the spraying nozzle.

Syn.: Carburetor gasoline adjustment.

Carburetor Spraying Nozzle—The aperture or apertures through which liquid fuel is ejected in a more or less finely divided state from the standpipe of a carburetor into a contracted portion of the current of air within the vaporizing chamber. The apertures are usually in the end or in the wall of the standpipe and are so formed as to conduce to the thorough atomization of the fuel.

Syn.: Carburetor jet.

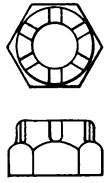
Carburetor Standpipe—A vertical pipe which rises centrally within the carburetor vaporizing chamber, usually terminating at a contracted portion thereof, and which carries the spraying orifice or orifices in its end or side walls.

Cardan Shaft—A shaft provided at one or at both ends with a universal (Cardan) joint, so as to enable it to rotate freely when in varying angular relations to another connected shaft or to two other connected shafts, attached to its respective ends.

Syn.: Universally jointed shaft.

Caseharden (v.)—To harden iron or steel superficially, in order to increase its wearing qualities by adding to the carbon content of the external layer of the metal. The part to be casehardened is heated, sprinkled with powdered ferrocyanide of potassium and then heated again, the carbon resulting from the decomposition of the ferrocyanide, uniting with the outside part of the metal, then it is quenched. Or the part to be treated is packed in horn parings, to which a little common salt has been added, heated for a time and quenched.

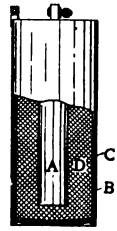
Castellated Nut—A form of lock nut which is secured from turning after being tightened, by means of a pin passed through a hole in the bolt and also secured in slots cut into the upper surface of the nut, which slots are provided entirely around the top of the nut.



CASTELLATED NUT.

Caulk (v.)—To make a tight joint between abutting metal parts by forcing metal into the interstices between them with a form of chisel, called a caulking tool, and a hammer. The metal may be raised from the edges of the parts or may be taken from a wire of softer metal. Used in the production and repair of steam boilers.

Cell, Dry—A primary or voltaic cell the electrolyte of which is not a free liquid, but is absorbed in a porous material, placed between the elements, so that the danger of its spillage is avoided. The common dry cell consists of a central rod of corrugated carbon, placed in the axis of a cylindrical cup of pure zinc. In internal contact with the zinc cylinder is a layer of absorbent material, such as blotting paper, saturated with sal ammoniac solution. The annular space between the absorbent layer and the carbon element is packed with a mixture of pulverized carbon, manganese dioxide and sometimes other materials, which is moistened with electrolyte. The top of the cell between the elements is sealed with insulating compound and the whole cell is slipped into a paper carton. Binding posts are provided upon the zinc and carbon elements. Used as a source of ignition current.



DRY CELL.

A, Carbon Rod; B, Zinc Cup; C, Absorbent Paper; D, Depolarizer.

Cell, Storage—See accumulator.

Cell, Voltaic or Primary—A cell which is the primary source of electrical energy developed by the irreversible chemical actions of the materials contained therein. The electrical energy developed results from the combination of zinc with various acid radicals. The term is used in contradistinction to "secondary cell," which refers to a storage cell or accumulator which is not a true source of electrical energy, but a device for accumulating electrical energy developed elsewhere.

Centre of Gravity—In general, the point of application of the resultant of the gravitational forces acting upon a freely suspended body in equilibrium. The vertical distance of the centre of gravity from a horizontal plane upon which the wheels of a motor car are resting is the most important factor determining its stability against overturning.

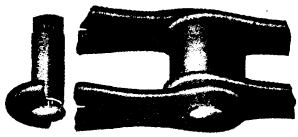
Centre Control—The location of the control devices of an automobile—the brake and gear shifting levers in a gasoline car—at the centre of width of the front seat space, so that neither the driver or front seat passenger need climb past them in entering or leaving the car. In cars with left hand control (q. v.) the levers are convenient to the operator's right hand.

Chain, Block—A form of chain used to transmit power from one sprocket to another, consisting of a series of hardened steel blocks joined by pairs of side pieces, which are secured together through the ends of the blocks by hardened steel rivet pivots, enclosing a sprocket tooth and preventing the chain from slipping sidewise from the sprocket.

Chain, Detachable—A form of sprocket chain, the links of which are so put together that when the chain is removed from the sprockets by the removal of the master or fastening link, the links may readily be detached one from another without tools being required.

DETACHABLE CHAIN.

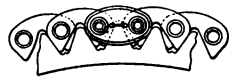
Chain, Roller—A form of sprocket chain, in which the contact of the links with the sprocket teeth is of a rolling rather than of a sliding character, in order to reduce wear upon the parts. It consists of a series of hardened steel rollers which fit between adjacent sprocket teeth and which turn upon hardened steel pins that also secure the rollers to the side pieces which hold the chain together, enclose the sprocket teeth and prevent the sidewise slipping of the chain from the sprockets. As the chain meets a sprocket tooth the roller which makes the contact is supposed to rotate upon its pin and to prevent sliding friction between the chain and the tooth.



ROLLER CHAIN.

Used for the final drive of most chain driven cars.

Chain, Silent—A form of chain adapted for use upon sprockets, which possesses a very high transmission efficiency, operates almost noiselessly, wears very slowly, and compensates for such wear as takes place. The sprockets are of rather wide face and resemble spur gears. The chain is built up of a large number of hardened sheet steel stampings, each individual stamping being so formed as to present two V shaped teeth toward the sprocket face.



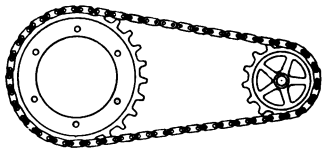
SILENT CHAIN.

Adjacent links are jointed together flexibly, the stampings of one link alternating with those of the next on the pivot pin. In action the tooth driving faces of each link make direct contact with the sprocket teeth, and as the chain moves on, leave the sprocket without slippage on the points of contact. As the chain stretches the points of link contact move outwardly on the sprocket teeth, but the driving action is free from slip, unless chain stretch becomes excessive. Used in the transmissions of electric vehicles, for driving cam and auxiliary shafts and occasionally as the final drive of gasoline cars.

Syn.: Link belt.

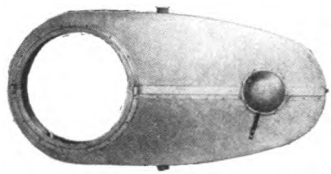
Chain, Tire—See tire chain.

Chain and Sprocket Gear—A method of rotating a shaft from another parallel shaft at any desired speed ratio therewith. Each shaft carries fixed upon it a toothed wheel or sprocket, the two being located in the same plane, and a flexible endless chain, composed of a series of pivoted links, each equal in length to the pitch of the sprockets, runs upon the sprocket teeth, thus maintaining the two shafts in definite but not absolutely inflexible driving relation. The ratio of the rotative speed of the driven shaft to that of the driving shaft is inversely as the ratio of the number of teeth in the driven sprocket to the number of teeth in the driving sprocket.



CHAIN AND SPROCKET.

Chain Case—A housing arranged to enclose a chain and sprocket gear, adapted to exclude dust, retain lubricant and deaden noise. When used in connection with the driving chains of motor cars it is usually a tight, sheet metal construction conforming in shape to the path of the chain, supported at its front end upon the shaft of the driving sprocket and at its rear end upon the driving axle, means being provided to permit free movement of the axle under spring action and to allow of chain adjustments.



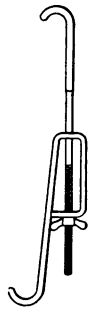
CHAIN CASE.

Chain Drive, Double—That form of final drive in which power transmission is effected by two chains each running from a sprocket fixed upon one end of a horizontal, transverse, divided shaft carried by the vehicle frame to a corresponding sprocket attached to one of the driving wheels.

Chain Drive, Single—That form of final drive in which power transmission to the traction wheels is effected by means of a single chain, running from a sprocket carried upon a horizontal, transverse, engine-driven shaft, carried upon the vehicle frame to a corresponding sprocket secured to the pinion frame of the differential gear of a live driving axle.

Chain Oiler—An automatic journal oiling device consisting of an oil reservoir formed in the bearing stand or bracket and a short endless chain, threaded around the shaft, so arranged that its lower portion dips in the oil in the reservoir. As the shaft rotates, the chain is carried over it and distributes oil upon it.

Chain Tool—A special form of clamp adapted to draw together and hold in position upon the sprocket the ends of a chain, while they are being secured together.



CHAIN TOOL.

Chamfer (v.)—To bevel the engaging edges of the teeth of sliding gears to a somewhat wedge form so that they may readily enter the tooth spaces of their mates.

Change Gears (v.)—In the operation of a gasoline car, the act of altering the ratio of the rotative speed of the motor to that of the driving wheels, by the use of some form of change speed gear, in order that a higher or a lower vehicle speed may be attained, or that a greater torque or driving effort at the traction wheels may be realized.

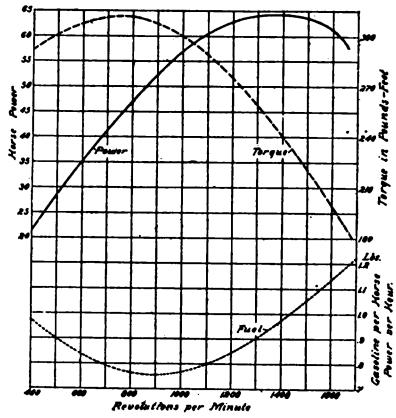
Change Speed Gear—A mechanism, forming one of the transmission elements of a gasoline vehicle, which permits the ratio of the rotative speed of the driving wheels to that of the motor to be varied at the will of the operator. It is employed so that a wider range of driving effort and of speed at the traction wheels may be obtained than can be secured by control of the motor itself. The required changes of speed ratio are generally obtained by the use of combinations of spur gears (the sliding gear, individual clutch system and the planetary gear, q. v.), or by some type of variable friction drive device (q. v.)

The mechanism for producing backward motion, the reverse gear, is generally a part of the change speed gear.

Syn.: Transmission (not the best usage).

Channel—A form of structural steel having a U shaped cross-section and used in the construction of vehicle frames and subframes. This section is sometimes used in front axles and in minor pressed steel parts.

Characteristic Curve—A graphic representation of the relation of torque (q. v.), speed and output of an internal combustion motor, prepared by plotting on cross section paper respectively, as abscissæ and ordinates, simultaneous observations, covering the practicable speed range of the motor, of speed in revolutions per minute and torque in pounds-feet, and drawing a curve through the points thus plotted. An output curve, the points of which are obtained by computation, is usually drawn upon the same plot with revolutions per minute as abscissæ and horse power as ordinates and a fuel consumption curve is frequently added, with the same horizontal scale and pounds of fuel per horse power hour as ordinates. Such curves are usually plotted from observations taken at full throttle opening with the most advantageous ignition timing and thus represent maximum performance.



CHARACTERISTIC CURVE.

Charge (v.)—To pass an electric current through an accumulator or storage cell, from an external source, in the direction opposite to that in which the accumulator furnishes useful current, in order to cause chemical changes, the reversal of which, upon the subsequent discharge of the cell, results in the useful return of a part of the electrical energy supplied.

Charge (n.)—The electrical energy supplied an accumulator, to be later returned, in part, as useful work, during the process of discharge.

Charge (n.)—The combustible fuel mixture which is contained in the cylinder of an internal combustion motor, generally a suitably proportioned mixture of gasoline vapor and air.

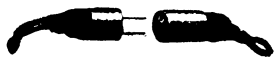
Charge, Freshening—A special charge given an accumulator or storage cell the plates of which have become sulphated, for the purpose of restoring it to normal condition. Such a charge is usually of long duration at such a low rate that the temperature of the electrolyte does not rise above 100°F., and is usually carried somewhat beyond the ordinary point of full charge.

Charge, Rate of—The volume of current, usually expressed in amperes, which is employed in charging an accumulator. The greater the capacity of the accumulator the higher the rate of charge, and a higher rate is generally used at the beginning than toward the end of a charge. The rate of charge is usually that which will entirely charge an accumulator in from 4 to 8 hours. Charging rates of ignition accumulators range from 3 to 6 amperes, and those for pleasure vehicle batteries from 10 to 30 amperes.

Charge Ratio—The ratio of the weight of the charge actually drawn into the cylinder of an internal combustion motor per cycle, when operated at a known speed and full throttle opening to the computed weight of the charge required to fill its piston displacement at atmospheric pressure and normal air temparture. This ratio is in practice always less than unity and approaches unity in proportion as the intake resistance (q. v.) and the pre-expansion (q. v.) are less.

Syn.: Volumetric efficiency.

Charging Plug—A plug, attached by a flexible conductor to a source of continuous electric current, adapted to be inserted in a corresponding socket carried upon an electric vehicle and thus automatically to establish connection between a vehicle battery and a charging source.



CHARGING PLUG.

Charging Resistance—An adjustable resistance inserted into the charging circuit of a storage battery to regulate the volume of the charging current (rate of charge). Adding more resistance to the circuit diminishes the charging current and vice versa.

Charging Stroke—See aspirating stroke.

Chassis, (pronounced shássee)—A motor vehicle, complete as to its essential mechanical parts, but without a body and certain other parts which are generally carried in or on the body.

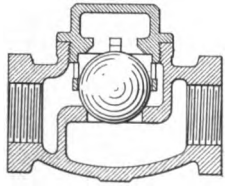
Chassis, Stripped—A chassis from which such parts as the tires, fenders, running boards and all but the essential mechanical parts have been removed.

The significance of these terms is not rigidly exact.

Chatter, v.—To produce a rapid, irregular vibration with accompanying noise. Applied to the action of a pair of meshed gears, between the teeth of which backlash exists. Whenever one of the pair changes from the condition of the driver to that of the driven gear, or vice versa, their teeth strike together and chattering results. In clutches, the surfaces sometimes spasmodically engage and disengage a number of times before permanent engagement takes place, with resulting chattering.

Chauffeur (pron. shófer)—The paid operator of a motor vehicle; one who makes a business of driving motor vehicles for money. (In France, where the term originated, it is used in the sense of automobile owner.)

Check Valve—A valve designed automatically to permit the passage of fluid in one direction and to prevent its passage in the other. One form of check valve consists of a pipe fitting enclosing an annular seat upon which a valve ball is lightly forced by a spring or by gravity. Fluid pressure acting from under the seat lifts the ball and forces a passage, but pressure in the opposite direction merely forces the ball more tightly upon its seat. Used in the piping of steam cars, in some lubrication and fuel supply systems on gasoline cars and in self-starters.



CHECK VALVE.

Syn.: Non-return valve.

Cheek—That portion of a crank shaft, which extends at an angle with the axial or bearing portion of the shaft and connects the same with a crank pin.

Syn.: Crank shaft web.

Choke, v.—In a gasoline engine, to miss explosions or to explode weakly on account of such an excess of fuel in the mixture supplied the cylinders that it becomes imperfectly combustible or actually non-inflammable.

Circuit, Closed—A system of electrical conductors forming a completely closed path through which an electric current can flow. Syn.: Complete circuit.

Circuit, Open—A system of electrical conductors which does not form a completely closed path through which an electric current can flow.

Syn.: Broken circuit; incomplete circuit.

Circuit, Primary—In the case of two or more electrical circuits, arranged in inductive relation, that one is the primary circuit in which the electrical energy existing in the system was originally developed, e. g., in a spark coil, the circuit in which is included the battery, dynamos or magneto is the primary.

In apparatus designed to raise the electrical tension above that of the original source, the number of turns of conductor in the primary circuit is less than that in the secondary and of correspondingly larger cross section.

Circuit, Secondary—In the case of two or more electrical circuits, arranged in inductive relation, the circuit or circuits in which the electrical energy manifested does not orginate, but is produced by induction, are secondary circuits. In apparatus designed to raise the electrical tension above that of the prime source thereof, the number of turns of conductor in the secondary circuit is greater than that in the primary, and the conductor used is of correspondingly smaller cross section.

Circuit Breaker—An automatic protective device intended to break or open an electric circuit whenever certain predetermined electrical conditions prevail, which may be deleterious to the apparatus involved. In charging electric vehicle and lighting accumulators a circuit breaker is sometimes so connected as to act whenever the supply of charging current fails or weakens and thus to prevent the battery from discharging back into the charging source. It may also be arranged to act whenever the voltage of the battery indicates that it is fully charged or whenever the charging current becomes excessive. Also a timer (q. v.) or a magneto make-and-break (q. v.).

Circulating Pump—A pump employed to keep in motion, in a closed path, a body of liquid, generally water or oil. Such a pump is usually driven by the vehicle motor, and the circuit includes the pump, the apparatus through which the circulation is to be maintained and the necessary connecting piping and reservoir. (See water pump.)

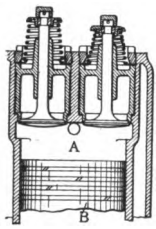
Circulating System (of lubrication)—See lubrication, circulating system.

Circulating System, Water—The cooling system of a water cooled motor. See water cooling.

Circulation Gauge—A gauge used to indicate the liquid pressure acting in a circulating system. The failure of such a gauge to show a pressure denotes the cessation of action of the circulating pump or that the liquid in the system is exhausted or escaping.

Circulation Indicator—See sight feed.

Clash Gear—See sliding gears.



CLEARANCE SPACE.
A, Clearance Space.
B, Piston.

Clearance Space—The space in the head end of a gas engine cylinder above the piston head when the piston is in its extreme upward or inward position, including valve pockets and ports. The portion of the cylinder volume not swept by the piston. In this space the charge is compressed and fired at or near the end of the compression stroke. It is common practice to make this space from 20 per cent. to 40 per cent. of the volume swept by the piston.

Syn.; Compression space; combustion space.

Clearance, Gear—In setting meshed gears, the slight freedom intentionally provided between the tooth faces, so that they may not jam.

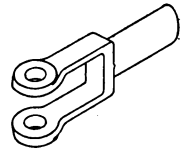
Loss of energy through friction, and noise are prevented by the provision of clearance.

Clearance, Ground—The shortest perpendicular distance from a plane upon which the wheels of a motor car are resting to any part of the car. This distance is usually the perpendicular distance from the lowest point of the front axle, of the rear axle housing or the flywheel to the level ground upon which the car is standing.

Clearance, Valve—A small amount of lost motion allowed at some point or points between the cam follower and the valve stem in the mechanism which operates a poppet valve of a gas engine, in order to insure that the valve spring may always be able to seat the valve even though the parts of the mechanism may be expanded by heat.

Clevis—The forked end of a rod, or the part by which it is connected in operative relation to some other part.

Clevis Pin—A pin which secures together a clevis and an attached part, the pin passing through holes drilled in both arms of the clevis fork and a corresponding hole in the other part.



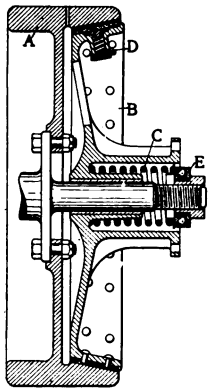
CLEVIS.

Climb (v.)—That action of a badly fitted sprocket chain caused by the failure of the links properly to fall into place between the sprocket teeth. The links ride upon the teeth, making the path of the chain longer than normal, tightening it excessively and sometimes causing its breakage, the breakage of sprocket teeth or the springing of the sprocket shafts. The stretching of the chain, through wear, so that its pitch is increased, is the chief cause of this action.

Syn.: Ride.

Clockwise Rotation—Rotation in the same direction as that of the hands of a clock.

Syn.: Right handed rotation.



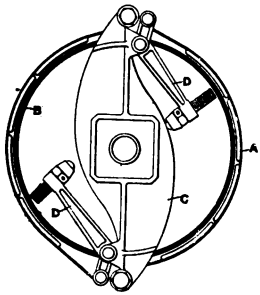
CONE CLUTCH.

A, Flywheel; B, Clutch Cone; C, Clutch Spring; D, Clutch Slip Spring; E, Spring Thrust Bearing.

Clutch, Cone—A clutch, the engaging frictional surfaces of which are the surfaces of conical frusta. In the face of one member, generally the driving member and usually the motor flywheel itself, a concentric, conical recess is formed. The periphery of the driven member is conical and so shaped as exactly to fit into the conical recess in the driving member, and is held in alignment therewith, the two members being forced into engagement axially by a spring and being drawn apart by a mechanism usually operated by a pedal. With conical surfaces, a high pressure between the members can be secured with a relatively low axial spring pressure. The engaging surface of the driven member is commonly faced with leather or some fabric to secure a high coefficient of friction.

Clutch (Friction)—A device adapted to connect in a gradual manner and to disconnect the motor of an automobile to and from the transmission mechanism through which the traction wheels

are driven, thus permitting the motor to be run freely without moving the vehicle and providing for the vehicle's gradual acceleration. It consists of a member or members fast upon and rotated by the motor shaft and another member or set of members fast upon and rotating with a shaft connected in driving relationship to the driving wheels. These two members or sets of members are in close juxtaposition and in alignment, and are arranged to be forced one against the other, or to be drawn apart by means of a suitable control mechanism. When forced together, the friction developed between them tends to cause the member rotated by the motor to rotate the other member at a speed less than or equal to that of the motor (depending upon the force of friction acting) and to set in motion the driving mechanism and the traction wheels.



CONTRACTING CLUTCH.

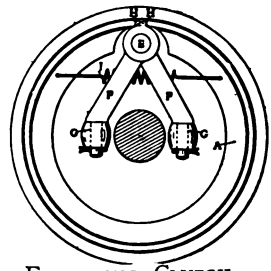
A, Contracting Band; B, Clutch Drum; C, Spider; D, D, Operating Arms.

Clutch, Contracting Band—A clutch, the driving member of which is a drum secured upon and rotating with the driving shaft. The driven member consists of a somewhat flexible metal band, encircling the driving drum and carried by a spider fast upon the driven shaft. The band is so arranged that it may be contracted upon the drum by means of a toggle, cam or wedge mechanism actuated by one or more springs and a linkage, and loosened therefrom by pressure upon a pedal. When contracted, the band and its attached mechanism rotate with the drum, under the frictional forces acting. The band is usually lined with some friction increasing material.

Clutch, Dry Plate—A clutch of the disc or plate type, the engaging surfaces of which are not lubricated. (See clutch, multiple disc.)

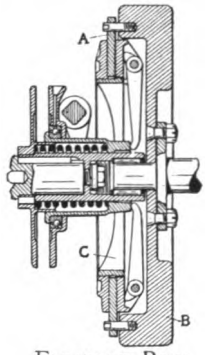
Clutch, Expanding—A clutch, the driving member of which is a drum, fast upon the driving shaft. The driven member

consists of a somewhat flexible metal band carried upon a spider fast to the driven shaft and capable of being expanded against the inside, cylindrical surface of the drum by a spring actuated cam, wedge or toggle mechanism. The band may or may not be lined with a fabric or similar material. Instead of a continuous band, the driven member may consist of a series of shoes which are forced outwardly against the inside surface of the drum. The flywheel itself may be utilized as the drum.



EXPANDING CLUTCH.

A, Expanding Ring; F, F, Operating Arms; C, C, Rollers for Arms; H, H, Operating Lever Tips; J, Spring.



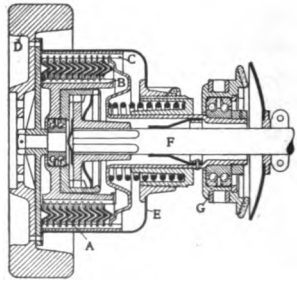
FLOATING RING CLUTCH.

A, Floating Ring; B, Flywheel; C, Driven Drum.

Clutch, Floating Ring—A form of plate clutch, consisting of one plate fast upon the motor shaft (sometimes the flywheel itself), another plate fast upon the driven shaft, and between them a metal ring which is fast to neither shaft. When the driven plate is forced towards the driving plate, by spring action, the floating ring is caught between them and engagement takes place. The use of the floating ring doubles the surface over which friction is distributed. It is often provided with cork inserts (q. v.).

Syn.: Three plate clutch.

Clutch, Hele-Shaw—A form of multiple disc clutch (q. v.) in which the discs are thin rings alternately of phosphor bronze and mild steel. The rings are not flat, but formed with a V-shaped cross section. In action, the annular V of one ring enters into and makes frictional contact with the A-shaped annular depression of the adjacent ring. Named from its inventor.



HELE-SHAW CLUTCH.

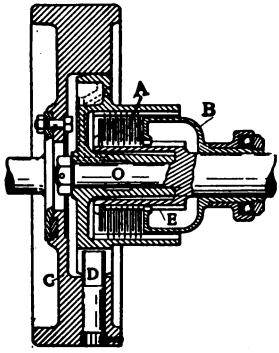
A, Hele-Shaw Discs; B, Inner Drum; C, Outer Drum; D, Flywheel; E, Casing; F, Driving Shaft; G, Shifter.

Clutch, Jaw—A clutch, not of the frictional, but of the positive engagement type, consisting of two members which, when brought together, lock in driving relationship by projections upon one entering corresponding depressions in the other. A closely related form of clutch (the gear type) consists of two members, one a spur gear of coarse pitch and special tooth outline and the other an internal gear of such size and tooth form that the first member speeds in constantly meshed (individual clutch) gearsets and also in driving power air pumps from vehicle motor.

Clutch, Magnetic—A clutch, the surfaces of the driving and driven members of which are held in engagement by magnetic force induced by a coil carried by one of the members through which an electric current can be passed at the will of the operator.

Clutch, Metal to Metal—A clutch, the engaging frictional surfaces of which are of similar or dissimilar metals and not of organic material. Such clutches generally require lubrication and must possess rather large contact areas. Most multiple disc and plate clutches and occasionally cone and expanding clutches are of the metal to metal type.

Clutch, Multiple Disc—A clutch, the engaging members of which consists of two alternated, closely juxtaposed sets of rather numerous thin, annular discs of metal or of metal fabric lined, arranged concentric to and in a plane at right angles to the shaft axis. The discs of one set are held from turning upon the driving shaft, and the discs of the other set are held from turning upon the driven shaft, but both sets are free to move slightly along the shaft axis. One or more springs act to force the whole collection of discs together, and as the discs of the two sets alternate, each disc of one set is thus pressed between two discs of the other set and engagement is thereby effected. A releasing device, usually pedal operated, is pro-

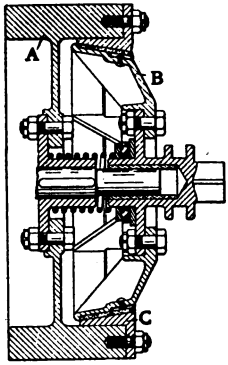


MULTIPLE DISC CLUTCH.

A, Discs; B, Compressing Member; C, Flywheel; D, Driving Plug; E, Inner Drum; O, Shaft.

vided to overcome the spring pressure and to allow the discs of the two sets to separate and disengage. When metal discs are used, the discs usually operate in an oil bath.

Clutch, Reversed Cone—A form of cone clutch in which the conical engaging surfaces converge away from the motor instead of toward it, as in the ordinary construction. Engagement is thus effected by moving the driven member away from the motor instead of toward it.



REVERSED CONE CLUTCH. A, Flywheel; B, Male Cone; C, Bolted on Female Cone.

Clutch, Slipping of (v.)—An action sometimes intentionally caused by the partial engagement of a clutch, characterized by more or less relative motion between the two members. The two members do not grip positively, but slide more or less one upon the other. It is necessary when a car is to be gradually accelerated from rest, when a car speed lower than that corresponding to the lowest motor speed is required and when it is desired partially to relieve the motor of a load too great for it to carry. It accidentally occurs when the clutch spring is too weak or when the co-efficient of friction between the members is abnormally low.

Clutch Bearing (Radial)—The bearing upon which rotates the driven member of a clutch when the clutch is not in positive engagement. The driven member is usually held in alignment with the motor shaft by being mounted upon an extension of the same, and the clutch bearing is between the hollow shaft of the driven member and the engine shaft extension.

Clutch Bearing (Thrust)—A bearing designed to take the axial pressure of the clutch spring when the clutch members are separated in disengagement. This is usually a ball bearing of the end thrust type interposed between the spring and the collar or spool upon which the disengaging mechanism acts.

Clutch Brake—An automatic device designed to arrest the rotation of the driven member of a clutch and its attached shaft and gears, when disengagement has taken place, and thus to render easier the meshing of another gear in changing speeds.

The disengaging movement of the driven member produces contact between some part of it and a stationary brakeshoe, the friction of which tends to bring the spinning member to rest.

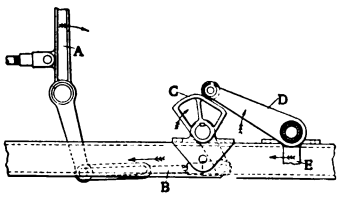
Clutch Case—An enclosure placed about a clutch to exclude dust and to retain lubricant.

Syn.: Clutch housing.

Clutch Collar—A collar or ring to which is applied the force which acts against the clutch spring (q. v.) to disengage a clutch. It is usually located in a circumferential groove formed in the clutch spring housing, which is secured to the driven clutch member and the disengaging motion is communicated to it by the ends of the clutch throwout yoke (q. v.) which engage with it. A ball thrust bearing is provided between the collar and the flanges of the grooves to resist the spring pressure and upon which the collar rotates when the clutch is disengaged.

Clutch Disengaging Spring—A small spring, one or more of which are often placed between adjacent discs of a multiple disc clutch in order to insure their separation when the clutch is thrown out. Such a spring may be simply a bent-out, resilient portion of the disc itself. Used especially in oil immersed clutches in which the viscosity of the lubricant is likely to prevent the proper parting of the discs, even though the releasing mechanism has been operated and thus to cause an objectionable dragging of the clutch.

Clutch Interlock—A mechanical connection between a clutch disengaging mechanism and the operating device of a brake or pair of brakes (usually the lever brake), so arranged that the application of this brake automatically disengages the clutch. The object is to prevent brake application until the driving power has been cut off and to prevent the application of the motive power, for the purpose of starting the car when the brakes are set.



CLUTCH INTERLOCK.

A, Brake Lever; B, Link Connecting to Cam; C, Cam; D, Lever Operating Clutch Fork; E, Clutch Fork.

Clutch Lining—An application, usually of some non-metallic material, made to one of the members of the clutch, so as to form its actual engaging surface. Leather, fabric belting, vul-

canized fibre or special asbestos fabric is used, the material being chosen as being superior to metal in one or more of the following respects: As producing a higher co-efficient of friction, giving a more gentle action, wearing better or obviating the necessity of using oil. The material used is generally riveted to the face of the engaging member.

Clutch Operating Device—The mechanism which transmits the force applied by the operator to the pedal (or lever) to overcome the spring and disengage the clutch. It usually consists of a linkage, designed to multiply the force applied to the pedal, and a yoke, which presses against a thrust collar acting against the end of the clutch spring.

Clutch Operating Shaft—A transverse shaft upon which are secured the clutch pedal and the clutch throwout yoke, and by the partial rotation of which the disengaging motion is transmitted from the pedal through the yoke to the clutch collar.

Clutch Pedal—The pedal by pressure upon which the operator disengages the clutch.

Clutch Shaft—The shaft upon which the driven member of a clutch is carried and which conveys the driving effort to the change-speed gear and to the final drive of an automobile. This shaft is usually a sleeve at its forward end, and is supported upon an extension of the motor shaft. At its rear end it usually carries some form of universal and slip joint, which connects with the shaft entering the change gear case. This latter shaft, which carries a constantly meshed gear, is sometimes considered a part of the clutch shaft.

Clutch Spider—A construction usually formed of several arms radiating from a hub, secured to and rotating with one of the shafts of a clutch and carrying the engaging portion of one of the members thereof.

Clutch Slip Spring—One of a series of springs placed under the lining of a clutch (see clutch lining) and tending slightly to lift the lining at the points of their application so that, when the clutch commences to engage, frictional contact will first be established at these points and later, as engagement progresses the springs are compressed, the lining flattens and the whole of it finally comes into action. The engagement of the clutch is thus progressive and any tendency to grab (q. v.) is obviated. See diagram of clutch, cone.

Syn.: Spring insert, engagement spring, expansion spring, spring plunger.

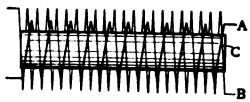
Clutch Spring—A spring which acts to force together the frictional surfaces of two clutch members or sets of members. A single spring or a number of springs so placed as to distribute the engaging pressure over all parts of the frictional surfaces, may be used.

Clutch Throwout Yoke—A fork, fastened centrally upon the clutch operating shaft, the ends of the arms of which act upon the clutch collar (q. v.) to disengage the clutch when the yoke is partially rotated by the shaft.

Syn.: Clutch shipper-yoke, clutch fork.

Coast (v.)—To allow a car to move without the application of engine power, under the influence of gravity as in running on a down grade. In coasting, the clutch is disengaged, and the gears generally thrown out of mesh. To allow a car to run upon the level under its own momentum may be called coasting, but more properly "drifting."

Coil, Induction—An electrical apparatus for the transformation of a low tension into a high tension current by means of electromagnetic induction, comprising a laminated, soft iron core and two coils of insulated wire wound upon it. One of these, the primary, consists of a relatively small number of turns of rather coarse insulated wire, through which the low tension current flows, and the other, the secondary, consists of a very large number of turns of fine insulated wire. When the current flowing in the primary winding is abruptly broken, a very high electrical pressure is developed between the ends of the secondary coil, sufficient to cause a spark to pass through a short gap from one secondary terminal to the other. A condenser (q. v.) is generally connected to the primary winding. All jump spark ignition coils are induction coils.



INDUCTION COIL DIAGRAM.

A, Primary Winding; B, Secondary Winding; C, Iron Core.

Syn.: Step-up coil, step-up transformer, jump spark coil.

Coil, Plain—An induction coil, for ignition purposes, which is provided with no automatic means for making and breaking

the primary current, the quick acting make and break device being separate from it. A condenser is generaly attached to such a coil.

Syn.: Non-vibrator coil.

Coil, Primary—That winding of an induction coil for ignition purposes through which circulates the primary or low tension current, derived from a battery or low tension magneto winding and which is in circuit with the timer (q. v.) and the vibrator or other means for abruptly breaking the current.

Coil, Secondary—That winding of an induction coil, for ignition purposes, in which a high tension current is generated by induction, and the terminals of which are connected to a spark plug in a jump spark ignition system.

Coil, Self Induction—A coil, consisting of a laminated, soft iron core upon which are wound a small number of turns of coarse wire, through which a low tension current is passed. When the circuit including it is abruptly broken, a momentary high tension current, due to the self-induction of the coil, passes in the form of a spark or arc across the break. Used to produce the igniting spark in some low tension contact spark (q. v.) systems.

Coil, Tubular—A form of plain induction coil, for ignition purposes, which is enclosed in a tubular water and oil proof case. Used when the coil is to be placed out of sight under the hood or flooring of a car, and is likely to be exposed to oil or water. Used also on motor bicycles.

Coil, Unit—A form of ignition induction coil so designed as to be interchangeable with other similar coils. It is designed to be put into service by inserting it in a coil box containing spaces for a number of identical coils. Inserting any coil unit into any space in the box automatically makes its connections with the external circuit which is wired to contacts fixed in the inside of the box. Such coils are used because they are instantly changeable, in case they become damaged and because they are readily interchangeable from one circuit to another by which the location of ignition defects is facilitated.

Coil, Vibrator—An ignition induction coil with which is incorporated an electromagnetic vibrator (q. v.) for abruptly making and breaking its primary circuit. The vibrator is usu-

ally mounted upon one end of the coil, and its armature is operated by the magnetism of the core of the coil itself.

Syn.: Buzzer coil, trembler coil.

Coil Box—A box designed to contain one or more induction coils for ignition purposes and provided with the necessary binding posts for their connection to their respective external circuits. Usually adapted to be mounted upon an automobile dashboard.

Cold Chisel—A short, stout chisel with a hardened edge of V-shaped section, adapted to be used with a hammer in cutting or chipping metals when in a cold condition.

Cold Test—A test applied to lubricating oils, which consists in determining the reduction of temperature which an oil can withstand without passing from the fluid to the non-fluid condition. An oil of high cold test is one which becomes non-fluid only at a very low temperature.

Collar—An enlarged portion of a shaft, either integral with the rest of the shaft or applied in the form of a ring sometimes fastened upon the shaft by set screws, designed to limit the end play of the shaft or to support end thrust.

Collector Ring—A conducting ring carried by a rotating portion of an electric device with which a stationary brush makes contact. Designed to convey electricity to and from the rotating element.

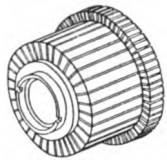
Combustion Lag—The very short period of time which elapses between the instant at which the ignition spark passes in the cylinder of an internal combustion motor and the instant at which the maximum gas pressure is developed. It is dependent upon the time required to complete the inflammation of the charge and to raise the gases to their maximum temperature, and this is modified by the character and location of the spark or sparks, the quality of the mixture, the dimensions and form of the combustion chamber, etc.

Combustion Space—See clearance space.

Common Terminal—A terminal or binding post to which more than one circuit is attached.

Common Wire—A wire which forms a part of more than one electric circuit, e. g., a ground wire which simultaneously grounds several distinct circuits.

Commutator—A device for automatically reversing the direction of current flow in an electric circuit. In a direct current dynamo, a device for automatically reversing the connections of each armature coil to the external circuit, when the direction of the current induced in it reverses, so that the current which it supplies to the external circuit shall always flow in the same direction. It consists of a cylindrical shell of hard copper, mounted upon an insulating bushing, secured upon one end of the armature shaft. This shell is axially split into equal insulated segments, usually the same in number as the armature coils. Adjacent ends of adjacent armature coils are electrically connected to the same segment. Upon the commutator bear two or more sets of stationary, conducting brushes (q. v.).



COMMUTATOR.

The term commutator is sometimes applied to the ignition timer (q. v.).

Compensating Gear—See differential gear.

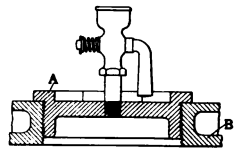
Compression—The reduction of the space occupied by a gas or vapor, attended by rise of pressure and the evolution of heat. In internal combustion engines, compression of the fuel charge is effected by the motion of the tightly fitted piston in the cylinder. During the suction stroke, the cylinder and its compression space are completely filled with fuel charge, at or near atmospheric pressure, and the valves are then closed, thus confining the charge within the cylinder. As the piston, starting at its extreme outward position (downward position in the case of a vertical motor), performs its inward or upward travel, the space occupied by the charge is progressively reduced until, when it reaches its extreme inward or upward position, the total charge is crowded into the clearance space. The main object of compression is to reduce the exposed surface of the charge at ignition, and thus to reduce its great heat losses.

High compression and low compression are relative terms, but vehicle motors which carry a gauge compression of not over 70 pounds per square inch may be called low compression and those carrying higher pressures, high compression motors.

Compression, Ratio of—The quotient obtained when the total volume of the cylinder of an internal combustion motor, from the beginning to the end of the piston stroke, plus the

clearance volume, is divided by the clearance volume. In automobile practice, the compression ratio is usually between three and four.

Compression Cock—A cock communicating with the clearance space of the cylinder of an internal combustion engine which, when opened, permits the escape of the charge as the piston makes its compression stroke. Used to reduce the labor of cranking at starting, as an indicator that the cylinder is firing properly and as a means of escape of superfluous lubricating oil from the combustion space.

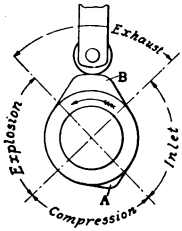


COMPRESSION COCK.
A, Valve Cap; B, Cylinder Wall.

Compression Gauge—A pressure gauge adapted to be so connected to the clearance space of an internal combustion engine as to indicate the pressure above the atmosphere existing in the cylinder during the compression stroke. Principally used to detect leakages of the charge from the cylinder.

Syn.: Compressometer.

Compression Release—A mechanism for reducing the compression pressure within a gas engine cylinder, and thus of reducing the effort required at cranking. It consists of a special exhaust valve cam, so formed and so timed as to hold the exhaust valve open during the first part of the compression stroke, thus allowing a portion of the charge to escape. The special cam is substituted for the regular cam, at starting, by means of a small lever, within reach of the operator, and, in multi-cylinder engines, the cams of all the cylinders are brought into action by the same movement, which generally consists of an endwise displacement of the exhaust cam shaft.



COMPRESSION RELEASE.
A, Relief Cam; B, Exhaust Cam.

Compression Stroke—In a four stroke cycle internal combustion motor, the inward (upward in a vertical motor) piston stroke, during which the fuel charge is compressed in the clearance space of the cylinder, preparatory to being fired. It

is usually regarded as the second stroke in the four-stroke cycle. In a two-stroke cycle motor, the compression stroke is that stroke during which the fuel charge is being compressed back of the piston and mixture is also being drawn into the crank case or separate pump, preparatory to being transferred, under pressure to the working cylinder to form the charge for the succeeding cycle. The compression and intake strokes are therefore identical.

Condenser, Electrical—A device used in connection with ignition apparatus to suppress the spark or arc produced at the point where the primary circuit is broken, and, by increasing the abruptness of the break, to increase the intensity of the igniting spark delivered by the secondary circuit. It consists of a large number of sheets of tinfoil piled together, each sheet being separated from its neighbor by a sheet of mica, or other insulating material. Alternate tinfoils are all connected together, making two series thereof, one of which is electrically connected to one side of the point at which the circuit is to be broken, and the other set to the other side of the break. When the primary circuit is interrupted, the electricity, which would otherwise be expended in an arc at the point of break, thus delaying the opening of the circuit and burning the contacts, is absorbed by the condenser. A condenser is usually installed with each ignition induction coil, and in high tension magnetos one is usually incorporated with the armature connected around the make and break device.

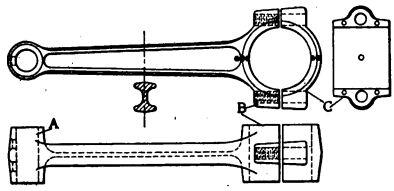
DIAGRAM OF ELECTRIC CONDENSER.
A, Positive Electrode; B, Negative Electrode.

Condenser, Steam—A means of conserving the water supply of a steam car, by condensing the exhaust steam upon the vehicle instead of allowing it to escape into the atmosphere. It consists of an arrangement of numerous thin walled tubes, exposing a very large surface to the air, usually carried at the extreme front of the car, and sometimes assisted by an air fan, into which tubes the steam from the engine is exhausted. The cool air, impinging upon the tubes, extracts the heat from the steam, reducing it to water. It is then returned to the supply tank or boiler after oil separation.

Condenser Pump—A pump, usually driven from the engine of a steam car, which returns water from the condenser to the supply tank or boiler.

Conductor, Electric—A substance through which a current of electricity can flow. Theoretically all materials are in a degree conductors, but only those such as metals, carbon and aqueous solutions through which electricity can flow with comparative freedom, are so classed. Copper wires and cables are the most common forms of conductor.

Connecting Rod—The rod which connects the piston of a steam or gas engine with the crank, and converts the reciprocating motion of the former into rotation of the latter. Its own motion is a combination of reciprocation and oscillation. In the ordinary type of gasoline vehicle motor, its upper or "head" end is secured to the trunk piston by the piston pin (wrist pin). Its lower or "crank" end contains a bearing which secures it to the crank pin, upon which it freely turns. The end of the rod which is attached to the crank pin is generally made of greater cross section than the other, and is known as the "big end."



CONNECTING ROD.

A, Piston Pin Bearing; B, Connecting Rod Head; C, Connecting Rod Cap.

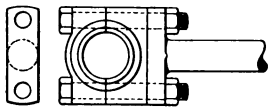
Connecting Rod, Angularity of—The maximum angle made by the connecting rod with the axis of the cylinder. The greater the ratio of the piston stroke to the length of the connecting rod, the greater is the angularity. A high degree of angularity is objectionable, in that it results in excessive side pressure of the piston upon the cylinder walls.

Connecting Rod, Hinged Type—A connecting rod, the crank end of which contains half the crank pin bearing; the bearing cap, which contains the other half of the bearing, being hinged to the rod end at one side and held in place at the other by bolts.

Connecting Rod, I Section—A connecting rod, the cross section of which is an I, placed with its web in the plane of its

movement. The use of this section secures greater rigidity than can be obtained from the same mass of metal in a solid section.

Connecting Rod, Marine Type—A form of connecting rod of great ruggedness. The rod proper is a steel forging, the crank end of which is flanged out to the size of two bronze castings, each of which contains one-half the crank pin bearing. These bronze castings or brasses are drawn together and against the end of the forging by means of four bolts which pass through the flanged end of the rod and both brasses.



HEAD OF MARINE TYPE CONNECTING ROD.

Connecting Rod, Tubular—A connecting rod, the section of which is a circular or oval tube. The use of this section secures greater rigidity than is obtainable from the same mass of metal in a solid section.

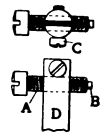
Connecting Rod Cap—The cap which secures the large end of a connecting rod to the crank pin and which contains half the bearing bushing. It is bolted to the rod end.

Connecting Rod Tip—The large end of a connecting rod which has a bearing upon the crank pin.

Contact Breaker—See mechanical make-and-break, magnetic vibrator, magneto make-and-break.

Contact Point—A small piece of infusible, non-oxidizable metal, usually platinum or an alloy of platinum and iridium, adapted to withstand the action of the electric arc. Such points are used in pairs in the make-and-break devices of ignition apparatus, the primary circuit being completed by their contact and interrupted by their separation.

Contact Screw—A screw carrying a contact point which, when screwed in or out of a stationary support, adjusts the distance between its contact point and another similar contact point, in a make-and-break device.



CONTACT SCREW.

A, Contact Screw; B, Contact Point; C, Clamping Screw; D, Contact Post.

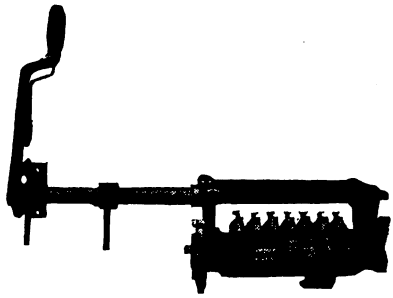
Continuous Current—An electric current which flows always in the same direction. Such a current is produced by primary and storage cells, and by dynamos and magnetos fitted with commutators, and is required for

the charging of storage batteries. The term is used in contradistinction to "alternating current."

Syn.: Direct current.

Control Device—A general term applied to all handles, pedals and so forth, by means of which the speed and direction of an automobile are regulated by the operator, including those which operate the steering mechanism, brakes, clutch and change speed gear, and those which vary the operation of the motor or engine.

Controller—A device which regulates the flow of current from the battery to the motor of an electric vehicle, and thus controls the motor output and the speed and tractive effort of the vehicle. It consists of a hand operated lever which, when moved by the operator into certain positions or "points," makes and breaks suitable contacts by the action of which a succession of graded electrical pressures or voltages are applied to the motor, or by means of which the current may be completely cut off.



ELECTRIC VEHICLE CONTROL.

Controller, Continuous Torque—A type of electric vehicle controller, the contacts of which are so arranged that, at the moment when it is being changed from one speed or point to another, there is no cessation of driving power, and thus no jerk is imparted to the vehicle. This result is secured by closing the contacts corresponding to a certain speed just before the connections corresponding to the preceding speed are opened.

Controller, Field Commutating—See field commutation control.

Controller, Magnetic—A type of controller in which the combinations of contacts corresponding with the several speeds are not effected by the direct action of the operator's hand, but by electromagnets actuated by an electric switch button or lever moved by the operator.

Controller, Resistance Type—See resistance control.

Controller, Series Parallel—A form of controller in which the gradations of voltage applied to the motor, and hence the speed variations, are obtained by the use of a battery usually divided into two equal sections, which sections, when coupled in parallel, supply a low voltage to the motor and, when coupled in series, supply double this voltage.

Controller Contact—A metal contact piece' forming part of a controller, generally a movable contact.

Controller Cylinder—The cylinder, of insulating material, which is rotated by the operator in changing speeds and upon which are mounted the conducting segments with which the controller fingers make contact.

Syn.: Controller barrel.

Controller Finger—The stationary contacts of a controller, which are spring-pressed upon the movable contacts, and to which the controller leads to the motor, battery, rheostat and other parts of the control system are attached.

Cooler—See radiator.

Cooling Flange—A thin conductive rib or flange, a number of which are formed integrally with or applied to a part which it is desired to cool by exposure to the surrounding air, such as a gas motor cylinder (see air-cooled), an exhaust pipe or brake drum. Such flanges offer a large surface to the air and convection rapidly removes heat through them from the part which bears them.

Syn.: Radiating flanges.

Cooling System—A term applied collectively to parts the function of which is to abstract excess heat from the cylinder walls of an internal combustion motor and thus to maintain them at a proper working temperature. It consists of means for passing a fluid (air or water) around and in contact with the external surfaces of the cylinders, which fluid, mainly by convection, absorbs heat therefrom and carries it away to be dissipated in the external air. It includes such parts as air and water jackets, water piping, circulating pumps, radiators and fans.

See air cooling and water cooling.

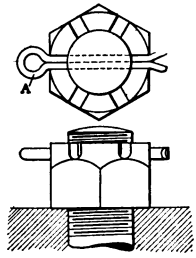
Core, Magnetic—The mass of soft iron about which are wound the wire coils of an induction coil, magneto or dynamo armature, or other form of electro-magnetic device. The function of the core is to multiply the magnetic effect set up by the electric currents circulating in the windings or to serve as a path for magnetism created by an external magnetizing force.

Cork Insert—A plug of compressed cork adapted to be set into the surface of one of the members of a frictional device such as a clutch or brake, or into the face of a belt driven pulley. A series of holes are drilled in the frictional surface of the member and a properly formed piece of cork is forced into each, under pressure, so that it protrudes slightly beyond the surface. When pressure is applied between the working surfaces, the corks first make contact with the opposing frictional member, resulting in a gentle engagement and finally the corks are sufficiently compressed so that the entire working surfaces contact, securing positive engagement. The use of cork inserts is claimed to increase the coefficient of friction, to diminish the rate of wear of the surfaces, to reduce the necessity for lubrication and to prevent harsh action.

CORK INSERTS USED IN AUTOMOBILE BRAKE.

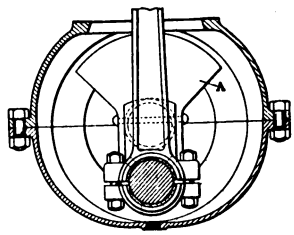
Cotter Pin—A split metal pin, used to prevent a nut from backing off its threads, to hold small parts together and for various similar purposes. A hole is drilled through the bolt or stud at a point just beyond the nut. The pin is passed through the hole and its halves are bent apart, so that it cannot pass back through the hole.

Syn.: Split pin.



A, COTTER PIN.

Counterbalance (n.)—A weight or weights so distributed upon and attached to a moving part as to balance it, thus preventing vibration, noise and sudden pressures upon the bearings.



A, COUNTERBALANCE.

When a counterbalance is so applied to a rotating part that the centre of gravity of the whole system lies in the axis of rotation, the part so counterbalanced is in static balance. When so applied, that, during rotation, the inertia forces produce no resultant component at right angles to the axis of rotation, the system is in dynamic balance; e. g., in the case of a one cylinder engine, with a single throw crankshaft, the mass of the crank is entirely upon one side of the crankshaft and a mass of metal is so distributed upon the other side of the crankshaft as to counterbalance it, and, at the same time, to partially neutralize the unbalanced effect of the reciprocating parts.

v. To apply a counterbalance.

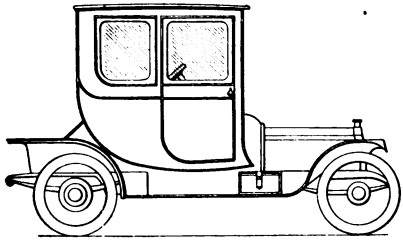
Counterbore (n.)—A hole bored in a part concentric with another hole and superposed upon it, but of a larger diameter, resulting in a shoulder, where the two bores meet. Also the tool used in this operation, consisting of a guiding spindle, fitting the smaller hole, which forms the end of a boring-bar, the cutter of which is of an effective diameter equal to that of the desired larger bore. v. To perform the above described operation.

Counterclockwise Rotation—Rotation in the direction opposite to that of the hands of a clock. Left handed rotation.

Countershaft—A subsidiary shaft driven from a main shaft. In a gearset of the sliding gear, direct drive type, the shaft which is driven from the clutch shaft through permanently meshed gears is often called the countershaft. Syn.: Lay-shaft. In a double chain driven car, the transverse shaft which carries the differential gear and the driving sprockets is so called. Syn.: Jackshaft.

Countershaft Unit—A term applied to the combustion of parts employed in double chain driven (see chain drive, double) motor cars, consisting of the bevel driving gears, the differential gear (q. v.) and countershaft (q. v.), and, in some cases, including the change speed gear.

Coupé—A rather short, permanently closed-in body, usually seating two inside, with outside seat for the operator.



COUPE.

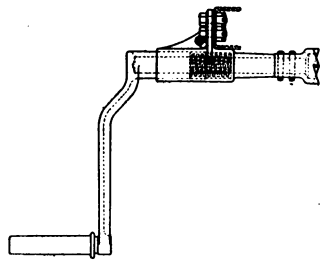
Coupé, Inside-driven—A form of coupé body, mounted well forward on the chassis, within which the steering column and levers are included, so that a car equipped with it may be driven without exposure of the operator to the weather. It usually seats one besides the operator.

Crank (n.)—An offset in a driving or driven shaft, to permit of a rotary motion being imparted to the shaft from a reciprocating part, or of a reciprocating motion being imparted to a part from the rotation of the shaft. A crank consists of two webs or cheeks projecting from the shaft nearly at right angles thereto, the extremities of which are joined by a cylindrical shaft-like portion—the crank pin—parallel to the crankshaft.

Crank (v.)—To turn over a gasoline motor by hand, in order to draw fuel charges into its cylinders and to cause the ignition apparatus to act, so that a charge may be fired and the motor may commence to operate under its own power.

Crank, Safety Starting—A form of starting crank, so arranged that in case the motor upon which it is used "kicks back," the reverse turning force of the motor is not transmitted to the crank and the operator's hand, and possible injury to him is thus prevented.

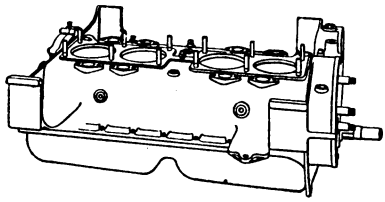
Crank, Starting—A hand crank adapted to engage with the end of the crankshaft of a gasoline motor, which enables the operator to turn over the motor to start it. The crank is slidably guided in a bracket attached to the car frame, and its end is formed with a ratchet face, which can be engaged with a corresponding



STARTING CRANK.

ratchet face upon the motor crankshaft end. A spring acts to slide the ratchet faces out of engagement and they are so shaped that they are automatically disengaged when the motor starts. A strap, or similar device, is generally provided to prevent the crank from swinging when it is not in use.

Crank Case—The case or housing, generally of cast iron, aluminum or pressed steel, which encloses the crankshaft, connecting rods and some other parts of a gasoline motor, contains the crankshaft bearings and retains lubricant for the oiling of the moving parts. The flanged crank ends of the cylinders are bolted to the top of the crank case, in which suitable spaces for the play of the connecting rods are provided, and the case itself is usually provided with projecting arms, by means of which it and the entire engine are secured to the vehicle frame.



CRANK CASE.

Syn.: Engine base.

Crank Case, Barrel Type—A crank case cast in one piece, except that one or both ends are not included. The crankshaft is inserted through the open ends, which are closed by end plates in which are the end bearings of the crankshaft.

Crank Case, Divided—A crank case which is split in halves in the plane of the crankshaft. The upper half, to which the cylinders are secured generally carries the bearings of the crankshaft and the arms or web by which the engine is fastened to the vehicle frame. The lower half generally performs only the function of retaining oil and excluding dust.

Crank Case Arm—A projection formed upon a crank case, by means of which the motor is bolted to its foundation.

Crank Case Compartment—One of the longitudinal subdivisions of the crank case of a multiple-cylinder motor. The divisions are usually but partial, being formed by transverse partitions arising somewhat from the bottom of the case. Compartments are used to prevent the oil supply, carried in the case, from collecting in one end thereof and thus stopping the lubrication of certain cylinders, when the motor is inclined fore and aft.

Syn.: Crank case section.

Crank Case Compression—In a two-stroke-cycle motor, the practice of using the crank case and the piston as a pump to force the fuel mixture through a transfer passage into the working cylinder. Mixture is drawn from the carburetor into the tight crank case during the upstroke of the piston, through a non-return valve arrangement and, being trapped therein, it is compressed during the succeeding downstroke to a pressure sufficient to force it through the transfer passage into the cylinder and to displace some of the burned gases.

Crank Case Drain Cock—A cock communicating with the lowest point of a crank case compartment, through which the lubricant contained therein can be drawn off.

Crank Case Explosion—See base explosion.

Crank End—The end of an engine cylinder nearer the crankshaft.

Crank Pin—The cylindrical portion of a crank, parallel to the crankshaft and at a perpendicular distance from it of one-half the piston stroke, to which the large end of the connecting rod is secured and upon which it rotates.

Crank Pit—A depression in the bottom of a crank case shaped to conform somewhat with the path of the crank, and which generally contains a supply of lubricant which is distributed by the splashing action of the crank and connecting rod tip.

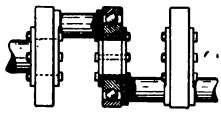
Crankshaft—The main shaft of an engine, in which are formed the crank or cranks. It is supported in several bearings (usually carried by the crank case), with its axis at right angles to the axes of the cylinders, and upon it is secured the balance wheel or flywheel. It communicates the turning effort

CRANKSHAFT.

of the engine to the driving member of the clutch, which is secured upon it.

Crankshaft, Ball Bearing—A crankshaft supported upon ball bearings, generally of the annular type, instead of upon plain bearings.

Crankshaft, Built-up—A crankshaft whch is not a single piece of metal, forged and machined into form, but which is made up of several sections, so formed as securely to lock together when assembled. They are not much used and were devised mainly to permit the use of ball bearings which cannot readily be applied to the centre bearings of integral shafts.



BUILT-UP CRANKSHAFT.

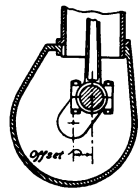
Crankshaft, Double-Throw—A crankshaft with two cranks arranged side by side upon it, in the same plane but opposite, one to the other. Used in two cylinder twin and opposed motors and sometimes in four cylinder motors of the V type.

Crankshaft, Five-Bearing—A crankshaft supported upon five bearings, a type which is commonly used in four cylinder motors the cylinders of which are separately cast.

Crankshaft, Four-Bearing—A crankshaft supported upon four bearings, and used in three and six cylinder motors.

Crankshaft, Four-Throw—A crankshaft used in four cylinder motors, carrying four cranks in the same plane, the two end cranks being located upon the same side of the shaft, and the two middle cranks being located upon the other side of the crank or at an angle of 180 degrees from the end cranks.

Crankshaft, Offset—A crankshaft so positioned that its centre line is not in the plane including the axes of its cylinders, but is somewhat displaced along a line at right angles to the cylinder axes toward that side of the crank chamber in which the crank is located during the compression stroke. The object of offsetting the shaft is to bring the connecting rod thrust more nearly into the axis of the cylinder and thus to reduce the side pressure exerted between the piston and the cylinder walls during the power stroke. An offset equal to 1-6 the piston stroke is quite common.



OFFSET CRANKSHAFT.

Crankshaft, Roller Bearing—A crankshaft supported upon roller bearings for the purpose of reducing frictional losses.

Crankshaft, Seven Bearing—A crankshaft supported in seven bearings, and used in six cylinder motors, the cylinders of which are separately cast.

Crankshaft, Single Throw—A crankshaft with a single crank, used in single cylinder motors and also in two cylinder V motors.

Crankshaft, Six Throw—A crankshaft with six cranks, used in six cylinder engines. The cranks are located in three planes at angles of 120 degrees. Numbering the cranks from one end of the shaft: Cranks 1 and 6 are in the same plane, cranks 2 and 5 are in a plane making an angle of 120 degrees therewith and neighboring cranks 3 and 4 in the remaining plane, at 120 degrees from those occupied by the other two pairs.

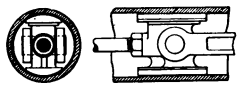
Crankshaft, Three Bearing—A crankshaft supported in three bearings and used in four cylinder and two cylinder twin motors.

Crankshaft, Three Throw—A crankshaft with three cranks arranged in planes making angles of 120 degrees, one with another, used in three cylinder motors and in six cylinder motors of the V type.

Crankshaft, Two Bearing—A crankshaft supported at its ends only, used in motors of one to four cylinders.

Creep (v.)—In the case of a tire, to rotate gradually upon its rim in a direction opposite to the rotation of the wheel, under the stress of the tractive effort. The cause is usually insufficient inflation or insecurity of the fastening devices, and the result is sometimes to tear the valve stem from the inner tube where it passes through the felloe. A similar action sometimes takes place with tire chains and tire bands, which creep relatively to the tire itself.

Crosshead—That part of a steam engine which forms the connection between the piston rod and the connecting rod and on which the latter pivots. It is a block-shaped member so formed that its sides are slidably restrained in guides which permit of its reciprocating in line with the piston movement. The piston rod is secured in the head end of the crosshead and a wrist pin passes through the crosshead and the head end of the connecting rod and secures them together.



CROSSHEAD.

Crosshead, Ball Bearing—A crosshead in which a series of balls is arranged between each of its guided sides and the guides themselves upon which the crosshead slides with very slight friction and wear.

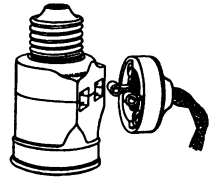
Crosshead Guide—In a steam engine the two parallel guides or ways, located in line with the piston movement and usually fixed to the engine frame, in which the crosshead slides.

Cross Member—A transverse structural member which unites the two side members of an automobile frame and gives it form and rigidity. Such a member is placed at each end of the frame and others are distributed at intermediate points, usually in such positions as to form supports for the motor, clutch and gear box.

Syn.: Transverse member.

Crystallization—The alleged deterioration of a metal from a tough, fibrous condition to a brittle crystalline condition, brought about by its long continued subjection to vibratory stresses. See fatigue.

Current Tap—An electrical fitting so arranged as to permit of the convenient connection of a storage battery in series with an incandescent lamp or group of lamps for the purpose of charging the battery from a direct current circuit, the number of lamps used definitely limiting the charging current. It consists of a number of lamp sockets connected in multiple to the supply circuit, and a receptacle wired in series with one side of the lamp group, into which may be inserted an attachment plug.



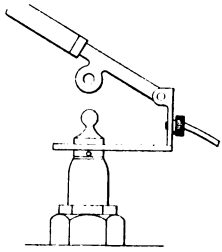
CURRENT TAP.

Cut-off, Point of—In the operation of a steam engine, that point in the piston stroke at which the valve ceases to admit live steam.

Cut-out, Muffler—See muffler cut-out.

Cut-out Button—See ignition cut-out.

Cut-out Switch, Individual—A switch, by means of which the ignition of one cylinder of a multicylinder gasoline engine may be thrown on or off. By the use of a series of such switches it is possible to determine which cylinder or cylinders are receiving imperfect ignition. When the engine is running and one of these switches can be opened without reducing the engine speed it is an indication that that cylinder is not firing. If the engine is running irregularly, and, upon opening the switch pertaining to a certain cylinder, the irregularity ceases, it indicates that that particular cylinder is missing explosions. (See ignition cut-out.)



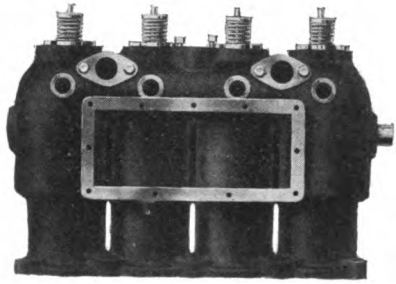
CUT-OUT SWITCH.

Cycle of Operations—The successive actions of the working fluid of a heat engine upon its piston and of its piston upon the working fluid, commencing when a certain relationship between the two exists and ending with the next recurrence of the same relationship, e. g. In a four cycle gas engine, commencing with the suction of the charge and continuing through its compression, its ignition and expansion and through its exhaust, when suction again begins.

Cylinder—That portion of a heat engine in which the transformation of heat energy into mechanical energy takes place, as the result of the expansion of a gas or vapor. In a reciprocating steam or internal combustion motor, a nearly cylindrical metal vessel, closed at one or both ends and provided with an axially placed truly cylindrical bore, in which a closely fitted piston slides back and forth, and with suitable port openings controlled by valves giving ingress and egress to the working fluid. In an internal combustion motor of the trunk piston type, a nearly cylindrical casting of specially adapted iron, closed at the head end and open at the other end, where it is secured to the crank case, with a truly cylindrical axial bore and with provisions near the head end for the placing of the inlet and the exhaust valve, and with the necessary ports cored out in the cylinder wall to permit communication between the valves and the bore.

Cylinder, Air Cooled—See air cooling.

Cylinder, Block Cast—A cylinder which is formed together with one or more other similar cylinders as a single casting, the water jackets, valve pockets and often a portion of the piping of all the cylinders being included in the casting. Compactness, rigidity and a smooth external appearance are secured by this method. The term is particularly applied to cylinders cast in groups of four and the practice is at present most commonly applied in the manufacture of rather small four cylinder motors.

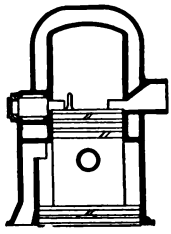


CYLINDER, BLOCK CAST.

Syn.: Cylinders *en bloc.*

Cylinder, Dome Head—A cylinder, the head of which is of somewhat hemispherical shape and which, when used with a piston with a concaved head, affords a compression space of somewhat spherical form, which possesses certain thermodynamic advantages. It is most often employed in overhead valve (q. v.) motors.

Cylinder, Double Acting—A heat engine cylinder with a head and an expansion chamber at each end thereof and means for admitting and exhausting the working fluid from both expansion chambers. The cylinders of most steam vehicle engines are of the double acting type.

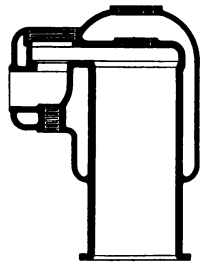


CYLINDER, DOUBLE DIAMETER.

Cylinder, Double Diameter—A form of cylinder the bore of which is larger at the crank end than at the head end, and concentric with it, a shoulder or step being formed where the two bores meet. In it reciprocates a double diameter piston, the two sections of which respectively fit the two cylinder bores. This type is used in some two cycle motors, the smaller piston being the working piston and the larger bore and piston, in conjunction with the shoulder between the two bores, forming

an annular space which is used as the cylinder of a pump by means of which the fuel charge is forced into the working cylinder. The double diameter cylinder has also been used to render a gasoline motor double acting, both the smaller cylinder and the annular space above referred to being used as working cylinders.

Cylinder, L-Type—A gasoline engine cylinder having cast upon one side of its head a chamber or pocket or a pair of closely adjacent pockets designed for the reception of one or both of its valves. An axial section through the valve chamber of such a cylinder, when inverted, resembles the letter L, whence the name. Used in engines which have all valves upon one side and also in those which have one set of valves upon one side and the other set in the cylinder heads.



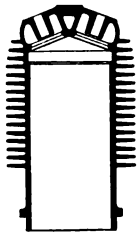
L-Type Cylinder.

Cylinder, Pair Cast—A cylinder which is formed together with another similar cylinder in a single casting which includes the water jacket, valve pockets and ports of both.

Syn.: Twin cast, dual cast cylinders.

Cylinder, Ribbed—A cylinder the external surface of which is provided with ribs, fins, flanges or other projections, either cast integral therewith or applied thereto, which expose a large surface and assist in the dissipation of excess heat. Air cooled cylinders are usually so made.

See air cooling.

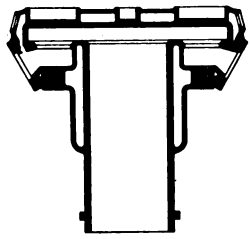


Ribbed Cylinder.

Cylinder, Separately Cast—A cylinder which is cast singly and not in combination with other similar cylinders.

Cylinder, Single Acting—A cylinder having a head and expansion chamber at one end only. Practically all gasoline vehicle motors are single acting.

Cylinder, T-type—A gasoline engine cylinder cast with a chamber or pocket for the reception of the inlet valve upon



T-TYPE CYLINDER.

one side of the head and a similar chamber for the exhaust valve upon the diametrically opposite side of the head. An axial cross section of such a cylinder, through the valve chambers, resembles a letter T, hence the name.

Cylinder, Water Cooled—See water cooling.

Cylinder Barrel—The cylindrical portion of a cylinder exclusive of the head, valve pockets and water jacket.

Cylinder Bore—The truly cylindrical chamber or cavity forming the inside of a cylinder, within which the closely fitted piston reciprocates and which, together with the clearance space, is the seat of action of the gases concerned in the operation of the motor. Also the diameter of the bore, usually expressed in inches or millimeters.

Cylinder Counterbore—A slight enlargement of the bore of a cylinder, beyond the limit of piston travel, at the head end where it joins the clearance space.

Cylinder Flange—A flange cast around the crank end of a trunk-piston engine cylinder, through which pass the studs or other fastening devices which secure the cylinder to the crank case.

Cylinder Head—The somewhat circular end portion of a cylinder, which closes it and which, in conjunction with the piston head and the walls of the cylinder bore, forms the closed combustion and expansion space within which the working fluid acts.

Cylinder Head, Integral—A cylinder head which is cast as one with the cylinder barrel and other related parts.

Cylinder Head, Removable—A cylinder head which is not cast as one with the rest of the cylinder, but is cast as a separate piece, which often includes the valve pockets and parts of the water jacket, and which is secured to the cylinder barrel usually by means of studs. A gasket or packing is generally inserted between the abutting surfaces of the head and of the rest of the cylinder in order to secure a tight joint.

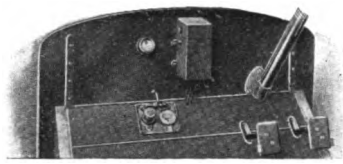
Cylinder Plug—A removable portion of the cylinder head of a gasoline motor, the removal of which gives access to the combustion space.

Cylinder Oil—A grade of oil specially adapted to the lubrication of the pistons and cylinder walls of steam and gasoline motors, the properties of which are such that it lubricates effectively at the high temperatures to which the parts attain in practice.

Cylinder Oil, Gas Engine—A grade of mineral oil especially adapted to the lubrication of internal combustion engine cylinders, characterized by a satisfactory fire test (q. v.) and flash test (q. v.), and a minimum tendency to leave solid residue at the very high temperatures to which it is exposed.

Cylinder Oil, Steam—A grade of oil, usually a compound of mineral and animal oils, specially adapted to give the best lubricating results at the temperature to which live steam raises the cylinders of a steam engine.

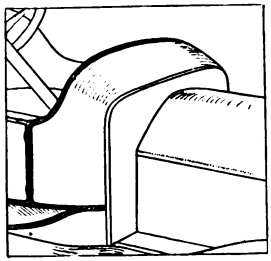
Dashboard—That portion of an automobile body which forms the front of the forward seat space, and, in the accepted type of "motor-in-front" construction, the back of the bonnet space in which the motor is housed. It acts as a wind break, and as a support for various indicating and control devices. It is made either of wood or of metal.



DASHBOARD.

Syn.: Dash.

Dashboard, Hooded—A rearwardly concave form of dashboard, usually made of pressed steel, the edges of which are curved backwardly so as to form surfaces which somewhat protect the front seat passengers by deflecting the moving air away from them. A common type upon runabouts, roadsters and speed cars.



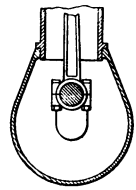
HOODED DASH.

Dashboard Adjustment—An arrangement which enables a carburetor to be adjusted from the driver's seat,

consisting of a handle mounted upon the dashboard so connected by a linkage with the needle valve or air intake control of the carburetor as to permit of its regulation by the driver while the car is in motion.

Dashpot—A device for automatically dampening or slowing down the movements of a part without preventing its free change of position. It consists of a piston fitting in a cylinder filled with a fluid, generally air, gasoline, oil, glycerine or mercury. Small orifices are provided for the gradual escape of the fluid from the cylinder. The dashpot piston is connected to the part the sudden motion of which is to be checked and the slow rate at which the fluid can enter or leave the cylinder prevents sudden movements. Used to prevent the fluttering of the air valves of carburetors under sudden fluctuations of engine suction.

Dead Centre—In a reciprocating steam or internal-combustion engine the two positions of the crank and the connecting rod in which they are in the same straight line. When so placed, pressure acting upon the piston cannot cause rotation of the crankshaft. Of these two positions, that in which the crank is upon the side of the crankshaft toward the piston is the inward dead centre and the other position is the outward dead centre.



Crank in Dead Centre Position.

Dead Storage—In garage practice, the housing of an automobile (usually at a special low rate), upon an understanding with the owner that it is not to be used, but is to remain idle.

Decarbonize (v.)—To remove carbon incrustations from the piston head, valves and combustion space of an internal-combustion motor.

Decarbonizer—A substance or device used to decarbonize a motor. Chemical or solvent decarbonizers are liquids or powders intended to be introduced into the combustion space and which are capable of disintegrating and loosening the deposits through a solvent action upon their binding materials. Mechanical decarbonizers are those devices which scrape or break off the deposits from the metal surfaces.

Syn.: Carbon remover.

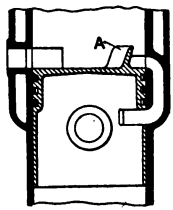
Decelerate (v.)—To decrease in speed or velocity.

Deceleration—The rate of decrease in the speed or velocity of a moving body. Strictly speaking, the limiting ratio of the loss in velocity during an infinitely short period of time to the length of the period of time itself. In practice deceleration is generally measured in feet per second per second. The antonym of acceleration and used in connection with the effect of automobile brakes.

Syn.: Retardation, which is preferable.

Deflate (v.)—To reduce the pressure within a pneumatic tire by allowing the air within it to escape.

Deflector Plate—A specially formed, usually curved plate on the pistons of two stroke cycle engines, the function of which is to cause the fuel charge, as it enters the cylinder, to take such a path that it partially forces out the remaining exhaust gases, but does not escape wastefully through the exhaust passages.



DEFLECTOR PLATE.
A, Deflector.

Deflocculated Graphite—Graphite in such a very finely divided state that it will remain almost indefinitely in suspension in a liquid. It is added to oils and greases to increase their lubricating qualities and especially to gas engine cylinder oil for use in vehicle motors.

Demi Limousine—A form of limousine body in which, while the extreme rear portion is permanently enclosed and the roof is fixed, the sides are not entirely enclosed.

Demi Tonneau—A form of touring body with a small tonneau, usually seating two, which is occasionally made detachable. The front seat is usually placed well forward as in the roadster type.

Syn.: Baby tonneau; miniature tonneau; toy tonneau.

Denatured Alcohol—Ethyl or grain alcohol, which has been rendered undrinkable by the addition of wood alcohol, benzine or other substances, and which is sold at a much lower price than grain alcohol, on account of not being taxed. When added to water it forms an excellent anti-freeze solution for use in the circulating systems of water cooled cars and in acetylene generators. Mixtures of denatured alcohol and water contain-

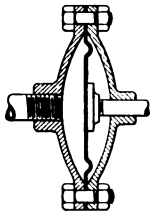
ing the following percentages of alcohol freeze at approximately the temperatures given below:

20%.....+14° F.
30%.....— 5° F.
40%.....—20° F.
50%.....—35° F.

Also used to a limited extent as a fuel for internal combustion motors, either alone or in combination with gasoline and benzol.

Depolarizer—A chemical substance with which the carbon or copper element of a primary battery cell is surrounded and which prevents the reduction of the cell's activity, known as polarization, that results from the accumulation of hydrogen upon the element. Depolarizers are substances which readily give up oxygen which combines with the hydrogen while in a nascent state, forming water. Manganese dioxide is used in dry cells.

Diaphragm—A thin, somewhat flexible, usually circular plate or sheet of rubber, metal or other resilient material, held rigidly at its edges and so arranged that one side is subjected to a fluid pressure which bulges the central portion of the plate. Such deformation, the amount of which is somewhat proportional to the pressure acting, makes the diaphragm a detector of pressure variations and adapts it for use in pressure regulating devices. It is used to regulate the fire in steam vehicles, the diaphragm being under the influence of the steam pressure and acting upon the fuel valve; also in gasoline motor speed governors, the diaphragm being under the influence of the circulating water pressure, and controlling the throttle opening. A diaphragm, acted upon by a succession of intermittent pressures, is sometimes used as an impulse pump to pump gasoline or air in fuel feed systems.



DIAPHRAGM DEVICE.

Dielectric—An insulator or non-conductor (q. v.).

Differential Brake—See brake, differential.

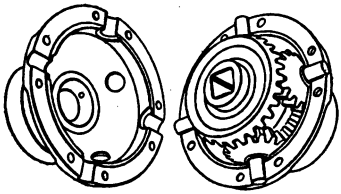
Differential Carrier—The frame which carries the driven bevel gear, the differential gear and the bearings thereof in a floating type rear axle (see axle, full floating), and which is

bolted to the inside of the axle housing in such a manner that it may be detached and removed therefrom through a handhole (q. v.) in the housing when the axle shafts have been withdrawn.

Differential Case—The housing that encloses and forms the main structural part of a differential gear. It is usually of cast iron or pressed steel, made in halves and provides two bearings in which the two master gears of the differential are supported. In it are fastened the studs upon which the differential pinions rotate and to it is also secured the driven gear or sprocket which receives the driving effort. It is often not a tight housing, but somewhat open to allow lubricant to enter from the axle housing. The term is often applied to the enlarged portion of the axle housing which, in shaft driven cars, encloses the driving gears as well as the whole differential.

Differential Gear—A combination of gears included in the transmission system of an automobile, which permits driving effort to be equally transmitted to each of the two traction wheels, even when they are rotating at different speeds, as in rounding corners. It is mounted upon the driving axle in live axle cars and upon the divided countershaft in double chain driven cars, and forms the connection between the two axle shafts, or between the two sections of the countershaft respectively. It consists of two master gears, one of which is secured to each of the adjacent ends of the divided shaft and between which, and in simultaneous mesh with both of which gears is a series of pinions carried upon studs fixed in a rotating frame or housing. To this frame or housing is fastened the driven gear or sprocket which receives the driving effort of the motor. So long as the traction wheels of the car are required to rotate at the same speed, driving effort is transmitted from the frame or housing, through the pinions equaliy to the two master gears and their shafts, and no rotation of the pinions takes place. When however, the traction wheels are required to rotate at differing speeds, the pinions rotate upon their studs and simultaneously revolve upon the master gears, permitting relative motion of rotation between the latter, and allowing each to turn at the speed required by its respective road wheel to which equal tractive efforts are transmitted.

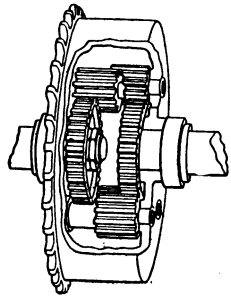
Syn.: Differential; compensating gear; equalizing gear; jack-in-the-box.



BEVEL DIFFERENTIAL.

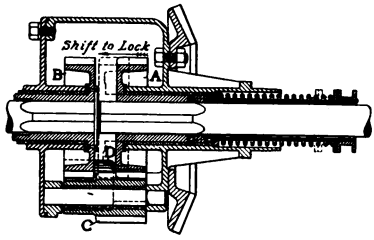
Differential, Bevel—A type of differential gear, the two master gears and the pinions of which are all of the bevel type, two, three or four of the latter generally being used.

Differential, Spur—A type of differential gear in which spur gears and pinions are substituted for bevels. To each of the adjacent ends of the divided axle or countershaft is secured a spur master gear and the frame or housing supports, two, three or four pairs of spur pinions. The two parallelly arranged spur pinions of each pair are in mesh with each other upon the inside half of their tooth faces, and one pinion of each such pair is in mesh upon the outside half of its tooth face with one of the master gears, while the other pinion of each pair is in mesh on the outside half of its tooth face with the other master gear. The action of the spur combination is, in effect, the same as that of the bevel arrangement.



SPUR GEAR, DIFFERENTIAL.

Differential Lock—A device which, when in action, prevents the operation of the differential gear and which is installed upon some cars for the purpose of facilitating starting even though one driving wheel may lack adhesion on account of slippery road conditions, in which case it would slip and fail to drive and the other wheel would fail to rotate. The differential lock acts to so fasten together the master gears of the differential, that they and



DIFFERENTIAL LOCK.

A and B, Master Gears.
C and D, Spur Pinions.
When A is shifted to the dotted position it meshes with C and D at the same time, thus locking the differential.

their shafts cannot rotate relatively and the traction wheels thus being rigidly fastened together turn at the same speed. It is usually put into action by means of a pedal.

Differential Master Gear—One of the main gears of a differential which is fastened to one of the abutting ends of a divided axle or countershaft and with which and the other master gear the pinions simultaneously mesh.

Differential Pinion—One of the small gears which acts to transmit the driving effort from the frame or housing of a differential to the master gears and their shafts and to divide the tractive effort equally between the two driving wheels.

Differential Piston—See piston, double diameter.

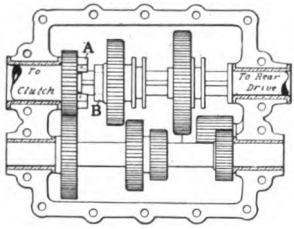
Differential Spider—A part consisting of a hub and two, three or four symmetrically disposed radial arms which carry studs upon which the pinions of a differential gear rotate. It is rotatably mounted upon the ends of the two divided shafts or upon the inside portions of the hubs of the master gears. The outer ends of its arms are fast in the differential frame or housing.

Syn.: Pinion frame.

Dimmer—An arrangement for reducing the intensity of electric headlights, usually consisting of a rheostat (q. v.), more or less of the resistance of which can be introduced into the headlight circuit at the will of the operator.

Direct Current—See continuous current.

Direct Drive—The transmission of the driving effort of a vehicle motor from the crankshaft to the final drive mechanism without the use of a countershaft or system of gears under load. In a shaft driven car, when on the direct drive, transmission is effected by a connection of the crankshaft through the clutch, clutch shaft, the main shaft of the gearbox (in line with the clutch shaft), the drive shaft and its universal joints and the propeller shaft to the driving pinion at the rear axle, all these parts rotating at crankshaft speed. Re-

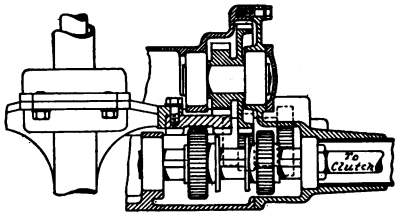


DIRECT DRIVE BY MEANS OF JAW CLUTCH.

A, B, Jaw Clutch.

duced frictional losses and noise are advantages of the direct drive. (See sliding gears, direct drive type.)

Direct Drive, Double—The transmission of the driving effort from a vehicle motor to the road wheels at two different speed ratios, without the use of a countershaft or a system of change speed gears under load. In a shaft driven car with the gearbox and rear axle constituting a single unit, a double direct drive is sometimes secured by mounting upon the differential housing two bevel gears of different diameters which are in constant mesh with two bevel pinions of correspondingly differing diameters which are loose upon the propeller shaft except when one or the other of them is made fast thereto by means of a double jaw clutch controlled by the gear shaft lever.



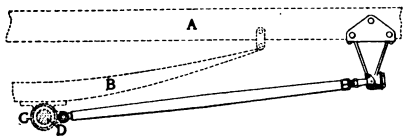
DOUBLE DIRECT DRIVE.

Discharge (n.)—In a storage cell, the flow of stored electricity therefrom into an external circuit. The opposite of charge. In ignition practice, the passage of high tension electricity through a dielectric, usually an air gap in the form of a spark or arc; e. g., the disruptive discharge between the points of a spark plug. Discharge (v.). To produce such a flow or passage of electricity as above described.

Discharge, Rate of—The rate at which electricity flows from a storage cell through an external circuit, usually measured in amperes.

Discharge Terminals—The two conducting points between which a disruptive discharge of high tension electricity takes place. In a jump spark plug, the two discharge terminals are usually of platinum or an alloy thereof or of other not readily fusible or oxidizable metal. Syn.: Sparking points.

Distance Rod—A rod the function of which is to maintain related parts at a fixed distance apart. The term is specifically



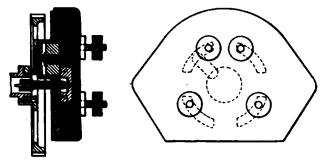
DISTANCE ROD.

A, Frame; B, Spring; C, Rear Axle Tube; D, Rear Axle.

applied to the two rods that maintain the fore and aft position of an axle, especially that of the driving axle, by resisting the reaction of the tractive effort which tends to shift the driving axle forward relatively to the rest of the car. The rods are usually of steel tubing, pressed steel or steel forged into an I-section.

Syn.: Strut rod.

Distributor—A device for directing high tension ignition current from a single secondary winding to the respective spark plugs of a multicylinder engine in the correct firing order. It consists of a stationary plate of insulating material, upon the surface of which are fastened symmetrically spaced, circularly disposed contact segments, in number equal to the cylinders to be served. A shaft, operated at one half motor speed, passing through the shell carries an insulated contact brush, which, when in rotation, successively contacts or nearly contacts with the segments. One terminal of the secondary winding is electrically connected to the rotating brush and the other is grounded, and each segment is electrically connected to a spark plug. A distributor forms a part of nearly all synchronous jump spark magnetos and of all single-coil battery systems adapted to multicylinder motors.



MAGNETO DISTRIBUTOR.

Syn.: High tension distributor; secondary commutator.

Distributor Valve—See valve, distributor.

Distribution Gears—See half time gears.

Double Ignition—Ignition which can be obtained at will from either one of two complete and distinct ignition systems, which are in no way dependent one upon the other, and which can

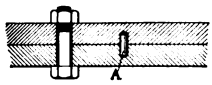
generally be used simultaneously, if desired. A double ignition outfit generally consists of a synchronous magneto, serving one set of spark plugs and some form of battery system serving another set of spark plugs, with a switching arrangement adapted to put into action, at will, either ignition source or both together.

Double Motor Equipment—In an electric vehicle, the provision of two electric motors each one of which drives its respective traction wheel only, being direct connected or geared thereto. No differential gear or live driving axle is thus required.

Double Spark Ignition—Ignition which is effected by two sparks produced simultaneously at two separate points in the combustion space of a gas motor, the object being to secure a more rapid combustion of the fuel charge. Two plugs, placed at a distance apart in the combustion space of each cylinder and served by two synchronized magnetos or a double magneto, are employed.

Syn.: Multipoint ignition, twin spark ignition.

Dowel Pin—A pin, usually of steel, fixed in a part which is to be positioned exactly upon a related part. Such pins exactly fit in corresponding, properly located holes, in the related part, and, when the pins are inserted in the holes, the two parts are always in exactly the same relationship.



Dowel Pin (A).

Drag (v.)—The faulty action of a clutch which, even when in the released position, still communicates a slight turning effort from the driving to the driven member, and its shaft, occasioned by the failure of the engaging surfaces or the lubricant upon them completely to move out of contact.

In a brake, the failure of the band or shoe completely to move out of contact with the drum upon which it acts, even though the controlling mechanism is in the released position. Generally due to faulty adjustment or design.

Drag Link—In a steering gear, the rod which connects the steering device, mounted upon the vehicle frame, to one of the axle stubs and transmits the steering movements of the operator to the steering wheels. As the steering device has an up and down motion relatively to the

Drag Link.

axles the ends of the drag link have a universal movement at their fastenings, and ball joints are thus generally used at these points.

Drain Cock—A small cock, arranged to communicate with the steam chest of a steam engine cylinder which, when opened, permits the water of condensation to escape therefrom, thus preventing possible damage to the cylinder caused by the piston forcing water against the cylinder heads.

Also, any cock which is used to drain a liquid from a space in which it is confined.

Draw-off Plug—A plug inserted in a hole at the lowest point of an enclosed space containing liquid, the removal of which permits the liquid to escape. Used in the bottoms of crank, gear and axle cases and carburetor bowls and in water and oil circulating systems, etc.

Drift Pin—A tapered steel pin used to line up two or more holes in parts which are to be put together, so that the bolt, pin or other part which is to be inserted in the holes may readily be passed through them.

Drive Shaft—In general, a shaft which transmits driving effort from one rotating part to another. In a shaft driven car, the shaft which transmits the driving effort from the transmission parts that are mounted upon the vehicle frame to the transmission parts at the driving axle. In a car with a rear axle mounted gear box, the front end of the drive shaft is connected, through its universal joint, to the driven member of the clutch and its rear end is connected to the primary shaft of the gearset. In other shaft driven constructions, the front end of the drive shaft is universally connected to the final shaft of the gearset and its rear end to the pinion shaft in the rear axle, or it carries the driving pinion directly upon its rear end.

DRIVE SHAFT.

Drive Shaft, Double Jointed—A drive shaft with a universal joint at each end and usually including a slip joint.

Drive Shaft, Single Jointed—A drive shaft with a universal joint at its front end only, the shaft housing acting as a torque and distance rod, and the driving pinion being carried directly

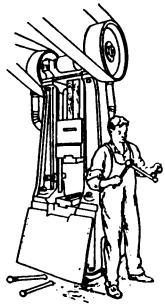
upon the rear end of the shaft, except in that type of construction in which the gearbox is integral with the rear axle housing.

Drive Shaft Housing—The tubular casing which encloses the drive shaft on a shaft driven car, supports the shaft bearings, excludes dust therefrom and retains lubricant. It also sometimes performs the functions of a torque rod and of a distance rod, preventing the axle casing from rotating unduly and from moving forward relatively to the rest of the car under the reaction of the tractive effort.

Driven Member—That one of two connected mechanical elements which receives its motion from the other, e. g., the member of a clutch which is not fast to the motor shaft; the gear which is mounted upon the differential housing in a shaft driven axle.

Driving Member—That one of two connected mechanical elements which transmits motion to the other, e. g., the member of a clutch which is secured to the motor shaft, the pinion upon the drive shaft of a shaft driven car.

Drop Forging—The process of producing parts from steel and other malleable metals when heated to a malleable condition, by forming the metal into the desired shape by repeated blows from dies carried in a powerful drop hammer. The term is used in contradistinction to "hand forging," and is also applied to the parts produced by the process.

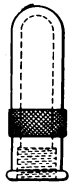


Drop (Forging) Hammer.

Syn.: Die forging.

Dry Battery, Dry Cell—See cell, dry.

Dual System—A system of ignition employing two current sources, namely, a synchronous magneto and a battery. The make-and-break, the distributor, the transformer coil, the wiring and the plugs of the magneto, or a part at least of these elements are traversed in common by both battery and magneto current, the battery current utilizing the magneto parts, as the elements of a single coil and distributor battery system. This system facilitates starting of the motor by the use of battery current. A switch applies either battery or magneto current at will. Such a system may provide a timer for the battery current entirely distinct from the magneto make-and-break and, in this case, only the magneto distributor and the spark plugs are common to both systems of ignition.



DUST CAP.

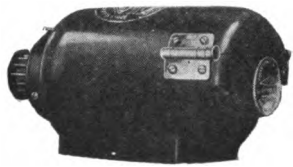
Dust Cap—A cap, screwed over the valve stem of a tire, seating upon the inside of the felloe. It prevents dust and water from entering the valve stem hole in the felloe and accumulating between the tire casing and rim.

A cap arranged over the exposed end of a bearing or over the exposed parts of a mechanism, to prevent the entrance of dust.

Dust Hood—See top cover.

Dust Pan—The sod pan (q. v.).

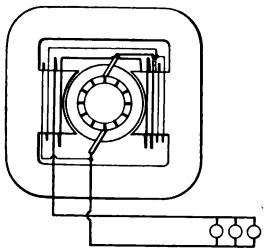
Dynamo—A mechanical generator of electricity, the soft iron field magnets of which are charged by current generated by the machine itself. It consists of an electro-magnetic field between the poles of which is rotated, by external mechanical power, an armature (q. v.). The cutting of the magnetic field by the armature conductors generates in them an electromotive force (q. v.) and in the operation of the machine mechanical energy is transformed into electrical energy. A commutator (q. v.) and brushes (q. v.) are used to convert the current produced in the armature conductors into a continuous current (q. v.) in the external circuit. A relatively small portion of the output of the machine is utilized in magnetizing its fields. Used to charge the storage batteries of electric vehicles and also installed upon motor cars to charge storage batteries for lighting and ignition service.



DYNAMO.

Syn.: Dynamo electric machine.

Dynamo, Bipolar—A dynamo, the magnetic field of which produces a single north and a single south pole, arranged diametrically opposite with respect to the armature.



COMPOUND WOUND DYNAMO.

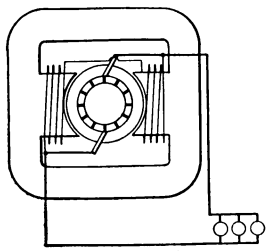
Dynamo, Compound Wound—A dynamo, the field magnets of which are magnetized by a combination of the methods used in the shunt wound dynamo (q. v.) and in the series wound dynamo (q. v.). It is used in some vehicle lighting systems.

Dynamo, Constant Current—A dynamo, so designed that the current it furnishes to the external circuit increases but slightly above normal with increased driving speed and reduced external resistance. Internal reactions caused by any slight increase of current produce a rapid drop in the external voltage and prevent further current increase. (See inherent regulation.) Used to charge the storage battery in some lighting and self-starter systems.

Dynamo, Constant Voltage—A type of dynamo used in vehicle lighting, which delivers a nearly constant electrical pressure to the external circuit, independent of the speed of the vehicle motor which drives it. An automatic clutch, under the control of a device sensitive to speed fluctuations, may be interposed between the engine and the dynamo and the speed of the latter be maintained nearly constant by clutch slipping, or the field magnets may be automatically weakened and strengthened in proportion with increases or decreases of speed and the voltage produced thus regulated to a nearly constant value.

Dynamo, Multipolar—A dynamo, the magnetic field of which comprises more than one pair of poles, produced by more than one electromagnet and symmetrically disposed around the armature. Each armature conductor cuts the magnetic field as many times per armature rotation as there are poles. The multipolar dynamo, especially the four pole type, is commonly used in vehicle lighting, as it is adapted for operation at a lower speed than is the bipolar type.

Dynamo, Series Wound—A dynamo, the field magnets of which are charged by coils of rather coarse wire and comparatively few turns, through which the entire current generated in the armature passes on its way to the external circuit.



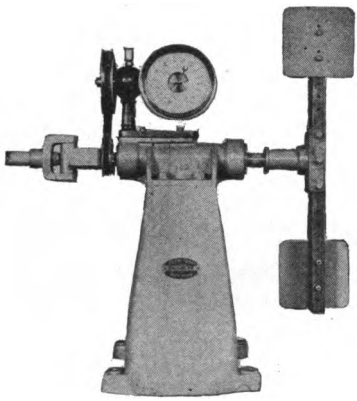
SHUNT WOUND DYNAMO.

Dynamo, Shunt Wound—A dynamo, the field magnets of which are charged by coils of rather fine wire and numerous turns wound about them. The coils are connected in series and one terminal of the series is connected to one brush and the other terminal to the other brush of the machine. A part of the current generated in the armature thus traverses the field coils and the remain-

der supplies the external circuit. At a constant armature speed, this type of dynamo maintains a nearly constant electrical pressure, even though the current supplied the external circuit varies quite widely and it is therefore largely used in charging electric vehicle batteries and in vehicle lighting.

Dynamo Bracket—A support provided upon the base of a gas vehicle motor, for the convenient mounting of a dynamo in suitable driving relationship to some moving part of the engine.

Dynamometer—In general, an instrument or apparatus designed to measure the rate at which mechanical energy is being delivered by or to a power producing or power transmitting mechanism. In automobile practice, an instrument capable of measuring the rate at which mechanical energy is being delivered by a vehicle motor which is used by automobile manufacturers to determine whether such motors are in proper working condition. Also occasionally used to determine the rate at which mechanical energy is being delivered to the traction wheels of an automobile and for similar purposes. A dynamometer measures the torque or turning effort received by it in pounds-feet, and by multiplying its indication by the angular speed in radians per minute, and dividing the product by 33,000 the horse power is obtained. A dynamometer which dissipates the energy to be measured is an absorption dynamometer, and one which measures the turning effort transmitted to another machine is a transmission dynamometer. The fan dynamometer and the prony brake are examples of the former type, and the electric cradle dynamometer and the power scale are examples of the latter type.

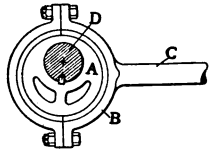


FAN DYNAMOMETER.

Dynamometer Test—As applied to an automobile motor, a test made upon it by means of a dynamometer to determine its output at various speeds, before mounting it upon the vehicle which it is to drive.

Syn.: Brake test.

Eccentric—A circular metal plate or disc fixed to a power shaft with its plane at right angles thereto, the centre of which disc does not coincide with the axis. The distance from the centre of the eccentric to its shaft axis is known as its eccentricity. It is used in connection with other parts to convert rotation into reciprocation of rather short stroke.



ECCENTRIC.

A, Eccentric Plate; B, Eccentric Strap; C, Connecting Rod; D, Shaft.

Eccentric Bushing—A bearing bushing the outside cylindrical surface of which is not concentric with its bore in which the shaft bears. By turning the bushing in the bearing support, the position of the shaft axis can be slightly altered. Used to adjust shafts, especially those which carry gears that require to be exactly pitched.

Eccentric Rod—The rod which transmits the motion of an eccentric strap to mechanism which is to be operated thereby.

Eccentric Strap—A metal strap which is fitted about the periphery of an eccentric and which transmits motion from an eccentric to an eccentric rod.

Efficiency—The ratio of the rate at which energy is given out by a machine or apparatus for the conversion of energy, to the rate at which energy is received by it. It is expressed as a percentage always less than 100. The energy received less the resulting losses of energy, divided by the energy received in a given period of time, gives the efficiency.

Efficiency, Ampere Hour—In a storage cell, the ratio of the total ampere hours of current delivered by it during discharge to the total ampere hours of current required to charge it to the condition from which it is discharged.

Efficiency, Dynamo—The ratio of the mechanical equivalent of the rate at which useful electrical energy is developed by a dynamo to the rate at which mechanical energy is expended in driving it.

Efficiency, Electric Motor—The ratio of the rate at which useful mechanical energy is given out by an electric motor to the mechanical equivalent of the rate at which electrical energy is absorbed in driving it.

Efficiency, Ideal—In a steam or internal combustion motor, its efficiency as computed by the application of thermodynamic laws, when certain assumptions not realized in practice are made. It is the maximum limit of efficiency which may be approached but never be attained, as actual conditions approximate more closely to the assumed or ideal conditions.

Efficiency, Mechanical—In a steam or internal combustion motor, the ratio of the rate at which useful mechanical energy is delivered at the driving end of the crankshaft to the rate at which mechanical energy is supplied to the piston or equivalent part by the working fluid.

Efficiency, Storage Battery—See efficiency, watt hour.

Efficiency, Thermal—In a steam or internal combustion motor, the ratio of the rate at which mechanical energy is delivered to the piston or equivalent part by the working fluid to the mechanical equivalent of the rate at which thermal energy is supplied the motor by the fuel used.

Syn.: Indicated efficiency.

Efficiency, Transmission—In a power transmitting device or systems of such devices, the ratio of the rate at which energy is delivered, to the rate at which it is received; e. g., in a motor car, energy is received from the motor at the clutch, at the rate of 30 horse power and delivered at the driving wheel rims at the rate of 21 horse power. The efficiency of transmission is thus $\frac{21}{30} = 0.70\%$.

Efficiency, Useful—In a steam or internal combustion motor, the ratio of the rate at which useful mechanical energy is delivered at the driving end of its crankshaft, to the mechanical equivalent of the rate at which thermal energy contained in the fuel used is supplied to it.

Efficiency, Watt Hour—In a storage cell, the ratio of the total electrical energy available during discharge to the total electrical energy required to charge it to the point from which it is discharged.

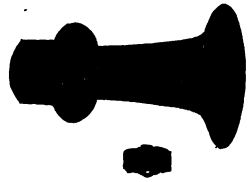
Efficiency, Weight—In a mechanism capable of delivering energy, the weight thereof per unit of output, e. g., in a gasoline

engine weighing 500 pounds, and capable of delivering 25 horse power, the weight efficiency is 20 pounds per horse power. Applied also to storage cells.

Syn.: Activity, which is rather to be preferred.

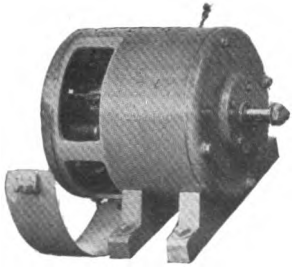
Eight Cycle (v.)—In a four cycle gas engine cylinder, to fire alternate charges only, so that a power impulse is produced but once in eight strokes. This faulty action is usually caused by the presence in the cylinder during the missed strokes of a mixture too foul to ignite, which is expelled unburned and replaced by a less foul charge during alternate cycles, the cylinder having been well scavenged during the inactive cycle.

Elastic Limit—The maximum stress per unit of cross section which can be applied to a certain material, such as a metal, without the production of a noticeable permanent deformation of the same. Stresses below the elastic limit produce temporary deformations, which disappear upon the removal of the stress. The elastic limit is usually expressed in pounds, per square inch and, unless otherwise stated, refers to tensile stress.



ELECTRIC HORN.

Electric Horn—An alarm or signaling device sounded by electricity. It consists of a diaphragm or reed vibrated by an electromagnetic vibrator or a diaphragm vibrated mechanically by means of a small electric motor driving a toothed wheel. A horn-shaped resonator amplifies and directs the sound waves set up by the diaphragm. Such horns are usually operated by battery current controlled by a push button located upon the steering wheel.



ELECTRIC MOTOR.

Electric Motor—A machine for converting energy in the electrical form into energy in the mechanical form, the construction of which is identical with that of a dynamo (q. v.). In fact, the same apparatus acts as a dynamo when its armature is rotated by mechanical energy, and as a motor when elec-

tricity is supplied to its windings from an external source. When used as a motor, electromagnetic reactions continually take place between the field and the armature conductors, and the armature shaft is rotated, delivering mechanical energy. It is used to propel electric vehicles, the supply of current being derived from a storage battery carried upon the vehicle.

Electric Motor, Axle Suspended—An electric motor which is supported by or upon the axle of the vehicle which it drives or upon some part attached to the axle, which is not spring supported.

Electric Motor, Back Geared—An electric motor the frame of which supports a countershaft which is driven from the armature shaft by gears or silent chain. A speed reduction is thus made at the motor itself.

Electric Motor, Bipolar—See dynamo, bipolar, which is identical in construction therewith.

Electric Motor, Compound Wound—See dynamo, compound wound.

Electric Motor, Frame Supported—An electric motor which is mounted upon the vehicle frame, its weight being thus supported by the vehicle springs. The accepted practice in vehicle motor mounting.

Electric Motor, Ironclad—A type of motor the field magnet frame of which is so formed as to enclose the field coils, armature and commutator, thus preventing the entrance of water, oil and dust. Most vehicle motors are of this type.

Syn.: Motor, enclosed type.

Electric Motor, Multipolar—See dynamo, multipolar. All vehicle motors are of this type, being usually of four or six pole construction. They operate at lower speeds than the bipolar type, and less speed reduction is required between the motor and the driving wheels.

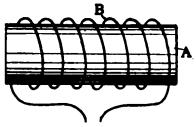
Electric Motor, Series Wound—See dynamo, series wound. Practically all vehicle motors are of this type on account of their superior flexibility and large torque development at low speeds. Their field coils are frequently wound in sections, different combinations of which, effected at the controller, produce different field strengths and corresponding speed variations.

Electric Motor, Shunt Wound—See dynamo, shunt wound. A type rarely, if ever, used in electric vehicle practice.

Electrical Pressure—See electromotive force.

Electrolyte—In general, a liquid which is decomposed when an electric current is passed through it. Specifically, a solution used to charge electric batteries. The electrolyte used in a lead storage cell consists of distilled water to which sufficient pure sulphuric acid has been added to make the specific gravity of the mixture about 1.250 at 60 degrees Fahr. In a storage cell of the Edison type the electrolyte is an aqueous solution of potassium hydrate and in a dry cell an aqueous solution of salammoniac.

Electromagnet—A magnet which owes its magnetic properties to the inductive action of an electric current, and which ceases to be magnetic upon the cessation of the current, being thus distinguished from a permanent magnet which requires no current to maintain its properties. It consists of a core of soft iron around which is wound a coil of insulated wire through which an electric current is passed. The cores of induction coils are electro magnets, as are also the fields of dynamos.



ELECTROMAGNET.
A, Core; B, Coil.

Electromotive Force—The force, analogous to a pressure, which maintains a flow of electricity through a closed circuit. The unit of electromotive force is the volt (q. v.).

Syn.: Electrical pressure; voltage. Abbreviation: e. m. f.

Electromotive Force, Counter—An electromotive force acting oppositely to the applied or impressed electromotive force or to the normal electromotive force. In an electric motor, the electromotive force set up by its armature acting in the capacity of a dynamo armature.

Element—One of the substances used in a battery between which and a dissimilar substance an electromotive force is set up by chemical action. The carbon and zinc plates of a dry cell and the positive and negative plates of a storage cell are the elements of these two types of battery.

Emergency Brake—See brake emergency.

Emergency Car—A motor car, equipped with tools, supplies, spare parts and towing tackle and carrying one or more automobile mechanics, which is maintained at some public garages and which is sent to the assistance of cars that have become disabled at a distance from repair facilities.

Emergency Tank—See auxiliary fuel tank and auxiliary oil tank.

Enamelled Wire—Wire which is insulated by coating it with a cellulose or other non-conductive enamel, instead of with silk or cotton. It is used for the windings of some induction coils because of the compact coils which it produces.

En Bloc—See cylinder, block cast.

End Play—A slight motion along its axis allowed a shaft rotating in bearings. Its object is to distribute bearing wear, to guard against excessive wear at thrust collars and to provide for slight inaccuracies of movement of parts attached to such a shaft.

End Thrust—Pressure in line with the axis of a shaft as distinguished from radial pressure, which acts at right angles to its axis and against its supporting bearing surfaces, e. g., the pressure acting along the driving pinion shaft of a bevel driven car due to the reaction of the gear tooth pressure.

Engine—See motor and steam engine.

Engine Base—The structural portions of a vehicle engine by which it is attached to the car frame. See crank case.

Engine Casing—A casing, usually of sheet metal, sometimes used to enclose a steam vehicle engine for the purpose of excluding dirt and of retaining heat and lubricant.

Envelope—A perforated pocket, made of thin insulating material, used to enclose a storage cell plate for the purpose of preventing detached active material from shortcircuiting between neighboring plates. Also a top cover (q. v.).

Epicyclic Gear—See planetary gear.

Equalizer—See brake equalizer.

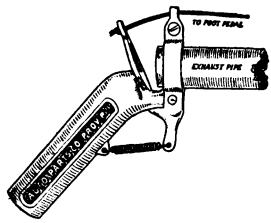
Equalizing Gear—See differential gear.

Exhaust (n.)—The working fluid of a heat motor which is rejected in an expanded condition from the power cylinder, at the end of the cycle of operations, after the available heat energy contained therein has been converted into mechanical energy. In an internal combustion motor the exhaust consists of a mixture of steam, carbon dioxide and nitrogen with more or less carbon monoxide, oxygen and hydrocarbon vapors. The exhaust from a steam engine is steam at a temperature and pressure relatively low as compared with its condition at entering the cylinder.

Exhaust (v.)—To reject the gases or vapors from a heat engine after they have given up their available energy.

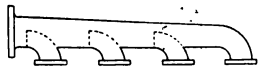
Exhaust, Auxiliary—See auxiliary exhaust.

Exhaust Alarm—An auditory warning or signaling device which is operated by the movement of the gases exhausted from a gasoline vehicle motor. The sound producing device is usually of the organ pipe type and one or several such pipes may be sounded separately or simultaneously upon the opening of a valve or valves which allows exhaust gas to flow from the exhaust pipe therethrough. A pedal arrangement is generally used to control the valve.



EXHAUST ALARM.

Exhaust Manifold—The common pipe or chamber into which pass the exhaust gases of all the cylinders of a multiple cylinder motor, on their way to the exhaust pipe and muffler. It is usually a casting of tubular form with short branch pipes ordinarily equal in number to the cylinders to be served, the ends of which branches are clamped or bolted over the exhaust port openings of the several cylinders.



EXHAUST MANIFOLD.

Exhaust Manifold, Air Cooled—An exhaust manifold, the external surface of which is ribbed, corrugated or otherwise so formed as to present a large convecting surface to the surrounding air to assist in the dissipation through it of the heat of the exhaust gases.

Exhaust Manifold, Ejector Type—A manifold for multi-cylinder gas engines, so constructed that the rush of exhaust gas through it from any one of the cylinders at the end of its power stroke is made to produce, through ejector action, a rarefaction in one of the other cylinders which is on its exhaust stroke, thereby causing the waste gases to be more fully ejected or scavenged from the latter cylinder.

Exhaust Manifold, Integral—An exhaust manifold which is formed as an integral part of a cylinder casting. Largely used in motors the cylinders of which are cast en bloc (q. v.).

Exhaust Manifold, Water Cooled—An exhaust manifold provided with a jacket through which the cooling water of the

motor is circulated, with the object of rapidly contracting the heated gases and producing a more quiet exhaust.

Exhaust Manifold Clamp—A clamp which fastens the exhaust manifold to the cylinders of a gas motor and secures a tight joint between the manifold branches and the exhaust port openings.

Exhaust Pipe—The pipe through which the exhaust gases or vapors escape from the exhaust port of a single cylinder engine or from the exhaust manifold of a multicylinder engine to the exhaust muffler or silencer.

Exhaust Port—The passage leading from the combustion space of an engine cylinder through the cylinder wall, to which the exhaust manifold or exhaust pipe is connected and through which, upon the opening of the passage, the exhaust gases escape.

Exhaust Port, Auxiliary—See auxiliary exhaust.

Exhaust Port, Siamesed—A form of exhaust port sometimes used in multicylinder gas engines which have twin cast cylinders. The exhaust passages leading from two adjacent cylinders are brought together into a single passage, so that a single branch of the exhaust manifold receives the exhaust from two cylinders.

Exhaust Stroke—In a four cycle gas engine that inward stroke of the piston (upward stroke in a vertical engine) during which the exhaust valve is open and the piston forces the gases out of the cylinder through the exhaust valve. This stroke is generally considered the fourth and final stroke of the four stroke cycle.

Syn.: Scavenging stroke.

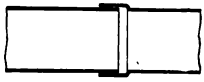
Exhaust Valve—The valve which controls the passage of gases from the cylinder through the exhaust port. Exhaust valves are generally of the poppet type (see headings under "valve") operated by cams (q. v.). In common practice the exhaust valve is set to open at about 40 degrees of crank angle ahead of bottom dead centre and to close at about 5 degrees past top dead centre.

Expand (v.)—To increase slightly, by internal pressure, the diameter of a steam boiler tube at the points where it enters the end sheets of the boiler, in order to secure tight joints between the tube and the plates. The tubes are so treated in the construction and repair of a boiler.

Expander—A tapered pin or swage of such diameter that, when forced into the end of a tube it will expand the latter.

Expansion, Ratio of—In an internal combustion motor, the ratio of the volume occupied by the charge at the instant of exhaust (q. v.) to the volume occupied by it at the end of the compression stroke (q. v.). It is of practically the same numerical value as the ratio of compression (see compression, ratio of).

Expansion Joint—A form of slip joint included in a rigidly supported part which is subjected to wide variations of temperature, in order to provide for its changes of length in such a manner as to avoid straining it or its supports. The two sections of the part can move relatively at the joint, thus making allowance for changes in length.



EXPANSION JOINT.

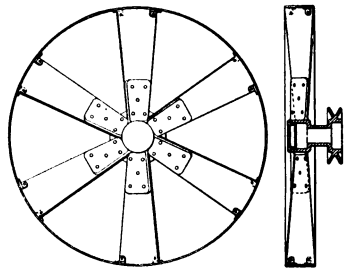
Sometimes applied to long exhaust manifolds and exhaust pipes.

Explosion Pressure—See pressure of explosion.

Extra Current—The high tension current set up by the electromotive force of self induction in the winding of an electromagnet, when the magnetizing current is abruptly broken. The extra current is discharged across the break in the circuit in the form of an arc. The igniting spark utilized in contact spark ignition systems which employ make-and-break spark plugs is produced by the extra current.

Eye Rod—A rod, the end of which is flattened and pierced with a hole or eye, through which a pivot bolt or pin is passed to secure it to some operative part, for instance, within a clevis (q. v.) or yoke end. Used in control linkages.

Fan—As applied to gasoline vehicle engines, a rotary fan of several sheet metal blades, generally carried by a horizontal shaft driven from the engine, and so arranged as to create a blast of cool air to assist in conveying away excess heat from the cylinders. On air-cooled engines the fan is so placed in front of the engine as to deliver its blast upon the cylinders and cylinder heads, the heated air escap-



FAN.

ing to the rear of the car. (See air cooling.) On water cooled cars, the fan is placed just back of the radiator, and creates a draft through it. (See water cooling.)

Fan, Belt Driven—A cooling fan, which is driven by means of a belt which passes around a pulley upon the fan shaft and around another pulley upon the crankshaft, camshaft or auxiliary shaft of the motor.

Fan, Condenser—The engine driven fan used upon a steam car to force cool air through the condenser (q. v.) and thus increase its effectiveness.

Fan, Gear Driven—A cooling fan which is driven by a train of gears. A friction coupling is usually provided at some point in the drive to prevent too sudden starting of the fan when the motor goes into operation.

Fan Belt—The belt which drives a cooling fan. This may be a flat leather or fabric belt running on flanged pulleys, a V section leather belt or a leather covered metal link belt running in V grooved pulleys.

Fan Belt Idler—An idler pulley over which a fan belt runs and which is adjustable in position so as to permit slack in the belt to be taken up.

Fan Guard—A circular metal guard arranged about the outside edges of a cooling fan, either fixed to an independent support or forming a part of the fan itself. It prevents objects from being struck by the fan blades and, in some instances, acts to concentrate the suction of the fan.

Fan Pulley—A pulley, fast upon a cooling fan shaft, by which it is driven by belt from an engine shaft. Usually a flanged or a grooved pulley.

Fan Support—The bracket or column which supports a fan shaft. This may be a bracket fastened to the forward cylinder of the engine, a column arising from the engine base or a structure supported by the radiator frame.

Syn.: Fan bracket.

Fatigue—The weakening of a metal brought about by its long continued subjection to frequently recurring intermittent or reversed stresses, such as act in the working parts of motor cars. Metals which possess special resistance to fatigue are known as anti-fatigue metals. The failure of metals through fatigue is sometimes held to be due to crystallization (q. v.).

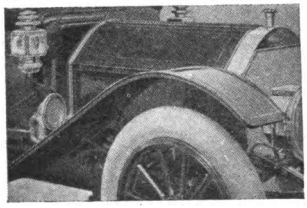
Feather—See key.

Feed Pump—The pump which delivers water from the water tank to the boiler of a steam vehicle. Usually a piston pump, continuously driven from the crosshead of the engine or from a rocking shaft driven from the engine. Its rate of delivery to the boiler is regulated by a hand adjusted by-pass (q. v.).

Feed Water Heater—A means for warming the feed water as it is pumped from the supply tank to the boiler of a steam vehicle. The water is passed through a coil of pipe which is surrounded either by exhaust steam or by hot chimney gases. The preheating of the feed water tends to reduce the fuel consumption.

Felt Washer—A ring shaped piece of thick springy felt, used to prevent the escape of oil from a lubricated part and the entrance of dust thereinto. Such washers are used at the points where a shaft emerges from a bearing or housing, the washer being tightly held against the inside surface of the part and around the shaft itself, thus sealing the slight opening which there otherwise would be.

Fender—A guard placed around and over the wheels of an automobile to prevent the spattering of mud upon the body and its occupants. The rear ends of the front guards are often united to the front ends of the rear guards by the two horizontal running boards (q. v.). The guards are usually of sheet metal, and are supported from the vehicle frame by irons. They usually conform, upon their inside edges, to the shape of the body, and thus form, with the running board and its extensions, a continuous protection against flying mud.



FENDER.

Syn.: Mud guard.

Field, Magnetic—The space between and around the poles of a magnet, within which magnetic influence is exerted. For purposes of illustration the magnetic force is represented by imaginary lines (lines of magnetic force) extending from the north to the south pole of the magnet in the field. The directions of

these lines represent the direction of the magnetic influence and their number per unit of cross section is proportional to the strength of that influence at the cross section in question. When a conductor is moved through such a field in a direction such as to make an angle with the lines thereof, it is said to cut the lines of force and an electromotive force is developed in it of a value proportional to the rate at which the lines are cut. This is the principle involved in the operation of a dynamo or magneto.

Syn.: Field of magnetic force.

Field Coil—A coil of insulated wire, through which is passed a current of electricity to magnetize the soft iron core which it encloses and thus to induce the magnetic field of a dynamo or electric motor. All the field coils, considered as a unit, constitute the field windings.

Field Commutation Control—A system of speed control employed in connection with series wound electric vehicle motors. The field magnet windings are divided into sections all or a part of which can be connected either in series or parallel by means of the controller (q. v.) to produce several graded field strengths. As motor speed increases with decrease of field strength and vice versa, several vehicle speeds can thus be secured. This method of control is often used in connection with series and parallel arrangements of the battery to secure many gradations of speed.

Field Magnet—A magnet which produces the magnetic field that is cut by the armature conductors of a dynamo, magneto or electric motor, in the process of its operation. The field magnets of dynamos and electric motors are electromagnets, and those of magnetos are permanent magnets (q. v.) of very hard steel.

Fierce Clutch—A clutch which is incapable of gentle engagement, and which cannot be so operated that various rates of slippage between the driving and driven members may be maintained. When its members are brought into contact, even though very gently, the driven member almost instantly assumes the same speed as the driving member, and the driven parts are started into motion with a sudden jerk.

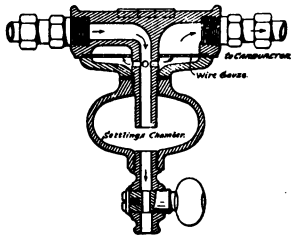
Syn.: Grabbing clutch.

Filler Board—A finished board so shaped as to fill the space between the upper edge of the dashboard (q. v.) and the lower

edge of the windshield (q. v.) of a car and fastened to these two parts so as to help to support the latter.

Fillet—In machine parts, where two surfaces intersect, a portion of the material left around the line of intersection, whereby a sharp corner is avoided. The object of a fillet is to obviate an abrupt change of cross section of the part and thus to avoid a dangerous concentration of stress at a particular point.

Filter—A device designed to remove foreign matter from a liquid which is caused to flow through it. It usually consists of one or more sheets of fine metal gauze, or of chamois leather so held that the liquid is constrained to pass through it. Such a metal gauze filter is generally included in the fuel pipe leading from the tank to the carburetor, or in the delivery to the carburetor float chamber, also in the oil delivery passage of a self-contained lubricating system, and in the water circulating system. A chamois filter is generally secured in the funnel through which gasoline is poured into the fuel tank, and a gauze filter is often placed within the filling holes of oil reservoirs.



FILTER.

Final Drive—The mechanism which transmits the driving effort of a vehicle motor from the transmission parts mounted upon the frame to the axle supported transmission parts. A chain or a pair of chains forms the final drive of a chain driven car and a shaft carrying bevel or worm gears forms the final drive of a shaft driven car.

Fire Test—A test sometimes applied to a lubricating oil to determine to what temperature it must be raised to cause it to burn.

Firing Order—In a multiple cylinder internal combustion motor, the sequence in which the cylinders perform their working strokes. Numbering the cylinders, in order, from the front to the rear, the firing order in four cylinder, four cycle engines is 1, 3, 4, 2 or 1, 2, 4, 3 and in six cylinder engines the orders

1, 2, 3, 6, 5, 4; 1, 5, 4, 6, 2, 3, and 1, 2, 4, 6, 5, 3 are customary.
Syn.: Firing sequence.

Firing Point—See ignition, point of.

First Speed—The lowest forward gear ratio obtainable from a change-speed gear. This gear is used when a car is started from rest and under conditions of extreme road resistance and grade.

Syn.: Low speed, slow speed.

Fixed Air Inlet—See air inlet, initial.

Flame Propagation—The spreading of the combustion of the fuel charge in a gas motor cylinder from the point at which the spark takes place to other portions of the charge.

Flange—In general, a projection formed around the surface of a part, usually at or near its edge, and ordinarily designed to receive the fastening devices which secure it to another part.

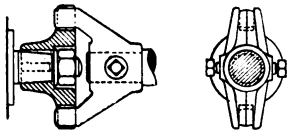
A disclike enlargement formed upon the end of a shaft by means of which it is bolted to another part, such as a wheel or another aligned shaft. A flange coupling.

Flash Generator—See boiler, flash.

Flash Test—A test applied to a lubricating oil to determine the temperature at which it begins to give off inflammable vapors capable of being ignited. The temperature at which this occurs is the flash point. The flash test is used to determine the relative abilities of various oils to withstand the temperatures to which they are exposed in the cylinders of internal combustion motors. The flash points of gas engine cylinder oils are usually between 400° and 500° Fahr.

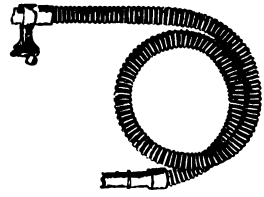
Flexibility—In an internal combustion motor, that quality which enables it to do useful work through a very wide speed range. The measure of flexibility is the ratio of its highest useful speed to its lowest useful speed. The lowest useful speed of a particular motor is the lowest speed at which it will run, under load, without missing explosions and without labor (q. v.), and its highest useful speed is that speed at which any increment thereof fails to increase the output; e. g., a motor possessing a useful speed range of from 100 to 1,200 r. p. m. has a flexibility of 12, and one possessing a useful speed range of from 200 to 1,600 r. p. m. has a flexibility of 8.

Flexible Coupling—A coupling used to connect two shafts, intended to be in alignment one with the other, which permits of slight angular motion between their connected ends, and thus prevents binding of the shafts in their bearings, which might be occasioned by slight inaccuracies in the shaft alignment. Such couplings are used to connect magnetos and other auxiliaries to their driving shafts, and to connect together transmission shafts which may at times be thrown out of perfect alignment through distortion of the vehicle frame. The Oldham coupling (q. v.) is of this type, and also various forms of flange coupling, with a resilient material placed between the two connected flanges.



FLEXIBLE COUPLING.

Flexible Metal Tubing—A kind of tubing formed of concentric, closely wound spirals of flat metal wire, which, while substantially tight to fluids, is capable of being bent at will. It is used for connecting horn bulbs to horns, to convey heated air to carburetors, to convey oil and grease to inaccessible points and under other conditions where neither rubber tubing or stiff metal tubing is desirable.



FLEXIBLE METAL TUBING.

Flexible Shaft—A kind of shaft composed of a succession of connected links enclosed in a tubular casing formed of a close spiral of metal wire. The ends of the link chain are attached respectively to the driving and driven mechanisms. Such a shaft may be bent almost at will, without interfering with its action. Used to drive speedometers from the road wheels and to operate various tools in garages.

Float, Float Chamber, Float Valve, Float Depressor—See under carburetor float, etc.

Floated Storage Battery—A storage battery which is connected in multiple both to a charging dynamo and a load, such as a group of lamps. It is constantly kept charged by the dynamo, and the load is carried by the dynamo, so long as it is in operation, no current being called for from the battery under these circumstances. When the dynamo is not in operation, or

not delivering a sufficiently high voltage, it is disconnected from the circuit, and the battery carries the load. The floated battery arrangement is generally used in vehicle lighting systems, which employ a dynamo.

Floating Shaft—A power transmitting shaft, which is not rigidly restrained except as to rotation. It is thus not subjected to bending but to twisting stresses only. Such a shaft is usually supported at its ends only and at these points in such a manner that it may readily accommodate itself to the movements of the driving and driven parts without any transverse stresses being set up in it. E. g., the shafts of a full floating axle.

(See axle, floating.)

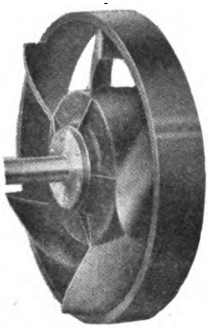
Flood (v.)—To cause gasoline to be emitted from the spraying nozzle of a carburetor into the vaporizing passage in order that a rich mixture may be obtained when the motor to which the carburetor is attached, is cranked. The flooding is usually accomplished by depressing the carburetor float, thus raising the fuel level above the spraying orifice, and causing gasoline to escape therefrom. Syn.: To prime, to flush.

Flooding System—See lubrication, circulating system.

Fluted Shaft—See sliding shaft and key, integral.

Flywheel—See balance wheel.

Flywheel, Fan Spoked—A kind of flywheel, with broad, flat spokes, the surfaces of which are inclined to the plane of the wheel. These spokes act as fan blades, and when the wheel is in motion draw a current of air through the radiator into the bonnet space, thus taking the place of a separate cooling fan.



FAN SPOKED FLYWHEEL.

Flywheel, Front Mounted—A flywheel carried upon the forward end of the crank shaft in front of the motor, and not forming or carrying upon it a member of the clutch, but frequently provided with fan spokes on account of its close proximity to the radiator.

Flywheel, Rear Mounted—A flywheel mounted upon the rear end of the motor crankshaft and usually forming or carrying one member of the clutch. The accepted flywheel location,

Flywheel, Web Type—A type of flywheel the rim of which is joined to its hub by a continuous thin web of metal, instead of by a series of spokes. This type is generally used when the flywheel is made use of as the driving member of the clutch.

Flywheel, Wire Wound—A type of flywheel the rim of which is wound with steel wire to reduce the danger of its bursting at high speeds under the influence of centrifugal force. A steel band is sometimes shrunk over the rim of a cast flywheel to serve the same purpose.

Flywheel Bearing—The crank shaft bearing next to the flywheel, which chiefly supports the weight of the wheel.

Flywheel Casing—A housing, usually of sheet metal, arranged around a flywheel to prevent objects being caught by the wheel and to prevent the wheel from throwing oil. In unit power plants in which the flywheel is located between the engine and the gear box, the flywheel casing forms a part of the cast structural portion of the unit.

Flywheel Flange—A flange formed upon the end of the motor crank shaft, to which the flywheel is bolted.

Flywheel Markings—Lines drawn upon the face of a flywheel, the coincidence of which, with a fixed index, indicate the correct points of inlet and exhaust valve opening and closing, and sometimes the dead centres of a motor. Syn.: Timing marks.

Foam (v.)—In a steam boiler, to bubble violently on account of the presence in the water of foreign matter, which renders it slightly viscous, so that large steam bubbles form, the water level rises, and much entrained water or priming is carried over into the steam pipe and engine.

Footboard—One of the boards which form the floor of an automobile, especially the floor of the front seat space, the removal of which, in most cars, gives access to the clutch, gear box, etc. Such boards are usually of wood, covered with linoleum or rubber matting, or of aluminum.

Foot Brake—See brake, foot.

Foot Throttle—See accelerator.

Footrest—A metal bar secured to the tonneau floor, transversely of the car length, at such a distance from the rear seat as to form a brace for the feet of the passengers. A similar rest is sometimes provided reaching but

FOOTREST.

part way across the front floor space, for the benefit of the passenger who is not driving.

Force Feed Lubricator—See lubricator, force feed, and lubrication, force feed.

Forced Draft—The practice of directing the exhaust from a steam vehicle engine into the uptake, which carries the products of combustion from the burner, in order to increase the draught upon the fire.

Forced Induction—The practice of charging the cylinder of an internal combustion motor with fuel mixture at a pressure above that of the atmosphere, in order to secure increased output thereby. The charges are forced in by a pump instead of being drawn in by suction. Not in practical use to any extent.

Fore-door Body—See body, fore-door (also written four-door body).

Four-stroke Cycle—The cycle of operations performed by the so-called four-cycle type of internal combustion motor, in which one piston stroke in each four is a power stroke. The four strokes are as follows: 1—suction, intake or aspirating stroke; 2—compression stroke; 3—power or working stroke; 4—exhaust or scavenging stroke. (See aspirating stroke, compression stroke, power stroke, exhaust stroke and cycle of operations.

Syn.: Otto cycle.

Four Cycle (v.)—In a two-cycle engine cylinder, to fail to fire each alternate charge. It is usually caused by the presence in the combustion space, during each missed explosion, of a mixture too foul to be ignitable and most commonly occurs when very small charges are being admitted by the throttle.

Four-wheel Drive—A form of automobile drive in which all four wheels exert tractive effort instead of but two, as in ordinary practice. The entire weight of the vehicle is effective in causing adhesion of the wheels to the road which is utilized to resist the driving effort.

Fourth Speed—In a change speed gear which provides four forward gear ratios, that gear ratio on which the rate of rotation of the traction wheels bears the largest relation to the rate of rotation of the motor. In some instances, the fourth speed is the direct drive (q. v.) and consequently the customarily used gear, but in some cases the fourth speed is indirect

and the rotative speed of the final shaft of the gearset is higher than that of the motor, in which case the fourth speed is said to be "geared up."

Frame—The principal structural portion of a motor car, which is supported upon the axles by the vehicle springs and carries the body and the engine, its auxiliaries and the trans-

FRAME.

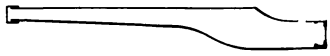
mission parts which are not axle supported. It usually consists of two horizontal, parallel, longitudinal beams or members of steel or wood, these side members being joined by a number of cross members (q. v.), riveted or otherwise secured to them.

Frame, Armored Wood—A frame the side members of which consist of beams of wood reinforced and protected by means of structural steel applied thereto.

Frame, Dropped—A frame each side member of which is curved upwardly into the form of a shallow U at that portion of its length which comes over the rear axle. This enables the frame to be hung low and a car with a low centre of gravity to be secured, at the same time preventing the frame members from striking the axle when the springs are fully deflected under load.

PART OF DROPPED FRAME, SHOWING DROP.

Frame, Inswept—A frame the side members of which are closer together at their forward than at their rear portions. The narrowing of the frame forward enables the steering wheels to be turned through a greater angle without striking the frame, and thus enables the car to be turned in a relatively small circle. Used particularly in town cars.



PART OF INSWEPT FRAME, SHOWING INSWEEP.

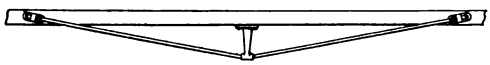
Syn.: Bottle neck frame.

Frame, Laminated Wood—A frame, the side members of which are built up of a series of relatively thin vertical sections of wood which are secured together and their grains so arranged as to secure the utmost strength.

Frame, Offset—A frame the side members of which are bent, either horizontally to narrow the frame, or vertically to clear the rear axle. The offset or curve is likely to be the weakest point of the frame, and the cross sections of the side members at the offset portions are usually enlarged with this in view.

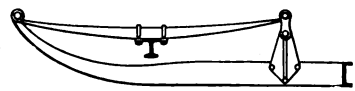
Frame, Pressed Steel—A frame constructed of steel members which are formed by dies into the desired cross sections and shapes, the various members being riveted together. The usual form of the side members is that of a channel with its web vertical, the spread and the width of flange at different points being somewhat proportioned to the load to be carried there. The spring hangers and some other fittings are frequently formed integral with the side members. Pressed steel channels or angles form the cross members.

Frame, Trussed—A frame each side member of which is stiffened against vertical stresses by means of a truss consisting of a tension rod, the ends of which are fastened respectively at points toward the ends of the side member and a strut located about midway of the side member. Occasionally a short truss is used, designed especially to stiffen some particular section of a side member.



PART OF TRUSSED FRAME.

Frame, Underslung—A frame which is suspended under the axles instead of being supported over them, the deflection of the springs, under load, carrying the frame downward and away from the axles. This construction is employed when a very low centre of gravity is desired, large diameter wheels generally being required when



PART OF UNDERSLUNG FRAME.

it is adopted, in order that the ground clearance may not be too much reduced.

Frame, Wood—A frame made largely or wholly of wood, usually ash. Used only by very few makers.

Frame, Wood Filled—A pressed steel frame the channels of which are filled with wood.

Frame Cross Member—See cross member.

Frame Side Member—One of the two main members of a frame extending fore and aft, forming the sides of the structure.

Syn.: Side bar, sill.

Freezometer—A hydrometer so calibrated that, when it is floated in an alcohol-water antifreeze solution, it indicates directly the temperature at which the solution will freeze.

French Chalk— See talc.

Friction, Coefficient of—The ratio of the force of friction acting between two bodies in contact to the pressure acting to force their surfaces together. Its value is dependent upon the materials of the two bodies and the condition of their surfaces.

Friction Cloth—A heavy cotton fabric the fibres of which are impregnated with rubber. Used in building up the tire carcase (q. v.) of pneumatic tire casings, the layers of rubberized fabric being united by vulcanization (q. v.).

Syn.: Friction fabric, friction duck.

Friction Clutch—See clutch, friction.

Friction Disc—A disc usually with a face of special friction material, rotated upon a shaft; so arranged as to drive a wheel, its shaft and attached mechanism by the force of friction, when the periphery of the wheel is pressed against the face of the disc at a point other than its centre.

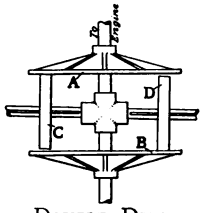
Used in automobile friction drives.

Friction Drive—In general, a form of drive in which the force of friction acting between rotating surfaces is employed to react against and thus to transmit the driving effort. It is to be distinguished from a positive drive in which the driving effort acts as a direct pressure between the moving parts concerned. As employed to transmit the power of a vehicle motor to its final drive mechanism, it usually consists of one or a pair of friction discs rotated by the motor, into contact with which a wheel or wheels, fast to the final drive device, can be forced

by means of a pedal or lever. It performs the function of a friction clutch, power being transmitted when the driving and driven members are in contact and not being transmitted when they are out of contact. It also performs the function of the change speed gear, the angular speed ratio of the driving and driven members being dependent upon the linear speed of the portion of the driving member with which the driven wheel is contacted. It also serves as a reverse gear.

The friction drive is employed to operate lighting dynamos and non-synchronous magnetos, the periphery of a friction wheel fast upon the armature shaft being pressed into frictional contact with the inside or outside face of the engine flywheel rim.

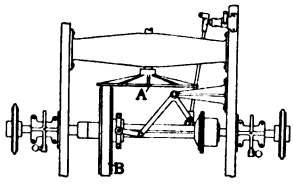
Friction Drive, Double Disc—A form of friction drive for automobiles in which two discs and two wheels are employed. The rearward extension of the motor crankshaft carries two friction discs A and B, facing each other. On a horizontal, transverse, divided shaft, located midway between the discs are slidably keyed two friction wheels C and D. This shaft has a very slight rocking motion in the horizontal plane so that, simultaneously, wheel C may be contacted with disc A and wheel D with disc B, or that, simultaneously, wheel C may be contacted with disc B and wheel D with Disc A. Under the former circumstances the rotation of wheels C and D, and their shaft is in one direction, and, under the latter circumstances its rotation is in the other direction. This provides for a forward and a reverse drive.



DOUBLE DISC FRICTION DRIVE.
A, B, Friction Discs.
C, D, Friction Wheels.

Friction Drive, Grooved Pulley—A form of final drive, used upon some cars of the buggy type. The motor crankshaft carries at each end a pulley, the face of which is formed with a number of closely placed V grooves. Fastened upon each of the driving wheels is a large similarly V-grooved, ringlike pulley. When the engine driven pulleys are forced into engagement with the wheel pulleys the V-shaped portions of one enter the V-shaped spaces of the other, and there is a frictional driving contact established between the sloping surfaces of the pulley faces.

Friction Drive, Single Disc—A form of friction drive which comprises a disc rotated by a rearward extension of the crankshaft; another shaft supported in bearings transversely of the frame and to the rear of the motor, and a friction wheel slidably keyed upon this shaft, with its plane at right angles to that of the disc, so arranged that its edge and the face of the disc may be forced into and out of frictional engagement at will. When the wheel is opposite one outside edge of the disc and in engagement therewith, the wheel and its shaft are rotated at their highest rate in a certain direction. When, however, the wheel is slid upon its shaft toward the centre of the disc the ratio of the angular velocities of the wheel and disc becomes progressively less. When the wheel contacts with the centre of the disc, no motion is imparted to it. As the wheel is slid beyound the centre and contacted, its direction of motion is reversed.



SINGLE DISC FRICTION DRIVE.

A, Friction Disc.
B, Friction Wheel.

Friction Tape—A kind of fabric tape saturated with a rubber or other sticky compound possessing insulating properties. When tightly wound about an object it stays in place by adhesion and cohesion, and it is thus used to temporarily bind loose parts together, to insulate joints in electrical conductors, in making minor tire repairs, and to form a soft buffer between parts which are likely to strike together and rattle.

Syn.: Tire tape, insulating tape.

Friction Wheel—A wheel adapted to make frictional contact with another wheel or a disc, and to be driven by it. It is usually of metal, with a face or contact portion of some slightly yielding material, such as leather, compressed paper or similar organic material. Used in the drives of frictionally driven cars, and upon the shafts of dynamos and magnetos.

Frictionally Driven—Driven by the force of friction, in contradistinction to positively driven, as a frictionally driven car or dynamo.

Front Gears—See half time gears.

Fuel—A combustible substance the burning of which in the oxygen of the air results in the conversion of chemical energy

into heat. The heat evolved can, in part, be converted into mechanical energy, by permitting it to expand a working fluid, such as air, in a closed vessel containing a movable piston. Fuels usually consist mainly of hydrogen and carbon, the combustion of which produces steam and carbon dioxide. The common automobile fuels are liquids, including gasoline, kerosene, benzol and alcohol, and mixtures of these substances. See gasoline.

Fuel Economy—In automobile practice, the measure of useful work accomplished in the operation of an automobile, in respect to the quantity of fuel consumed in so doing. It is generally measured in terms of the weight or volume of fuel consumed in moving a unit weight of car and load a unit of distance, e. g., pounds of fuel consumed per ton mile. Sometimes the reciprocal of this is used, and the result is given in ton miles per pound or gallon of fuel. The gross weight of the vehicle is generally used, but the net weight of passengers or goods may be employed, in which case, the result is given in pounds or gallons of fuel per net ton mile or in net ton miles per pound or gallon of fuel consumed.

Syn.: Fuel efficiency of a vehicle.

Fuel Feed, Gravity—The common method of feeding fuel from the fuel tank to the carburetor, in which the natural or gravity head of the liquid is depended upon to cause the required flow, the bottom of the supply tank being placed sufficiently above the carburetor, so that even when the vehicle is pointed up a steep grade the head is still adequate.

Fuel Feed, Pressure—A method of feeding fuel from the supply tank to the carburetor of a gasoline car, in which the flow is due to gaseous pressure acting upon the fuel in a tightly closed tank. The pressure may be produced by pumping air into the tank space, above the fuel, or may be derived from the exhaust gases, led from the exhaust manifold through a pipe and an automatic pressure reducing valve. Pressure feed is resorted to when the fuel tank is located at a level below or insufficiently higher than the carburetor, so that a gravity flow of fuel cannot be secured under all conditions of inclination of the car and under all degrees of fullness of the tank.

Syn.: Forced fuel feed.

Fuel Feed, Pressure—In a steam vehicle the arrangement which maintains the fuel supply or a portion of it at a pressure sufficient to cause its atomization to take place, when it passes through the atomizer of the burner.

Fuel Injection—The practice of furnishing directly, by means of a small pump, to the cylinder of an internal combustion motor the quantity of fuel required for each working stroke, thus dispensing with a carburetor.

Fuel Level—The height at which fuel is maintained in the float chamber of a constant level carburetor, by the action of its float and valve. This level is a matter of importance, for, if it is too high, fuel will constantly escape through the spraying apertures and be lost, especially if the motor is not running, while, if it too low, a considerable rarefaction is required at the spraying nozzle in order to cause fuel to be emitted, and a sufficiently rich mixture may thus not be secured, especially at starting.

Fuel Level Adjustment—An adjustment provided in some carburetors, which permits of the regulation of the fuel level. It is usually a screw, acting upon the float valve operating linkage, which changes the vertical position of the float at which it closes the fuel admitting valve.

Fuel Pipe—In a gasoline car the pipe which conveys fuel from the supply tank to the carburetor. In a steam car the piping connecting the main tank, pressure tank, fuel pump and burner.

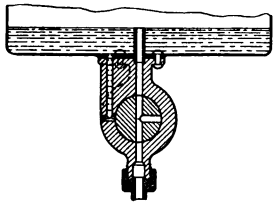
Fuel Tank, Auxiliary or Emergency—See auxiliary fuel tank.

Fuel Tank, Main—The vessel which contains the main fuel supply carried upon a motor car, and from which it flows, as required, to the carburetor or burners. It is usually a prismatic or cylindrical closed tank of sheet copper, galvanized iron or drawn steel, securely ironed to the vehicle frame and usually located under the front seat, to the rear of the front seat back, on or in the dash or under the rear overhang of the body. A rather large filling hole, closed by a screw cap, is usually provided in its upper surface and its outlet is usually in its bottom. Baffle plates are commonly fixed inside the tank to prevent excessive surging of the fuel under rough road conditions.

Fuel Valve—The valve which controls the flow of fuel through the fuel pipe from the supply tank. Usually a screw valve of the conical needle type. A lock is sometimes applied, which makes it impossible to open the valve except by the use of the key.

Syn.: Gasoline valve, gasoline shut-off.

Fuel Valve, Reserving—An arrangement of valves and piping designed automatically to warn the operator of the approaching exhaustion of his fuel supply. The flow pipe controlled by the main valve, which is always open when the car is running, projects upward quite a distance through the bottom of the tank, and, when the fuel in the tank falls below its mouth, no more will flow through it and the motor shows signs of stopping. Another short flow pipe, branching off from the main flow pipe outside the tank and controlled by this reserve valve, terminates flush with the inside of the tank and when its valve is opened the fuel remaining in the tank can flow to the carburetor, thus allowing the car to be driven to a fuel supply station. The accompanying cut shows a combined main and reserve supply valve.



Fuel Reserve Valve.

Fuse—In an automobile electric lighting system, a short length of lead alloy wire included in each circuit which melts and opens the circuit when the flow of current becomes excessive.

Fusible Plug—An automatic device designed to protect a steam vehicle boiler from being burned out when its water level is accidentally allowed to become abnormally low. A short pipe is inserted into the boiler, near the level of the bottom thereof, which is normally closed by a plug of metal that fuses at a comparatively low temperature. When the water recedes from this pipe, the temperature of the plug is no longer limited by the presence of water about it and it melts, allowing steam to enter the burner casing and to put out the fire as well as to visually and audibly warn the operator.

Gage—Of a vehicle. The straight line distance between the centres of the points of contact with the road, of the two front or of the two rear wheels. The standard gage for pleasure automobiles in this country is 56 or 56½ inches, although 60 inches is common in certain sections. The gage of heavy commercial vehicles is often greater than that of pleasure cars.

Syn.: Tread, track.

Gage—A device for indicating the quantity of or pressure of fluid.

Gage, Gasoline—A gage used to indicate the quantity of

gasoline remaining in a fuel tank. It usually consists of a float riding upon the surface of the fuel, the vertical movement of which is indicated upon a dial, upon the outside of the tank, the reading of which denotes the gallons of fuel still in the tank.

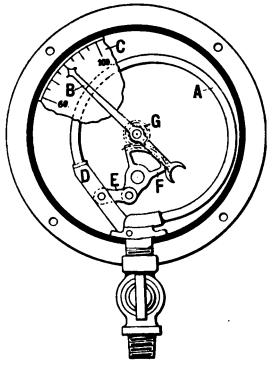
Gage, Gasoline Pressure—A pressure gage, connected by a pipe with the interior of the fuel tank of a pressure feed fuel system, which indicates the gaseous pressure acting upon the fuel. It is usually placed upon the dash.

Syn: Air pressure gage.

Gage, Oil—A gage used to indicate the level of lubricating oil in the oil compartment of a gasoline vehicle engine base. It may consist of a float riding upon the surface of the oil and carrying a vertical stem protruding upward through the case where its position can be observed. Or it may consist of a glass window or bullseye, set into the wall of the oil compartment, through which the level can be directly observed.

Gage, Oil Pressure—A pressure gage connected to the flow piping of a circulating system of engine lubrication, used to indicate that the pump which circulates the oil is in operation. It is generally placed upon the dash. See circulation gage.

Gage, Steam—A pressure gage, usually calibrated in pounds per square inch, used to measure the steam pressure acting within a vehicle boiler. It is piped into the steam space of the boiler and protected from the direct action of the steam by a column of water contained in the connecting pipe. In steam vehicles the gage is carried upon the dash.



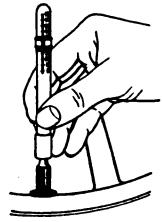
PRESSURE GAGE.

Gage, Pressure—A device used to indicate and measure fluid pressures, consisting of a part subjected to the pressure, which is deformed or displaced thereby proportionally to pressure changes, and an indicator, moved by this part over a graduated scale, by means of a suitable connecting mechanism. Its most common form is the Bourdon gage, in which an arc shaped tube A, subjected to the pressure to be measured, is progressively bent by increases or decreases thereof, the hand B moved by such bending indicating upon a circular dial C the

instantaneous pressure acting in pounds per square inch. The tube A is connected to the hand B through the intermediary of an arm D, a link E, a lever and sector F and a pinion G.

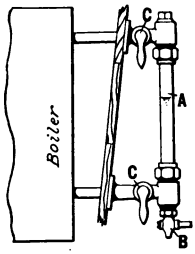
Syn.: Manometer.

Gage, Tire—A pressure gage used to measure the air pressure acting within a pneumatic tire. Usually a spring gage, or a small Bourdon gage which is screwed or pressed into the air connection of the tire in such a manner as to unseat the tire valve and allow the air pressure to reach the gage.



TIRE GAGE.

Gage, Water—A device used to indicate the water level in a steam boiler, consisting of a glass tube, the upper and lower ends of which, respectively, are connected through the boiler shell at points well above and well below the normal water level. The water in the tube assumes the same level as that within the boiler and can be directly observed. A shut-off or an automatic check valve is provided between each end of the gage glass and the boiler, so that the escape of steam may be stopped in case the glass tube breaks.



WATER GAGE.

A, Gage Glass; B, Drain Cock; C C, Stop Cocks.

Gage, Water Circulation—A pressure gage, under the influence of the pump pressure acting in a forced system of water cooling, an indication of pressure by which demonstrates that the pump is in operation and that there is water in the system. It is usually located upon the dash, but is not often installed upon cars.

Gage Cock—One of a series of several pet-cocks, arranged vertically one above the other, connected through a boiler shell or into a separate water column connected with a boiler. These cocks are respectively located above, below and in the vicinity of the normal waterline. Opening the upper cock should allow steam to escape and opening the lower should allow water to escape, thus approximately indicating the position of the waterline.

Syn.: Try cock.

Gage Glass—A glass tube or a transparent window set into a metal tube or into a reservoir containing a liquid, so that the level of such liquid may be observed therein.

Garage—A building devoted to the storage and care of motor vehicles, particularly a building in which the business of storing, caring for and supplying automobiles is conducted in a public manner.

Pronounced with the final *g* soft, the final *a* open and the accent upon the last syllable.

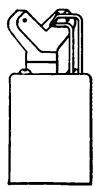
Gas (v.)—In a storage cell, to bubble violently and give off gas. An action which takes place mainly at or near the end of the charging operation, when the chemical changes in the plates are nearly completed, or when the rate of charge or discharge is excessive.

Gas Lamp—A lamp which burns acetylene gas, used upon automobiles for lighting the road. Usually a lamp of the projector type, which throws a beam of nearly parallel rays, directly ahead of the car. Two such lamps are commonly used, one carried upon each side of the front of the car.

Syn.: Gas headlight.

Gas Lamp Controller—A device for altering the intensity of the light produced by gas headlights without leaving the driver's seat, either by turning up or down the flame by means of a valve, by throwing the burner into or out of the focus of the reflector or by partially shielding the light.

Gas Lamp Igniter—A device for lighting gas lamps from the driver's seat. The electrical arrangement for this purpose comprises an insulated spark gap, fastened to the burner of each lamp, a source of high tension current consisting of a battery and jump spark coil, a switch and a valve controlling the flow of gas to the burners mounted upon the dash. When the lamps are to be lighted, the valve is opened and the switch is closed, sending a high tension spark across the spark gaps and lighting the burners.



GAS LAMP IGNITER.

Gas Tank—A tank carried upon an automobile for the storage of acetylene gas under pressure for consumption in lamps and self-starters. It is a cylindrical steel tank, provided with a needle valve to control the flow of gas therefrom and filled with an absorbent material saturated with acetone, holding acetylene gas in solution, under pressure. Acetylene gas is forced into the tank at high pressure, and may be drawn therefrom at will. The tank is usually carried upon the running board or under the rear of the vehicle frame.

GAS TANK.

Gasket—A sheet of somewhat compressible material bolted between two abutted machined surfaces, with which its shape conforms, in order to render the joint between them fluid tight. The yielding of the gasket, under the pressure acting between the surfaces, causes it to fill any inequalities in the surfaces and seals the joint. Gaskets are of paper, rubber, wire woven asbestos fabric, leather, sheet copper and asbestos cloth held between two sheets of thin copper. Used in the seats of gas engine valve cages and exhaust and manifold connections, between pipe flanges and the flanged sections of gear, crank and axle cases which require to be oil tight. Syn.: Packing.

GASKET.

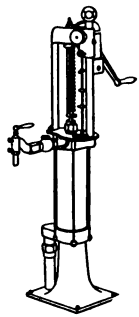
Gasoline—The hydrocarbon fuel most commonly used in internal combustion vehicle motors and in the burners of steam cars. It is a light distillate of the so-called "naphtha fraction" of crude petroleum, and is of variable composition, but consists mainly of the paraffines pentane C_5H_{12}, hexane C_6H_{14}, and heptane C_7H_{16}. It is a colorless, relatively light fluid, which rapidly gives off a highly combustible vapor at all ordinary air temperatures, thus being peculiarly fitted to the production, with air, of explosive vaporous mixtures. One part by weight of gasoline to 18 or 20 parts of air is the best practical fuel mixture. As at present marketed, its specific gravity ranges from about .747 to .713 or from 58° to 68° on the Baumé scale (q. v.). Its heat value is about 19,900 British thermal units per pound. Syn.: Petrol, motor spirit, essence.

Gasoline Feed, Gasoline Tank, Etc.—See headings under "fuel."

Gasoline-Electric System—A system of motor car propulsion in which the prime mover is an internal combustion engine which drives a dynamo, but in which the secondary or immediate source of the mechanical energy that produces the tractive effort is one or more electric motors geared to the driving wheels, supplied with electrical energy, through a suitable controller, from the engine driven dynamo carried upon the vehicle. The system is chiefly used in heavy commercial car practice, the elimination of the mechanical change speed gear constituting its chief advantage. Syn.: Combination system.

Gasoline Gage—See gage, gasoline.

Gasoline Pressure Gage—See gage, gasoline pressure.



GASOLINE MEASURING PUMP.

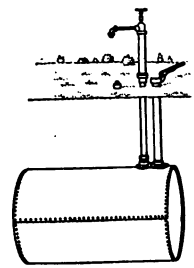
Gasoline Measuring Pump—A hand operated suction pump each stroke of which raises a definite quantity of gasoline, as one gallon, from a storage tank and delivers it into a receptacle or the tank of a car. By varying the length of the pump stroke, any desired fraction of a gallon can be delivered per stroke. The pump operates a counter which automatically registers the quantity of gasoline delivered and all handling of gasoline for the purpose of measuring is thereby avoided.

Gasoline Motor—See motor.

Gasoline Separator—See filter.

Gasoline Shut-off—See fuel valve.

Gasoline Storage System—A system of safely storing and drawing gasoline for use, consisting of a tank of heavy sheet metal, usually buried in the earth or placed in an underground vault outside of the building in connection with which it is installed. It is provided with a filling tube and vent placed above the ground line, and a pipe which extends from it to the point of delivery, usually within a garage. A manually operated suction pump may be used to raise the gasoline as re-



GASOLINE STORAGE SYSTEM.

quired, or a fluid pressure may be applied to the liquid in the tank and the gasoline forced to the delivery point thereby.

Gasoline Tester—A hydrometer (q. v.) so calibrated that, when floated in a sample of gasoline, its specific gravity in accordance with the Baumé scale is indicated.

Gate—See gear-shifting gate.

Gather—A slight forward convergence given to the planes of the front wheels of a motor car to neutralize the tendency produced by driving stresses to stretch certain parts and thus to cause a forward divergence of the wheels.

Syn.: Toe in.

Gear—A contraction of the term running gear (q. v.).

Gear—A toothed or cogged wheel, secured upon a shaft and adapted to rotate or be rotated by another similar toothed wheel upon an adjacent shaft. Gears are the most commonly used mechanism for the positive transmission of rotation from one shaft to another. The gears of a pair are of such sizes and forms, and their shafts are so placed that when in action the teeth of one gear successively enter the tooth spaces of the other, one or more teeth of the driver being always in contact with corresponding teeth of the other gear (the follower). The pressure of the successively contacted teeth of the driver upon those of the follower causes rotation of the latter. The tooth outlines are, whenever possible, such that the teeth of the two gears roll one upon the other rather than sliding together, thus minimizing friction, this result being brought about by making the acting faces of the teeth (the tooth profiles) arcs of hypocycloids and epicycloids or arcs of involutes, the latter form being the more used in automobile practice. The ideal motion of a pair of most types of gears is as if their pitch surfaces (q. v.) were rotating together in non-slipping contact.

Gear, Bevel—A type of gear used to transmit rotation from one shaft to another shaft in the same plane, but making an angle therewith. The pitch surfaces of the two gears concerned are the surfaces of conical frusta, the common apex of which is at the point of intersection of their shaft axes. Each element of each tooth is an element of a cone, coaxial with the pitch cone. The tooth profiles are such that their

Bevel Gear.

contact is substantially a rolling one, the involute form generally being used and the action is that of two cones rolling together without slip.

Bevel gears (mitre gears) are generally used in the final drives of all classes of shaft driven motor cars, on the countershaft of double chain drives, in differential gears, etc.

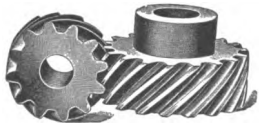
Gear, Change Speed—See change speed gear.

Gear, Composite—A gear, generally of the spur type, cut from a blank built up of a succession of laminations of metal, usually bronze, and of some organic material, such as rawhide or vulcanized fibre, clamped upon a metal hub. The organic material reduces the "ringing" quality of the gear, while the metal laminations give it strength. Occasionally used in camshaft and auxiliary shaft drives to secure silent operation.

Gear, Crown—A form of gear used to convey motion from a shaft to another shaft at right angles thereto, with a considerable change in angular velocity. The large gear (the crown gear) is a disc with an annular row of teeth upon its face instead of upon its edge, and the small gear upon the other shaft is substantially a spur, the teeth of which mesh with those of the disc gear, which require to be of rather narrow face. This form of gearing has been slightly used in a form of combined multiple direct drive and change speed gear in which the crown gear fixed to the differential of a live axle carries several concentric rows of different numbers of teeth into mesh with any one of which the other gear or pinion, fast to the drive shaft, may be slid at will, thus producing several direct drives at different speed ratios.

Gear, Fibre—A gear, usually of the spur type, cut from a blank of vulcanized fibre and used to drive light running auxiliaries under conditions calling for silence of operation rather than strength, as in driving a speedometer shaft.

Gear, Helical—A gear, cut upon a cylinder to mesh with another cylindrical gear, the teeth of which are not parallel to the axes of the cylinders but at an angle thereto. Such gears are most commonly applied to shafts which are not parallel nor in the same plane. All the elements of the teeth are arcs of helices or spirals drawn around the pitch (q. v.), top (q. v.)

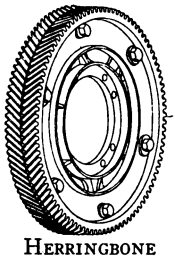


HELICAL GEARS.

and root circles (q. v.) of the cylinders and the tooth profiles are usually involute arcs. Such gears are entirely free from chatter, and are extensively used, in place of bevel gears, to operate auxiliary shafts which are not parallel with the motor shafts, such as vertical shafts carrying timers and horizontal transverse shafts operating magnetos and water pumps.

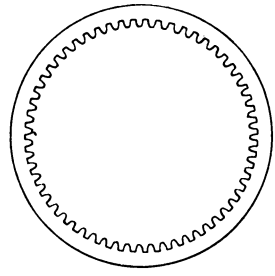
Syn.: Spiral gear; skew gear.

Gear, Herringbone—A gear consisting of two helical gears bolted together to form a single gear, the spiral teeth of the two sections pointing oppositely so that they form V's upon the gear face and give the gear the appearance indicated by the name. Such a gear, when meshed with a similar gear upon a parallel shaft, produces a very quiet running combination on account of the continuous contact of the teeth characteristic of all spiral gears and is free from end thrust, the axial pressure component of one half of the gear being neutralized by the oppositely directed end thrust of the other. Herringbone gears are used in camshaft trains, in the final drives of some electric vehicles, and sometimes for the continuously meshed gears of change speed devices of the sliding type.



HERRINGBONE GEAR.

Gear, Internal—A form of gear, usually of the spur type, with teeth cut upon the internal periphery of its rim instead of upon the external periphery thereof, which teeth mesh with an externally toothed gear of smaller diameter carried upon a shaft or stud within the larger gear. Two such gears turn in the same direction, while externally meshed spur gears turn in opposite directions. Used in some planetary change speed gears.



INTERNAL GEAR.

Gear, Planetary—See planetary gear.

Gear, Progressive—See sliding gear, progressive.

Gear, Rawhide—A gear, usually of the spur type, cut from a blank made up of laminations of rawhide highly compressed between plates, usually of bronze, secured to a metal hub. Used where silent operation is required.

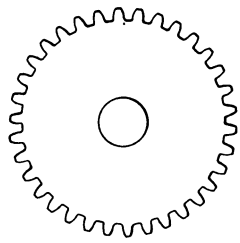
Gear, Selective—See sliding gear, selective.

Gear, Semi-selective—See sliding gear, semi-selective.

Gear, Sliding—See sliding gear.

Gear, Spiral—See gear, helical.

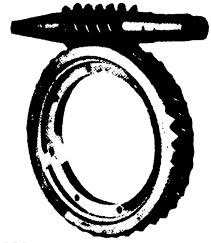
Gear, Spur—The usual type of gear for communicating rotation from one shaft to another parallel shaft. The pitch surfaces of such gears are parallel cylinders, and the action of such a gear pair is that of two cylinders rolling together in non-slipping contact. The teeth of such gears are usually of involute profile. Used in all change speed gears, in the final drives of some steam and electric cars, in timing-gear trains and for driving auxiliary shafts which are parallel to the motor shafts.



SPUR GEAR.

Gear, Stub Tooth—A form of spur gear extensively used in automobile practice the involute teeth of which are shorter and stronger than those commonly used in other mechanisms in which strength and lightness are of less importance. The obliquity of the tooth curves is increased in this system to 20 degrees, giving a steeper tooth and one the action of which approximates closely to the ideal rolling action.

Gear, Worm—A form of helical gearing commonly used to transmit the rotation of a relatively fast running shaft to a relatively slow running shaft, usually located at right angles thereto and not in the same plane therewith. The fast motion shaft normally the driver, carries an endless screw or worm which is meshed with a relatively large helical gear carried upon the slow motion shaft. In the single thread worm gear, the pitch of the worm is the same as that of the gear, and one turn of the worm



WORM AND WORM WHEEL.

shaft advances the worm gear one tooth. In the multiple threaded worm gear, that most used in automobiles, the pitch of the worm is several times that of the gear, and one turn of the worm shaft advances the worm wheel a corresponding number of teeth, all the threads of the worm included in the multiple driving simultaneously.

Used as the final drive mechanism of some shaft driven cars, especially of commercial cars which require a large gear reduction, the worm being carried by the driveshaft, and the worm gear being fast to the differential case of the live axle. Also used in steering devices, the worm being rotated by the steering wheel and the worm wheel shaft moving the steering linkage.

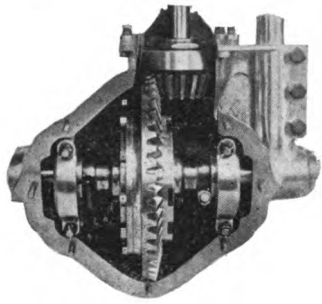
Gears, Distribution,

Gears, Secondary,

Gears, Timing,

—See cam gears

Gears, Driving—The gears included in the final drive, by which the shafts of the driving axle are rotated. In a longitudinal shaft drive, they consist of a relatively small bevel gear or pinion fixed upon the rear end of the propeller shaft or the pinion shaft meshing with a relatively large bevel gear fixed to the differential gear frame at the axle, or a multiple threaded worm carried by the rear end of the drive shaft, meshing with a worm wheel fixed upon the differential frame.



DRIVING GEARS.

Gear Blank—The piece of metal or other material, of the general shape of the finished gear, upon which the teeth are to be cut.

Gear Box—A tight housing, usually of cast iron, aluminum or pressed steel, used to enclose gears to confine their lubricant and exclude dust. The term is especially applied to the case which houses the change speed gears.

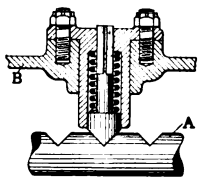
Syn.: Gear case.

Gear Box Position—The location of the gear box (change speed gear) with reference to other mechanical elements of a car. In a unit power plant (q. v.) the gear box and motor base are combined; in a transmission axle (q. v.) the gear box and rear axle casing form a single unit, and otherwise the gear box is a separate unit, placed between the motor and the rear axle.

Gear Face—That surface of a gear upon which its teeth are cut. The width of face is the perpendicular width of this surface.

Gear Lever Lock—A detent, carried by a gearshifting lever, arranged to catch in any one of a series of notches in the quadrant of a progressive change speed gear over which the lever moves. The detent holds the lever in any one of the various gear positions and in neutral, at the will of the operator. The detent is forced into engagement by means of a spring and is disengaged by means of suitable controlling mechanism placed convenient to the lever grip.

Gear Lever Interlock—A safety locking device which prevents the movement of the gear shifting lever, unless the clutch is disengaged, and thus obviates damage to the gears by their being forced together when under power. It is sometimes so arranged as to prevent the clutch from being engaged unless a pair of gears is in correct engagement or the gear shifting lever is in neutral.

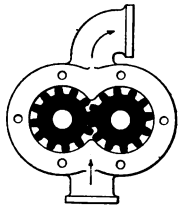


GEAR LOCK.

A, Shifting Rod.
B, Gear Case Cover.

Gear Lock—A device applied to the sliding gears of change speed devices, which, when one of the gears is in complete mesh with its mate, holds it in that position against accidental displacement, until it is intentionally moved out of mesh. The lock usually consists of a spring-pressed plunger which is moved with the gear, and which, when the gear is in correct meshed position, enters a stationary depression, thus holding the gear from moving out of mesh prematurely.

Gear Pump—A type of positive rotary pump, used for circulating oil or water. See pump, gear.



GEAR PUMP.

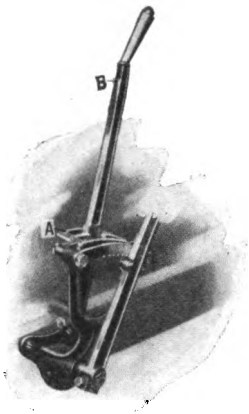
Gear Ratio—The ratio of the angular velocities of two shafts driven one from the other by means of a pair of gears. Their angular velocities are inversely proportional to the pitch diameters of their respective gears and hence inversely as the number of teeth in their respective gears, e. g.: if the bevel driving pinion of a shaft driven car is of eleven teeth, and the large gear of thirty-three teeth, the ratio of the engine speed to the axle shaft speed, on the direct drive is as $33:11 = 3:1$, and the car is said to be geared three to one. In the case of three shafts, geared together, as in a direct drive gearset, the gear of the first shaft having A teeth, which is meshed with a gear of B teeth on the second (lay) shaft, which also carries a gear of C teeth in mesh with a gear of D teeth on the third (driving) shaft, the ratio of the speed of the first shaft to that of the third shaft is $\frac{A}{B} \times \frac{C}{D}$. The total gear reduction from the engine to the rear axle on any gear, is the product of the reduction in the gearset and the reduction at the final drive. The gear ratio of shafts driven by sprockets is obtained by the same method used with gears.

Gear Shifting—In the operation of a gasoline car the act of changing the transmission of power from one set of gears to another, in order to secure a higher or a lower ratio of driving wheel speed to engine speed and thus a lower or higher tractive effort.

Syn.: Gear changing, changing gears.

Gear Shifting Fork—A fork-shaped member within a change gear case, which acts upon the gears which slide, moving them into their various positions, under the influence of a shaft and other mechanism which conveys the operator's effort from the gear shifting lever.

Gear Shifting Gate—A guide for the gear shifting lever, which controls a gearset of the sliding gear, selective type (q. v.). It consists of a somewhat rectangular, fixed quadrant, containing a somewhat H-shaped slot, within which the lever, pivoted at its



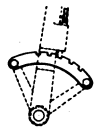
GEAR SHIFTING MECHANISM.
A, Quadrant.
B, Gear Lever.

lower end, can be moved about. When the lever is in the centre of the slot, the gears are so moved that they are all out of mesh, or in neutral, but when the lever is placed at either end of either arm of the H, the gears are so moved that one of the forward speeds or the reverse gear is engaged.

Gear Shifting Lever—The hand lever by means of which the several gears of a change speed gear are engaged and disengaged. It is a lever pivoted at its lower end, moving in a vertical fore-and-aft plane, usually placed at the side of, but sometimes in the centre of width of a car.

Syn.: Gear lever.

Gear Shifting Quadrant—A fixed quadrant over which moves the gear shifting lever of a sliding gear, progressive type (q. v.) change speed gear. The circumference of the quadrant bears a number of notches, in any one of which may be engaged a locking device, moved with the lever.



GEAR SHIFTING QUADRANT.

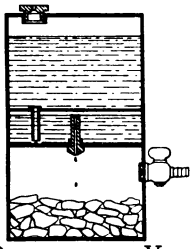
Gear Shifting Shaft—A shaft which is rotated by the motion of the gear shifting lever and transmits the motions by which the gears are shifted. In a selective gearset there are usually two such shafts, acting upon separate pairs of sliding gears, one shaft being engaged and rotated by the lever when it is moved in one side of the gate and the other being so engaged and rotated when the lever is moved in the other side of the gate.

Geared Up Speed—A drive shaft speed in a sliding change speed gear which is higher than that of the motor shaft, obtained by meshing a relatively large gear upon the lay shaft, with a relatively small gear upon the final shaft of the gearset. Used as the fourth or highest speed of a gearset in which the third speed is the direct drive.

Gearset—A term applied to any combination of gears used to secure several speed ratios between the motor and the final drive.

Syn.: Change speed gear; see sliding gear, planetary gear, individual clutch system.

Generator, Acetylene—A device for the production of acetylene gas as required for use in gas lamps, consisting of a closed vessel containing a compartment which is filled with calcium carbide (q. v.) and one containing water. The latter is provided with means by which water may be allowed to drip upon the carbide, the resulting decomposition liberating the gas. A valve is provided to control the flow of water and the upper portion of the generator is connected to the lamps by means of copper tubing. It is usually carried upon the running board of a car.

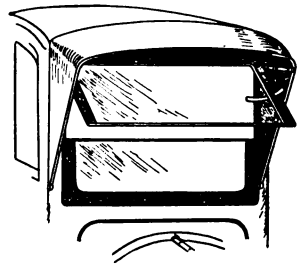


DIAGRAMMATIC VIEW OF ACETYLENE GENERATOR.

Gland—The part of a stuffing box (q. v.) which forces the packing material against the shaft or rod which is to be made liquid tight in its bearing or guide, consisting of a nut screwing into the external end of the stuffing box and thus compressing the packing therein.

Glass Front—A normally vertical, transversely placed shield fastened to the dashboard of a car, consisting of a metal frame holding a plate glass, through which the operator can see the road, while, at the same time, he is protected from the current of air into which the car is running. Such shields are usually made in sections, so as to fold in various ways and assume various angles, thus offering more or less protection from wind, rain and dust to the passengers.

Syn.: Wind shield.

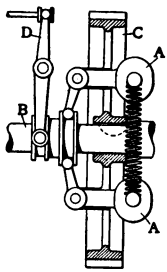


GLASS FRONT.

Glycerine—A thick, oily, nearly colorless, sweetish liquid, produced by the decomposition of animal fats, which is used in dashpots and sight feeds and, when mixed with water, as an antifreeze solution (q. v.).

Governor—In general, an automatic device consisting of a mechanism sensitive to changes in rotative speed and a linkage moved by this mechanism which acts to maintain such speed at or near a predetermined value or to maintain constant some action dependent upon speed. As applied to an internal combustion motor, a device, such as above described, the function of which is to maintain engine speed at or near a predetermined value irrespective of the work which the engine is doing, within the limits of its capacity.

Governor, Centrifugal—A form of automatic governor, consisting of a weight, or pair of weights, attached to and rotated by a shaft the speed of which is to be controlled, the weights tending to assume positions further from the shaft axis as the shaft speed increases, this tendency being resisted by spring action. The weights thus assume a certain distance from the shaft axis at any given speed, remaining further away from it at higher speeds and vice versa. Their movement operates a linkage which can be made to reduce the force driving the shaft, and hence its speed or vice versa.



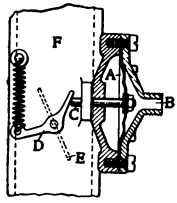
CENTRIFUGAL GOVERNOR.

A, A, Weights; B. Cam Shaft; C, Gear on Shaft; D, Linkage to Throttle Valve.

Syn.: Flyball governer.

Governor, Dynamo—An automatic voltage governing device applied to dynamos or magnetos, which tends to maintain constant the voltage delivered irrespective of the driving speed of the electrical generator. See dynamo, **constant voltage.**

Governor, Hydraulic—A form of governor applied to internal combustion motors, which are cooled by forced water circulation, in which the mechanism, that is sensitive to speed fluctuations, consists of a diaphragm or spring returned piston, the deformation or change of position of which is dependent upon the pump pressure acting in the water system, and hence upon motor speed. The motion of the piston or diaphragm can be made to regulate motor speed.



HYDRAULIC GOVERNOR.

A, Diaphragm; B, Water Inlet; C, Rod Actuating Lever D, which operates Butterfly Valve E in Intake Pipe F.

Governor, Maximum Speed—A form of automatic protective device applied to commercial vehicles to prevent their being driven faster than a certain speed. The governor mechanism is commonly sealed to prevent its being tampered with.

Governor, Throttling—A governor of either the centrifugal or hydraulic type connected through a suitable linkage, so as to progressively close the throttle valve as the speed increases above the predetermined value, and vice versa.

Grab (v.)—With reference to a clutch, to engage suddenly and violently (see fierce clutch).

Syn.: To grip.

Grade, Resistance Due to—The resistance due to gravity against which a car is propelled up a grade and which is approximately measured in pounds by the percentage of the grade (see grade, per cent. of) multiplied by the weight of the vehicle in pounds; e. g., the resistance occasioned by a 6 per cent. grade in the case of a 3,000 pound car is approximately 180 pounds. The horse power expended at the driving wheels in overcoming grade resistance alone is $H\ P=0.00266GV$, where G is the grade resistance in pounds and V the speed of the vehicle in miles per hour. The engine horse power required is found by dividing the horse power given above by the efficiency of transmission of the car expressed in per cent.

Grade, Per Cent. of—The tangent of the angle which an inclined roadway makes with the horizontal or the ratio of the

vertical rise of a road to the length of road in which such vertical rise takes place, reduced to a decimal fraction, e. g.: if a road rises 50 feet in a distance of 500 feet, its average grade is =0.10 or 10 per cent.

Gradometer— An instrument designed to be carried upon an automobile to measure the grade which it is ascending or descending. One form consists of a spirit level, made in the form of a circular arc, which is fastened upon the car, convex upward, in a vertical fore-and-aft plane, with its ends in a line horizontal with respect to the car. The movement of the bubble of the level over a scale calibrated in percentages of grade, gives a continuous indication of the steepness of the road.

Graphite—An allotropic form of carbon, which is of an unctuous nature. When in a state of fine subdivision it is an excellent lubricant and is mingled with greases and oils used in automobile lubrication. Also used as a substitute for talc powder in lubricating the exteriors of tire inner tubes in the shoes. See deflocculated graphite.

Syn.: Black lead, plumbago.

Graphite Grease—A grease or non-fluid oil with which a variable proportion of graphite has been intimately mingled. Used in bearings and gear cases.

Gravity Circulation—See thermo-siphon and water cooling.

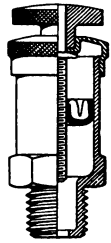
Gravity Feed—See fuel feed, gravity and lubrication, gravity.

Gray Iron—A variety of cast iron containing part of its carbon in mechanical mixture and a part in the graphitic condition; the softer grades, such as used in making intricate cylinder castings for automobiles, containing most of its carbon mechanically mixed with the iron. It is soft and fusible and wears very smoothly.

Grease—A semi-solid or non-fluid lubricant, manufactured from a petroleum base, used to lubricate automobile bearings, from which fluid oil would drip away, and where the pressures may be high, such as ball and roller bearings, spring pins, steering joints and so forth. Also used, when thinned with oil, in gear cases.

Syn.: Non-fluid oil.

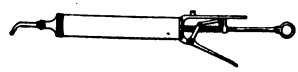
Grease Bag or Boot—See boot.



COMPRESSION GREASE CUP.

Grease Cup, Compression—A device for manually feeding grease to a bearing, consisting of a short tube screwed into a hole in the bearing cup and means for forcing grease through it from a cup filled therewith, in which the grease is compressed by screwing down the cup upon the threaded external portion of the delivery tube or by screwing a plunger into the cup. Such cups are fitted to automobile bearings which have no automatic lubricant feed, such as spring eyes, joints in the steering linkage, etc.

Grease Gun—An instrument used to fill bearings, grease boots and housings with grease, consisting of a metal tube, provided at one end with a delivery nozzle and closed at the other with a screwed-on cap. A tightly fitting plunger, the stem of which passes through the cap, is arranged to be moved through the tube upon a screw thread, thus forcing out, through the nozzle, the grease with which the tube is filled.



GREASE GUN.

Greaseway—See oilway.

Grid—The metal frame which supports and conducts electricity to and from the active material of an element of a storage cell. The term is especially applied to the lead frames, formed in gridiron shape, used in cells of the lead type.

Grip (v.)—In the case of a clutch, to engage too suddenly and violently. (See fierce clutch.)

Grind (v.)—To smooth metal parts to a true surface by means of an abrasive, such as emery or carborundum. In grinding pistons, cylinder bores, the bearing parts of shafts and similar cylindrical objects, the parts are rotated upon their axes while a rapidly rotating abrasive wheel slowly travels on a parallel axis along the part to be finished, a stream of water usually being applied to the point where cutting is taking place. In grinding a poppet valve to a perfect fit with its seat an abrasive paste is placed between the surfaces and the parts are given a partial rotary motion while a light pressure is applied between them.

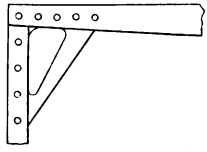
Ground (v.)—To connect an electric circuit to the common return of all circuits which is, in general, the earth. In an automobile, all the important metallic parts, such as the frame, the motor and the transmission parts, are electrically connected together, and these form the common return, or ground, of all ignition circuits, the use of special return wires thus being avoided. A wire connected to any metallic part of the car machanism is said to be grounded.

Ground Joint—A joint between two abutted parts which is made fluid tight by grinding their surfaces together with an abrasive until they conform accurately one to the other. Such a joint, when its surfaces are drawn together, is tight without the use of a gasket. Sometimes used at manifold connections and to secure the seating of valve cages.

Gudgeon Pin—The piston pin (q. v.).

Gunboat Body—See body, gunboat.

Gusset Plate—An angular reinforcing plate riveted to two frame members at their junction.



SECTION OF FRAME SHOWING GUSSET PLATE.

H Section—A form of cross section used in members subjected to compression and bending stresses, such as connecting rods, front axles, distance rods and structural members. The cross section consists of two flanges joined by a perpendicular web, thus resembling a letter H.

Halftime Gears—The gears which operate the cam shaft of a four cycle internal combustion motor at one-half the speed of the crank shaft. See cam shaft gears.

Halftime Shaft—The cam shaft of a four cycle internal combustion motor which runs at one-half the crank shaft speed. See cam shaft, inlet and cam shaft, exhaust.

Hand Pump, Gasoline Pressure—A hand operated air pump, used to raise the pressure upon the gasoline supply of a force feed fuel system previous to starting the engine (before the engine driven pump begins to act). Also used on cars fitted with gravity fuel feed systems to increase the fuel flow pressure on steep hills. It is usually located upon the dash or close to the heelboard of gasoline cars.

Hand Pump, Oil—A manually operated pump, drawing from a supply tank used to replenish the supply of lubricating oil in the base of an engine fitted with the circulating system of lubrication, or to maintain the oil level in the crank case of an engine lubricated by the simple splash system. It is usually located upon the dash or under the hood.

Hand Pump, Water—A hand operated pump drawing from the water tank, used upon steam cars to force water into the boiler when the engine driven water pump is not in operation or when its action is inadequate.

Handhole—An aperture in a housing through which the hand may be introduced, the parts inspected and adjustments be made upon the mechanism within the case. The hole is covered by a tightly fitting metal plate, fastened in place by nuts or studs or by a clamp.

Handhole Cover—The cover which normally closes a handhole.

Harden (v.)—To render steel hard by a tempering process, consisting of heating the metal to a red heat and plunging it into a liquid, such as water, oil or a saline solution. The metal is frequently heated again to reduce its hardness (tempering). Hardening increases resistance to surface wear and increases the elastic qualities of the metal generally, at the same time tending to render it more brittle.

Head End—The end of a motor cylinder which comprises the cylinder head.

Header—A pipe from which several pipes branch. The term is applied to the common water circulating pipe into which the flow pipes to or from individual water jackets connect and which leads to or from the radiator. Similar to a manifold.

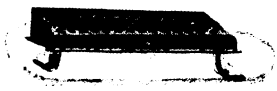
Heat Treatment—A general term applied to the processes applied to metals to change their physical properties in which heating and cooling are involved. It includes hardening, tempering and annealing. The shafts, gears and structural parts of automobiles are heat-treated.

Heat Value—The amount of heat given out by the complete combustion in oxygen of a unit weight of a fuel. Heat values are usually expressed in British thermal units (B. T. U.) per pound, or calories per kilogram of the fuel in question. The heat value of gasoline of average quality is commonly taken as 19,000 B. T. U. per pound, and that of commercial denatured alcohol at 13,300

B. T. U. per pound. Heat values are used in calculating the thermal efficiencies of motors.

Syn.: Thermal value, heat of combustion.

Heater, Vehicle—A device for warming the interiors of closed cars, consisting of a coil of pipe set into or under the floor of the car, through which is passed the hot water of the engine cooling system, or a drum into which is admitted a portion of the exhaust gases, the heat supplied being directly radiated or used to heat air which is allowed to enter the car over the heater surfaces.



VEHICLE HEATER.

Syn.: Foot warmer.

Heelboard—The vertical board or panel which fills the space between the car floor and the seat board. The board is sometimes hinged at its lower edge, so as to permit the space under a seat to be utilized for storage.

Heelplate—A metal plate, set into the floor board to the rear of a clutch or accelerator pedal, upon which the operator rests his heel while driving, the wearing out of the mat or other floor covering at these points thereby being obviated.

Helical Cam—See cam, spiral.

Helical Gear—See gear, helical.

Herringbone Gear—See gear, herringbone.

High Gear—That gear provided in a change speed gear which, when in use, makes the ratio of road wheel speed to motor speed the highest.

High Speed Adjustment—A carburetor adjustment used to regulate the mixture quality when the throttle is widely opened and the rate of gas demand is high. It usually consists in varying the strength of the auxiliary air valve spring, but may consist in regulating the opening of the gasoline needle valve or controlling the action of a second or third jet of a multiple jet carburetor.

High Speed Clutch—A clutch usually of the jaw type (see clutch, jaw) employed in gearsets of the sliding type to lock together the clutch driven shaft and the final driving shaft and thus to secure a direct drive (q. v.) Also, in the individual clutch system (q. v.) of speed changing, the clutch which puts into driving action the high speed gears.

High Tension Cable—A kind of very highly insulated flexible conductor adapted to carry high tension ignition currents without danger of an escape therefrom. It consists of a small stranded copper conductor surrounded by compressed paper, over which is wound a water and oil proof fabric covering or of a stranded conductor overlaid with rubber insulation around which is braided one or more layers of water and oil proof fabric.

HIGH TENSION CABLE.

Syn.: Secondary cable.

High Tension Current—An electric current produced by an electromotive force so high as to enable it to pass disruptively through an air gap or through weak insulation. In ignition practice high tension currents are of the order of tens of thousands of volts and are produced in the secondaries of jump spark coils and by high tension magnetos.

High Tension Ignition—See ignition, jump spark.

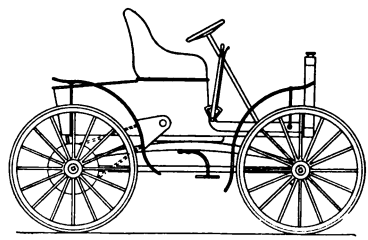
High Tension Magneto—See magneto, high tension.

High Tension Wire—A conductor through which passes a high tension current, e. g., the wires leading from coil secondaries or high tension magnetos to jump spark plugs.

The term is used in contradistinction to "low tension wire," which refers to a wire traversed by a battery current or by the armature current of a low-high tension magneto.

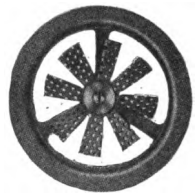
High Wheeled Car—A type of automobile which is mounted upon wheels of large diameter, similar to those used upon horsedrawn vehicles, and which are generally fitted with solid or cushion tires, the object being to secure the easy running and riding qualities characteristic of large diametered wheels without the disadvantages inherent in the use of inflated tires and also to obtain a large road clearance.

Syn.: Motor buggy, buggy type automobile.



HIGH WHEELED CAR.

Homogenizing Device—A device for breaking up the particles of liquid fuel entrained in the charge carried from the carburetor to the motor cylinders, thus assisting in their evaporation and rendering the mixture more homogeneous or perfectly vaporous. It usually consists of a small fan, introduced into the mixture pipe, which is rapidly rotated by the gas current, the blades of which, or special parts carried thereby, churn the mixture and subdivide the fuel globules.



HOMOGENIZING DEVICE.

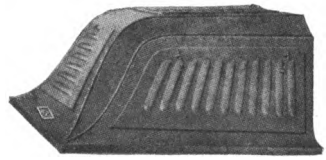
Hood—The removable covering which incloses the motor and its auxiliaries in cars which carry the motor at the forward end of the chassis. It is usually constructed of sheet metal, and may be tight or furnished with slits or louvres in its sides.

Syn.: Bonnet.

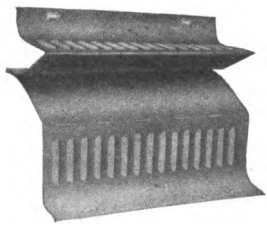
Hood, False—A hood which does not enclose the motor or other mechanism, but gives the car the appearance of the engine-in-front gasoline vehicle and furnishes space for gasoline and water tanks or storage batteries or for carrying tools and supplies.

Hood, Sloping—The type of hood used upon cars the radiator of which is placed against the front of the dash. The side elevation of the hood is a curved line sloping from the radiator top downward to the frame level, and the front elevation is usually more or less curved. It is usually made in one piece and hinged at its upper rear edge, so that it may be lifted from the front and thus expose the motor.

Syn.: French type hood.



SLOPING HOOD.



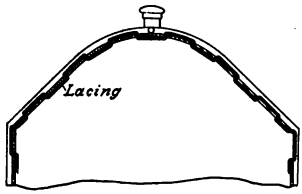
STRAIGHTLINE HOOD.

Hood, Straightline—The type of hood commonly used upon cars in which the vertical radiator is mounted upon the extreme front of the chassis. It completely fills the top and sides of the space between the rear surface of the radiator and the front of the dash and is usually constructed in two sections, hinged together in the longitudinal axis of the

car upon a metal rod, the front and rear ends of which are supported respectively in fittings attached to the radiator and the dash.

Hood Cover—A highly non-conducting covering of padded leather or pantasote, so fitted as to cover the entire hood and the radiator front, which is used to facilitate starting and running the motor in cold weather by preventing it from becoming too cold.

Hood Lacing—A lacing of rawhide or similar material, interposed between the edges of a hood and the frame, the fitting upon the dash upon which the hood rests and the rear edge of the radiator frame to prevent the hood's rattling.



HOOD LACING.

Hood Latch—A locking device for fastening the edges of a hood to the car frame, two of which are commonly used on each side of hoods of the straightline type. It consists of a spring catch, fastened in the frame, which, when engaged with the edge of the hood tends to draw it closely into place.

Syn.: Hood fastener.

Hood Strap—A leather strap, the ends of which are secured to fittings secured to the side frame members and which is passed transversely over a hood and tightly buckled to secure the hood in place and to prevent its rattling.

Hooke's Joint—See universal joint.

Horn, Bulb Type—A reed horn, which is sounded by air forced through it from a rubber bulb compressed by the hand or foot of the operator, the bulb being connected to the horn by flexible metallic tubing (q. v.) and the horn being placed under the hood or on the side of the car. Generally used as an alarm or signalling device. See siren, electric horn and exhaust alarm.

Horse Power—The customary unit in which is expressed the rate at which mechanical energy is delivered by or to a machine and equal to 33,000 foot pounds per minute. In general, the product of the average force measured in pounds acting for one minute and the distance in feet through which such force acts in one minute divided by 33,000 gives the average horse power

acting. The horse power is used in defining the output of vehicle motors. Abbreviation, H. P.

Horse Power, A. L. A. M.—The horse power which is obtained by applying to a gasoline vehicle motor of the four-cycle type, the rating formula adopted by the Association of Licensed Automobile Manufacturers. It gives an indication as to the horse power which such a motor may reasonably be expected to develop when running at a piston speed (q. v.) of 1,000 feet per minute. The formula is as follows:

H. P. $= \frac{d^2 n}{2.5}$, where d is the cylinder bore in inches and n is the number of cylinders.

Horse Power, Brake—The output of a motor, expressed in horse power, obtained by testing it by means of a dynamometer (q. v.) or brake, the rotative speed at which the horse power stated was obtained usually being quoted. The brake horse power is the useful or commercial horse power and is equal to the indicated horse power multiplied by the mechanical efficiency.

Horse Power, Electrical—The equivalent of a horse power expressed in electrical units, namely, the expenditure of electrical energy at the rate of 746 watts (q. v.). In an electric motor the output, in horse power, is equal to the product of the watts supplied to it and the motor's commercial efficiency divided by 746.

Horse Power, Indicated—The horse power delivered by the working fluid to the piston or pistons of a gas or steam engine, as computed by the use of an indicator (q. v.), which measures the mean effective pressure upon the pistons. In a gasoline engine, of the four-cycle type, it is computed by the following formula, in which d is the cylinder bore in inches, P the mean effective pressure acting during a working stroke measured in pounds per square inch, l the length of the stroke in inches, N the number of revolutions of the crank shaft per minute and n the unmber of cylinders.

$$H.\ P. = .00000991\ d^2\ P\ l\ N\ n.$$

In the case of a two-cycle gas engine or single acting steam engine the formula becomes

$$H.\ P. = .00001982\ d^2\ P\ l\ N\ n$$

and in the case of a double acting steam engine it becomes

$$H.\ P. = .00003964\ d^2\ P\ l\ N\ n.$$

The indicated horse power is equal to the useful or brake horse power of a motor plus the horse power dissipated in friction, and is equal to the useful horse power divided by the mechanical efficiency (q. v.).

Abbreviation, I. H. P.

Horse Power, Rated—The horse power accorded to a motor by its manufacturer. A motor may be rated at its brake horse power or by the A. L. A. M. or some other rating formula, or the rating may be entirely arbitrary in accordance with the judgment of the manufacturer. (See rating formula.)

Syn.: Nominal horse power.

Horse Power, Useful—The actual or net output of a motor expressed in horse power, which is delivered at the driving end of its shaft.

Syn.: Brake horse power.

Horseshoe Magnet—See magnet, horseshoe.

Hot Air Accumulator—A device for collecting warm air for the initial air inlet (q. v.) of a carburetor, usually consisting of a metal sheath affixed to the end of the initial air inlet pipe and applied closely around the exhaust pipe, a portion of a water jacket or some other hot part so that air entering it is warmed by the hot surfaces over which it passes when entering the accumulator.

Syn.: Hot air collector, hot air horn.

Hot Air Intake—The pipe which conveys heated air to a carburetor, usually delivering it at the initial air inlet but sometimes to the auxiliary air inlet as well. The pipe is often provided with a shutter so arranged as to admit to it variable proportions of heated and unheated air, as desired by the operator.

Hot Riveted—Parts which are secured together by means of rivets which are applied and upset when in a red hot condition. The term is especially applied to vehicle frames, the members of which are generally so riveted.

Hot Water Jacket—See carburetor, water jacketed.

Housing—A construction, usually of cast iron or aluminum or of pressed steel, used to enclose parts, especially working parts, and thus to retain lubricant and exclude foreign matter. See crank case, axle housing, gear case, differential case, etc.

Hub Cap—A cap, usually of aluminum or brass, which is secured over the outside end of an automobile wheel hub, to prevent the entrance of road dirt and escape of lubricant to or from the wheel bearings and, when removed, to give access to the fastening device which secures the wheel to the axle.

Hub Flange—The flange formed integrally with the hub of an artillery wheel (see wheel, artillery) between which and a removable flange the spokes are bolted and to which the brake drum is bolted or with which it is formed integrally.

Hydraulic Test—A test to which cylinder castings are subjected in the process of manufacture to disclose any leaks therein. The cylinder openings are tightly closed, water pressure is applied within the casting and any escape of water through its walls indicates that it is defective.

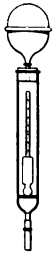
Hydraulic Transmission—An arrangement for transmitting the driving effort of a vehicle motor to the road wheels by means of the movement of a liquid, usually oil, under pressure, the function of a change speed gear being also performed thereby. In one system, a gasoline motor directly drives a three-cylinder piston pump, the length of the stroke of which and hence the rate at which oil is pumped, can be regulated by the operator. The hydraulic motor, which is geared to the traction wheels, is also a three-cylinder construction similar to the pump and connected thereto by piping, forming a circulating system, but it acts to convert reciprocating motion into rotary motion. When the stroke of the engine driven pump is adjusted very short, oil is forced to the motor at a relatively slow rate and its speed is relatively low, while the speed of the engine may be relatively high, and thus the effect of a very low gear is produced. When, on the contrary, the pump is set for full stroke, oil is circulated at a rapid rate, and the motor rotates relatively rapidly with respect to the engine, the effect of a high gear being then produced. Intermediate stroke lengths at the pump produce the effect of intermediate gear ratios. The elimination of a mechanical change speed gear and the great number and range of gear ratios obtained are the principal advantages of this system. Used on some commercial vehicles.

Hydrocarbon—A chemical compound of hydrogen and carbon. Gasoline, kerosene and benzol are hydrocarbons or mixtures of various hydrocarbons.

HYDROMETER WITH TEMPERATURE CORRECTIONS.

Hydrometer—An instrument used to determine the specific gravities of liquids. It consists of a closed glass bulb with a long stem, the bulb being so weighted that the instrument floats in the liquid for which it it adapted, with the stem projecting vertically out of the liquid. The denser the liquid in which it is floated the less deeply the instrument sinks. The stem is graduated, and the figure on the stem which coincides with the surface of the liquid represents the density of the liquid in which it is floated. Suitably calibrated instruments of this type are used for testing gasoline, alcohol and other anti-freeze solutions and storage battery electrolyte. A thermometer is usually attached to such instrument to indicate the temperature of the liquid and permit of the correction of the reading to the standard temperature.

Hydrometer Syringe A combined hydrometer and syringe used in testing and adjusting the strength of the electrolyte in storage cells. The hydrometer floats in the liquid in the barrel of the syringe, and, when the latter is filled with electrolyte drawn up from a cell, the hydrometer indicates its density.



HYDROMETER SYRINGE.

I Section—A cross section similar to an H section (q. v.) except that the web is longer relatively to the length of the flanges, giving it more the shape of an I than of an H.

Syn.: I beam.

Idle (v.)—To rotate without doing useful work. A gasoline or steam engine is said to idle when it is in operation but disconnected from the driving wheels either by clutch disengagement or by the placing of the change speed gear in the neutral position and thus developing only power enough to overcome its own losses. Syn.: To run free.

Idler—One of a train of gears which is not carried upon a driving or driven shaft, but usually upon a short shaft

or stud supporting it alone. It is used as an intermediate connecting gear between two shafts which are too far apart to be directly connected by gears of reasonable diameters, or which are required to rotate in the same direction. Used between the crankshaft and camshaft gears and between the two gears of the reverse pair in gearsets. See reverse idler. Syn.: Idle gear.

Igniter—The mechanism at which the ignition spark is produced in contact spark systems. The spark plug of the contact spark system. See ignition, contact spark.

Ignition—The inflammation or firing of the fuel charge in the combustion space of an internal combustion motor in order that it may burn, expand the working fluid and cause it to exert a useful pressure upon the power piston during its working stroke. An electric spark, produced in the midst of the fuel charge, by means of a spark plug (q. v.) at or near the instant when the fuel is ready to be efficiently burned and when the piston is about to begin an outward stroke, is the means of ignition commonly employed.

Ignition, Battery—Ignition in which the spark is produced by means of electricity furnished from a primary or storage battery. The term is used in contradistinction to "magneto ignition."

Ignition, Contact Spark—A system of electrical ignition in which the spark is produced by the extra current (q. v.) set up when an electric current is interrupted within the engine's combustion space. Each cylinder is provided with an igniter which consists of a fixed insulated electrode inside the combustion space and a movable electrode which can be moved into and out of contact with the fixed contact point by actuating mechanism operated from outside. The action of each igniter is as follows: Shortly before a spark is required in a cylinder, its mechanism brings the two internal contacts together and a current passes therethrough. At about the instant when the spark is required, the operating mechanism causes the contact points to separate and the current momentarily bridges the gap between them in the form of an arc and ignites the mixture. The contact spark system is little used at present.

Syn.: Touch spark, make and break, low tension ignition.

Ignition, Delayed—Ignition which takes place so late in the cycle of a cylinder that the working pressure is developed after the piston has begun its power stroke, thus causing an abnormally large part of its action to be lost by the escape of the working fluid at high pressure through the exhaust.

Syn.: Retarded ignition, late ignition.

Ignition, Distributor—See distributor and ignition, single coil.

Ignition, Double—See double ignition.

Ignition, Double Spark—See double spark ignition.

Ignition, Dual—See dual ignition.

Ignition, Electrical—Ignition produced by the electric spark, in contradistinction to hot tube ignition, a system formerly used, in which a tube inserted through the cylinder wall is heated by an external flame and fires the charge at or near its maximum compression point.

Ignition, Fixed—Ignition by means of a spark, the period of the occurrence of which in each cylinder cannot be altered by the operator, no spark controlling mechanism being provided. Such ignition is usually effected by a high tension magneto, on account of its very slight lag (see ignition lag). The action of the magneto make and break device always occurs when all the pistons are in the same relative positions, usually at or just before the inward dead centre. It is mainly used upon commercial vehicles which are likely to be driven by rather inexpert operators and simplifies the control while preventing abuse of the motors.

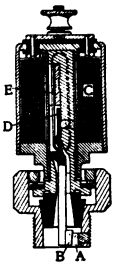
Syn.: Set spark.

Ignition, High Tension—Ignition which is produced by the discharge of a high tension electric current across the spark gap between stationary discharge terminals located within the combustion space. The term is used in contradistinction to ignition, low tension (q. v.). The generally used ignition system.

Syn.: Jump spark ignition.

Ignition, Jump Spark—See ignition, high tension.

Ignition, Low Tension—Synonymous with ignition, contact spark (q. v.).



MAGNETIC IGNITION PLUG.

A, fixed V shaped electrode; B, movable electrode which fits into A; C, magnetic coil; D, armature, whose attraction breaks the contact between A and B; E, spring which keeps A and B in contact when current ceases.

Ignition, Magnetic Plug — Contact spark ignition which is produced by an igniter, the make and break action of which is caused by magnetic attraction instead of mechanically. The igniter consists of a special plug which can be inserted into an ordinary jump-spark plug hole and which comprises a fixed and a movable platinum pointed electrode, the latter being capable of being drawn out of contact with the former by the action of an electromagnetic coil contained within the plug and traversed by the ignition current. The source of current is a synchronous, low tension magneto, the armature of which is normally short circuited by its make-and-break device, but, at each ignition period, the short circuit is removed and a heavy current is sent to one of the plugs, causing its contacts to be separated by the magnetic attraction of its coil and a spark to be produced at the contacts. In multiple cylinder motors the plugs are energized in rotation by the action of a distributor (q. v.) geared to the magneto, which sends the current through the wire leading to the appropriate plug.

Ignition, Magneto—Ignition produced by current furnished by a magneto, driven by the engine which it ignites. The term is used in contradistinction to battery ignition. See titles under magneto.

Ignition, Make and Break—Synonymous with ignition, contact spark (q. v.).

Ignition, Master Vibrator—A system of high tension ignition of the multiple coil type in which the individual coils are plain coils. In a common wire (q. v.) of the primary system is inserted a magnetic vibrator (q. v.), known as the master vibrator, which produces a succession of quick makes and breaks in the primary circuit of each coil, in sequence, as its circuit is closed by the timer. The object of this arrangement is to secure synchronized ignition in all the cylinders, which may not be obtainable by the use of a number of vibrators which cannot be identical in their action.

Ignition, Multiple Coil—A system of high tension ignition in which the spark in each cylinder is produced by a separate spark coil, which may be a vibrator coil or a plain coil. One secondary terminal of each coil is grounded and the other secondary of each is wired to the jump-spark plug of its respective cylinder. One primary terminal of each coil is connected to the same terminal of the battery or low tension non-synchronous magneto and the other terminal of each is connected to its respective insulated binding post of the timer (q. v.). The other terminal of the battery is grounded. If the timer is of the type which causes a quick break in each of the coil primaries, in sequence, plain coils are used, and if the timer merely closes and opens the primary circuits without quick action, vibrator coils are used, the vibrator producing the sudden break required.

Ignition, Point of—The point in the cycle of a gas engine cylinder at which the spark actually takes place. In order that the pressure of combustion may be fully developed exactly at the beginning of the piston's working stroke, the spark must occur at a greater angle of crank shaft rotation before the inward dead centre in proportion as the motor speed increases, on account of the ignition lag. See advance, angle of.

Ignition, Premature—The ignition of the fuel charge so early in the cycle of a cylinder that the explosion pressure is developed considerably before the piston is ready to commence its working stroke, with the result that the pressure acts contrary to the direction of rotation of the engine during a portion of an inward stroke, the output is reduced, the working parts are unnecessarily stressed and a knocking sound is produced.

Ignition, Self—Ignition of the fuel charge caused by the overheating of some portion of the motor within the combustion space to such an extent that the charge is fired by contact with it. Such local overheating may be caused by the failure of the engine cooling system, by lack of cylinder lubrication and by the accumulation of poorly conductive material, such as carbon deposits upon the surfaces of the combustion space.

Ignition, Single Coil—Ignition in which the discharge from a single jump-spark coil is employed to successively ignite the charges in a multiple cylinder motor. Systems employing a distributor (q. v) are single coil systems. See ignition, distributor and magneto, high tension.

Ignition, Single Spark—Ignition which is produced by a single spark per cycle of each cylinder, in contradistinction to ignition produced by a multiplicity of rapidly recurring sparks delivered in each cylinder per cycle from a vibrator coil. In single spark battery systems, the timer or equivalent device makes a single contact and a single rapid break of the circuit for each cycle of each cylinder, the length of the contact in some systems being independent of motor speed and only long enough to charge the coil. A saving in battery consumption is effected by such systems as compared with vibrator coil systems.

Ignition, Synchronized—Ignition of multicylinder engines in which the spark occurs in each cylinder at exactly the same point in its cycle so that the ignition timing of all cylinders is identical. Such ignition is secured only when the spark in all the cylinders is caused by the action of the same make and break device as is the case in the single coil and distributor system and the master vibrator system, and when high and low-high tension magnetos are used. In the multiple vibrator coil system the ignition is not perfectly synchronized because of differences of action of the several vibrators and the actions of the several cylinders are caused to vary somewhat thereby, to the detriment of the running of the motor.

Ignition, Touch Spark—Synonymous with ignition, contact spark (q. v.).

Ignition Battery—A battery used to supply current to an ignition system in contradistinction to a battery used for lighting purposes. Either three cells of accumulator furnishing six volts, or a battery of dry cells grouped five or six in series and sometimes several series in multiple, is used. Either one or two ignition batteries may be installed upon a car, one being held as a reserve while the other is in use.

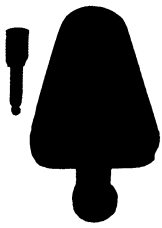
Ignition Cable—A special insulated cable adapted for use in high tension ignition systems. See high tension cable.

Ignition Cut-out—An electric switch, usually in the form of a button, generally mounted upon the steering wheel, but sometimes upon the dash or elsewhere, designed to temporarily interrupt the ignition of a vehicle motor. It is used in momentarily slowing down a car and in shutting down motors which are provided with magneto ignition only.

Ignition Lag—The very short period of time which elapses between the instant of action of the mechanism which causes the spark to be produced, to the instant at which the spark actually takes place, e. g., the time elapsing between the closing of the circuit by the timer (q. v.), of a vibrator coil system to the instant at which the spark passes at the plug. The time is taken up partly by the electromagnetic actions and partly by the mechanical action of the vibrator. This lag plus the combustion lag represents the total delay between the spark producing action and the attainment of the full working pressure upon the piston and renders variable spark timing desirable in the operation of most motors, especially when battery systems of ignition are used.

Ignition Lever—See spark timing lever.

Ignition Switch—An electric switch used to turn on or off the ignition current from a motor, at the will of the operator. It is usually placed in an insulating housing, upon the dash, upon the face of a dashboard coil box or upon the heelboard, the wires leading to it being concealed. In cars fitted with battery ignition only, it is usually a switch capable of three positions, namely: One battery in connection, the other battery in connection and "off." In cars using the dual system, the three switch positions are battery connected, magneto connected and off. In cars using a magneto only, the two switch positions are magneto on and magneto off. In cars equipped with double ignition the switch positions are usually magneto on, both magneto and battery on, battery on and both systems off. The switch is usually of the lever type and manually operated, but may be a kick switch, operated by the driver's foot. When the switch is mounted upon the steering wheel it is known as a steering wheel switch.



IGNITION SWITCH.

Indicator, Optical—See manograph.

Individual Clutch System—A form of change speed gear which consists of a shaft, rotated by the motor, carrying gears equal in number to the driving ratios required, and of diameters such as to secure the same and a parallel shaft connected to the final drive mechanism upon which is mounted a correspond-

ing set of gears, of appropriate diameters, each one of which is in constant mesh with one of the gears upon the engine driven shaft. The gears on one of these shafts are securely keyed thereto, while each of the gears upon the other shaft is free to rotate thereon unless made fast to it by one of a series of clutches, one being provided for each pair of gears.

In the individual clutch system no gears are clashed together when speeds are being changed.

Syn.: Separate clutch system.

Induction stroke—See aspirating stroke.

Incrustation—A term applied to the deposits of a calcareous, earthy or partly organic nature, which form upon the inside surfaces of steam boilers, especially when impure feed water has been used for some time. Their presence retards the conduction of heat from the fire to the water and reduces the output of the boiler as well as involving danger of burning the metal thereof. Boiler compounds, usually composed of sodium hydrate, are used to loosen such incrustations.

Induction, Electromagnetic—The action which results in the development of an electromotive force in an electric circuit when the number of lines of magnetic force (see field, magnetic) included within it is varied. Such variation may be caused by the variation of the current flowing in an adjacent, parallel, but separate circuit, as is the case in a jump spark coil (see coil, induction), upon the breaking of the primary current or the variation may be effected by moving the circuit so as to cut a magnetic field as in the case of the armature conductors of a magneto or dynamo armature.

Induction, Self—The action which results in the development of an electromotive force in an electric circuit when the number of magnetic lines set up by the current circulating in it is varied, especially by the sudden interruption of the current. See extra current and coil, self induction.

Inertia—That property of matter by virtue of which it resists changes in its state of rest or motion. Inertia force: The force required to overcome the inertia of a machine part endowed with periodic motion, like the piston of a motor.

Inflate (v.)—To raise the pressure within a pneumatic tire by forcing air thereinto by means of a pump or from a supply of compressed air. Antonym: Deflate.

Inflation—The act of inflating.

Inflation, Pressure of—The pressure which is found most desirable to be maintained in a pneumatic tire. This pressure increases with the cross section of the tire and with its diameter and ranges from about 65 to 90 pounds per square inch in rear tires, of from 3½ to 5 inches in cross section. The pressure in rear tires is usually from 20 per cent. to 30 per cent. higher than in front tires.

Inherent Regulation—A term applied to the tendency manifested in certain specially constructed dynamos, to maintain a nearly constant voltage independent of armature speed. The term is specially applied to such dynamos, when used for lighting vehicles and which have no external mechanism to regulate their voltage.

Initial Air Inlet—The pipe through which air enters a carburetor through the bottom of the vaporizing passage and hence around the regular spraying nozzle. Air is constantly passing through this pipe, so long as the motor with which it is used is in operation and it conveys all the air required for the mixture up to the point at which the auxiliary air valve begins to open.

Syn.: Primary air inlet, fixed air intake.

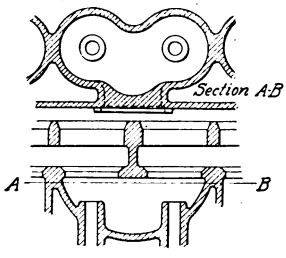
Initial Air Shut-off—See air damper.

Initial Pressure—The gas pressure acting in an engine cylinder after the entrance thereto of the working fluid. In a steam engine cylinder it is equal to the boiler pressure, less frictional and other losses and in a gas engine cylinder it is the pressure of the charge within it at the beginning of the compression stroke and is usually somewhat less than atmospheric.

Inlet Port—The port or passage through the cylinder wall which connects the intake pipe from the carburetor with the combustion space of an internal combustion motor and through which the fuel charge is admitted thereinto. In a four cycle motor, the inlet valve controls this passage and in most two cycle motors the entrance of the charge is controlled by the upper end of the piston covering and uncovering the inside end of the port.

Syn.: Admission port, intake port, induction port.

Inlet Port, Siamesed—An inlet port which branches from a single opening in the external wall of the cylinder structure to passages leading to the inlet valves of two cylinders, one branch of the manifold only thus being required to supply two cylinders.



SIAMESED INLET PORT.

Inlet Valve—The valve which controls the passage of the charge through the inlet port from the intake pipe and carburetor in a four cycle engine. The valve is usually of the mechanically operated poppet type (see headings under valve) and is usually timed to be opened by its cam at about 10 degrees of crank angle beyond the top dead centre after the exhaust stroke and to close at about 20 degrees of crank angle beyond the lower dead centre of the suction stroke. These figures are averages of recent practice.

Syn.: Admission valve, intake valve, induction valve.

Inner Tube—An endless circular tube made of lightly cured. high grade rubber, and provided with a spring-closed air valve. seated in a stem, through which it can be inflated. It is the air containing part of a pneumatic tire and performs that function only. It is fitted within the casing or shoe, and between it and the wheel rim. The shoe resists the pressure of inflation within the inner tube which acts to put the whole shoe in tension and render the tire hard and resilient.


INNER TUBE.

Syn.: Air tube.

Inner Tube, Self Healing—An inner tube which, when punctured, tends automatically to close the puncture and prevent the escape of air. It usually consists of a double-walled tube of rubber between the layers of which is a layer of viscous material which hardens upon contact with air. When a puncture occurs, some of this material extrudes therethrough, under the influence of the escaping air, and hardens in the puncture, thus sealing it.

Syn.: Non-deflation inner tube.

Input—The rate at which energy is delivered to a mechanism to be transmitted in the same form to another mechanism or to be converted into some other form, e. g., the rate at which electrical energy is supplied to an electric motor or storage battery, that at which mechanical energy is supplied to a dynamo or that at which mechanical energy is supplied to a transmission device. See horse power and watt. The opposite of output (q. v.).

Inside Control—The location of the control devices of a car within the body space of a closed car, so that the operator is protected from the weather.

Syn.: Inside drive. (See coupe, inside driven.)

Inspection Opening—A hole in a housing through which the mechanism therein may be inspected. See handhole.

Inspection Plate—A metal plate intended to close an inspection opening. See handhole cover.

Insulator—See non-conductor.

Intake Manifold—A pipe connected at one point, usually the centre of its length, with the intake pipe and comprising several branches, each of which makes a tight joint with the external end of the inlet port of one cylinder of a multicylinder gas engine. It distributes the charge received through the intake pipe to the several cylinders and is so designed that the distribution to all cylinders is equalized as nearly as possible. The manifold is usually a casting of aluminum or iron, the ends of the branches of which seat in ground joints or upon gaskets in the port openings.

INTAKE MANIFOLD.

Syn.: Inlet manifold, suction manifold.

Intake Manifold, Integral—An intake manifold which is cast as one with a cylinder casting and usually enclosed within the water-jacket. Used in en bloc (q. v.) motors. It possesses the advantage of warming the incoming charge.

Intake Pipe—The pipe, usually vertical, which conveys the fuel charge from the carburetor to the inlet manifold of a multicylinder motor or to the inlet port of a single cylinder motor.

Intake Pipe, Jacketed—An intake pipe which is surrounded by a jacket through which circulates warm water from the engine cooling system or hot exhaust gases, the object being to warm the walls of the pipe and thus to assist in the vaporization of the fuel passing through it.

Intake Resistance—The resistance offered to the movement of the fuel charge as it is drawn into the cylinder of a gas motor, occasioned by the friction of the intake piping and the contractions of the passage at the carburetor and inlet valve. It prevents a charge of full weight from entering the cylinder. (See charge ratio and volumetric efficiency.)

Intake Stroke—See aspirating stroke.

Integral Construction—Mechanical construction in which as many as possible of the related parts which might be made separate are combined into a single unit. Such construction usually results in greater strength and rigidity, less labor in assembling, and reduced cost of manufacture.

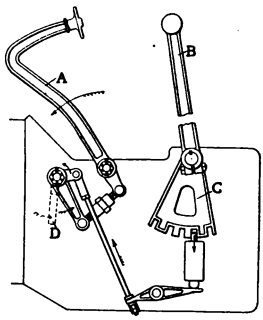
E. g., the front spring supports of a car may be made separate and riveted in position upon the vehicle frame, but in integral construction they are made in one with the side frame members.

Interchangeable Parts—Parts of the same kind and intended for identical use, which are made so nearly alike in all their dimensions that one such part may be substituted for any other such part without any special fitting being required. The system of interchangeable parts enables any worn or broken part to be replaced without any machine work being required upon the new part.

Interconnect (v.)—To connect together two mechanisms so that a single operating device actuates them both and thus accomplishes two related functions; e. g., in a carburetor, the throttle lever may not only operate the throttle but, at the same time, by means of an interconnecting linkage, may operate a mechanical air inlet valve, the opening and closing of which is required to be performed in proportion as the throttle is opened and closed.

Interconnection—A mechanism which interconnects, e. g., the linkage which extends from the battery timer to the magneto make and break in a double ignition system and causes both systems to be advanced and retarded together.

Interlock—An automatic connection between two mechanisms which prevents the action of one of them unless the other is in a condition appropriate to the action of the former; e. g., an interlock may be provided to prevent the engagement of the clutch while one or both of the brakes are set, thus obviating the stresses which would be occasioned by the application of the driving power, while the wheels were locked. A similar mechanism may be applied to prevent the engagement of the clutch unless a pair of gears of a sliding gearset is in complete mesh, thus preventing the power being applied to gears which are in mesh over a part of their faces only. The starting crank is sometimes interlocked with the ignition timing mechanism so that it cannot be turned unless the spark is safely retarded.



INTERLOCK.

A, Clutch Pedal; B, Gear Shifting Lever; C, Interlock Sector; D, Clutch Fork.

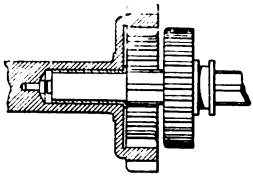
Intermediate Gear—The second speed or gear provided by a three speed change speed gear, which produces a ratio of drive wheel turns to engine turns that is higher than that produced by the low gear or first speed and lower than that provided by the high gear or third speed.

Syn.: Middle speed, middle gear.

Internal Combustion Motor—A heat motor, the operation of which depends upon the combustion of fuel in its working cylinder, the term being used in contradistinction to engines, such as the steam engine, the operation of which depends upon the combustion of fuel outside the cylinder, in the furnace of a boiler, from which the working fluid is conveyed in a heated condition, under pressure to the working cylinder. Internal combustion motors possess no store of heat energy to be drawn upon as does the steam engine, all the heat concerned being developed at the instant it is converted into mechanical work. The gasoline, alcohol and oil motors of vehicles are internal combustion motors.

Syn.: Explosion motor.

Internal-External Gear Clutch—A form of jaw clutch, one member of which consists of an externally toothed gear, resembling a spur gear and the other member consists of an internal gear of such size and tooth form that the external gear can be slid within it and the teeth be meshed, thus locking, in driving relationship, two rotating parts to which the two gear-like members are respectively attached, such as the two gear shafts concerned in a direct drive (q. v.). See clutch, jaw.



INTERNAL-EXTERNAL GEAR CLUTCH.

Interrupter, Electrical—A mechanism which automatically makes and breaks an electric current. See magnetic vibrator, magneto make-and-break and timer.

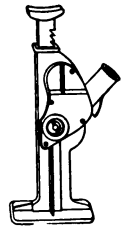
In and Out Storage—Storage of an automobile at a garage under an agreement that it may be used as desired by the owner but not including washing, polishing or the performance of any other work upon it or the rendering of any service in connection with it by the garage.

Iron (v.)—To equip a car body with the necessary fittings for the attachment of a top or other accessories carried upon the body.

Irreversible—Not reversible. The term is applied to two parts arranged in driving relationship in such a manner that force applied to one can cause motion in the other, but force applied to the latter cannot cause motion in the former. e. g., a small pitched worm and its worm wheel; a cam and a cam follower; a steering gear, the turning of the hand wheel of which readily moves the road wheels, but in which force applied to the road wheels cannot readily move the hand wheel.

See steering device, irreversible.

Jack—A device for raising a heavy load, such as a portion of the weight of an automobile, by hand power. It consists of a vertically movable guided member held in a frame, the bottom of which rests upon the ground or floor, the upper end of the movable member resting under the axle or other part of the car to be lifted. The power to raise the vertical



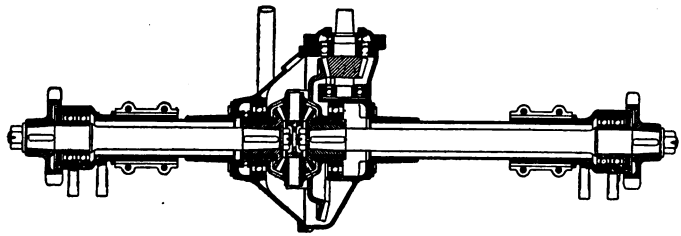
JACK.

member is applied by a ratchet and pawl, worm gear and rack, screw and nut or other power multiplying mechanism which is generally operated by a hand lever possessing great mechanical advantage.

Jacket—A closed casing enveloping a cylinder or other fluid containing vessel, to confine the flow of a liquid or gas around its outer walls, which casing conducts a current of liquid or gas from which heat is imparted to the fluid in the vessel jacketed or by which heat is abstracted therefrom.

See water jacket, water cooling; carburetor, water-jacketed.

Jackshaft—The transverse sprocket shaft of a double chain driven car, from which the road wheels are driven. See countershaft.



JACKSHAFT.

Jack Up (v.)—To raise by means of a jack, as a wheel of an automobile from the floor.

Jewelers' Sawdust—A variety of very fine sawdust, made from boxwood, sometimes used, when mixed with lubricant, to deaden the noise of badly worn gears of change speed devices.

Jig—A guide used to correctly position holes which are to be drilled in a part in the course of its manufacture, consisting of a plate in which are drilled guide holes corresponding in position to the holes desired in the finished parts, which holes are protected against wear by being fitted with hardened bushings. In use, the jig is clamped in exact position upon the piece to be drilled and the drill, while doing its work is guided

by the bushed holes. Used in the production of interchangeable drilled parts which are made upon a large scale.

Journal—A bearing (q. v.).

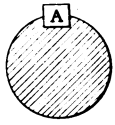
Jump Seat—One of the seats, two of which are located in the tonneau space of seven passenger touring cars, between the regular tonneau seat and the front seat. They are usually capable of rotation upon their supports, of being folded out of the way when not in use and of being removed entirely if desired.

Jump Spark Ignition—See ignition, jump spark.

Junction Box—In an automobile electric lighting system, a box or cabinet into which are brought the ends of all the circuits and where all the connections among them are made and their fuses located.

Junk Ring—In a sliding sleeve valve gas motor (see valve, sliding sleeve), a very wide packing ring (see piston ring) set into the surface of the portion of the cylinder head which extends into the cylinder space and acting between it and the inside surface of the inner sleeve to prevent the escape of gases between these parts.

Key—A means for securing a member, which is mounted upon a rotating shaft, against rotation thereon. It may secure a member, such as a flywheel, in a definite position upon its shaft, or it may be so fitted as to secure a member, such as a sliding gear wheel, so as to permit it to slide along the shaft, but never to rotate relatively to it. In its conventional form it consists of a straight piece of metal, usually of rectangular cross section, which is seated in a slot formed in the surface of the shaft, and in a similar coincident slot formed in the hub of the mounted member.



A, Key.

Syn.: Feather.

Key, Integral—A key, formed as one with its shaft as a projection, usually of rectangular section, arising from its surface and extending longitudinally along it.

Syn.: Integrally feathered shaft.

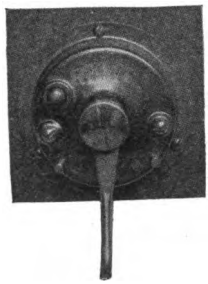
Key, Woodruff—A key, the profile of which is a circular segment instead of rectangular, the arc shaped edge being seated in a correspondingly shaped segmental keyway, milled in a longitudinal radial plane in the shaft and the straight edge being seated in an ordinary rectangular keyway in the inside surface

of the hub of the member which is to be keyed to the shaft. The liberal cross section of the key in the shaft secures great holding power and eliminates the likelihood of the key's turning over under severe stress.

Keying, Multiple—The practice of fastening a member upon a shaft by means of more than one key. Two to six keys, equally spaced about the shaft, may be used. Used to support sliding gears upon their shafts.

Keyway—The slot in the surface of a shaft or in the bearing surface of a shaft-mounted member in which the key is fitted.

Kick Switch—An ignition switch, usually dashboard mounted, which is intended to be operated by the foot of the operator.



KICK SWITCH.

Kilowatt—A unit employed in expressing the rate at which electrical energy is delivered and equal to 1,000 watts (q. v.).

Knock (v.)—To make a succession of blow-like shocks attended by clanking or hammering sounds. A gasoline motor will knock when its charges are ignited too early, either by the spark or by self ignition, thus causing the working pressure to act, at times, upon its working parts contrary to the direction of their rotation, and resulting in the abnormal stressing of the parts and the violent taking up of any lost motion which may exist in the bearings or between the pistons and their cylinders.

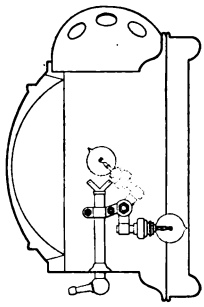
Labor (v.)—In the operation of a gasoline motor, to rotate jerkily at low speed with noticeable variations in angular velocity between the instants preceding and the instants following power impulses. It occurs when a motor is overloaded, under which condition the energy stored in the balance wheel is insufficient to maintain a substantially constant angular velocity. Laboring occurs when a change to a lower gear is too long delayed under road conditions of increased severity, and it involves unnecessarily severe stresses upon the motor bearings and other parts.

Lag, Combustion—See combustion lag.

Lag, Ignition—See ignition lag.

Lagging—A non-conductive, non-combustible covering wrapped about steam boilers to reduce the loss of heat therefrom arising from radiation and convection, and sometimes also applied to exhaust pipes and mufflers to prevent their heat from setting fire to adjacent combustible parts.

Lamp, Combination—A lamp containing two light sources, either of which can be used at will. Side and tail lamps are frequently fitted with both a kerosene burner and an electric bulb, and headlights are sometimes fitted with both an acetylene burner and an incandescent bulb, the arrangement being such that either light source can be placed in the focus of the projector at will.

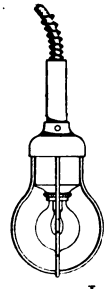


COMBINATION LAMP.

Lamp, Electric—A lamp containing as a source of light an incandescent electric bulb, usually of the tungsten type (see tungsten lamp), either placed in the focus of a parabolic reflector, in the case of head or search lights; in a lamp of ordinary carriage type, in the case of side lights, or in a lamp of special construction when used as a tail lamp (q. v.). An electrical connector of the plug type is generally used to connect the incandescent bulb to the car wiring, thus permitting the removal of the lamp for polishing.

Lamp, Gas—See gas lamp.

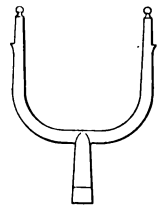
Lamp, Inspection—An incandescent electric bulb, provided with a guard and carried upon a handle. It is supplied with current through a long flexible conductor and is thus portable and useful for lighting obscure parts of an automobile.



INSPECTION LAMP.

Lamp, Oil—A lamp burning kerosene oil.

Lamp Bracket—A bracket carried by an automobile to support a lamp. A headlight bracket is usually a Y-shaped forging, fastened at its central point into a socket usually formed in the front spring horn. The two vertical arms of the Y are placed transversely of the car, and fit into sockets in the lamp, and are clamped therein by set screws. A side or tail lamp bracket is usually a forging bolted to the body or the dash with a single vertically projecting arm to which a socket upon the lamp is clamped.



LAMP BRACKET.

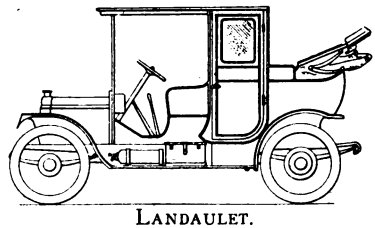
Lamp Cover—A protecting boot, usually made of enamel cloth or other water-proof material, made to fit about a lamp, and to protect it from the weather when it is not in use.

Lamp Lighter—See gas lamp igniter.

Lamp Tie Rod—A rod which joins the two lamp brackets (q. v.) that support the headlights and tends to prevent their vibration under road shocks.

Land—One of the annular ridges on the surface of a piston which are left between the piston ring grooves (q. v.).

Landaulet—A form of closed body, similar to the limousine, except that a part of the enclosed portion of the body, generally that to the rear of the entrance doors, is collapsible—folding up or sliding out of the way, so that this section of the car may be used closed or open at will.



LANDAULET.

Lap—In a steam engine slide valve, the portion added to the length of the valve to increase the portion of the stroke during which the ports are covered, beyond the length positively required to insure the closing of all ports when the valve is in mid-position.

In a gasoline engine, the delay in opening or closing of a valve after the dead centre nearest which the valve action is supposed to take place. It is usually expressed in degrees of crank movement from the dead centre to the point at which the valve action occurs. See inlet valve and exhaust valve.

Lap (v.)—To finish to mutual conformity surfaces which are to run in contact, by operating the parts by external power as they are to operate in practice, while a mild abrasive, floated in a liquid, is allowed to act between them. The process is used in perfecting the tooth forms of gears which are to run together and sometimes in finishing pistons and their cylinder surfaces.

Layshaft—In general, a secondary shaft which is operated from a primary or principal shaft, specifically, the secondary or countershaft of a sliding gear change speed device through the speed reducing action of which the lower and reverse gears are obtained and which, by being geared to the clutch driven shaft, is constantly in rotation under load when these speeds are in use and in idle rotation when the direct drive is in use. See sliding gear.

Syn.: Countershaft.

Lead (pron. leed)—An electrically conducting wire or cable. A lead wire.

Lead (pron. leed)—In a steam engine, the amount by which the steam port is open when the piston is at the beginning of its stroke.

In a gas engine, the advance in the opening or closing of a valve prior to the dead centre nearest to which the action takes place. It is usually measured in degrees of crank movement between the action of the valve and the attainment of dead centre. See exhaust valve and inlet valve.

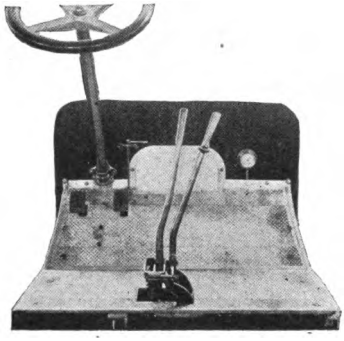
Lead Battery—See accummulator.

Lead Burning—A process used in making electrical connections between the lead terminals of storage cells. The two terminals are clamped together, a temporary mold is placed around the junction and the non-oxydizing flame of an oxyhydrogen or oxyacetylene blowpipe is directed upon the junction. The metal of the two terminals fuses and runs together, making a perfect electrical joint, after which the mold is removed.

Leakage, Electrical—The slow escape of electricity through the defective insulation of conductors, which results in the exhaustion of batteries and in the reduction of the sparking effect when it takes place in an ignition circuit. It is usually caused by the moistening of the insulation or by its deterioration from some other cause, which permits a "leak" or a so-called "partial shortcircuit."

Lean Mixture—A fuel mixture which contains a smaller proportion of fuel vapor and a larger proportion of air than are present in a mixture of normal quality.

Syn.: Weak mixture, rare mixture.



LEFT-HAND DRIVE.

Left-hand Drive—A type of automobile control in which the operator occupies the left front seat instead of the right front seat of the car. The steering column and pedals are thus located further toward the left of the width of the car than in the right hand control, and the gear and brake levers are placed either at the extreme left side of the car, and operated by the operator's left hand or in the centre of width of the car and operated by the right hand.

Left Hand Thread—A thread cut with a direction of slant opposite to that of an ordinary or right hand thread, so that a part so threaded, when turned lefthandedly or counterclockwise screws into instead of out of a part correspondingly threaded. Left hand threads are used in securing together rotating parts which tend to turn loose when right hand threads are used; e. g., to secure the left wheels of cars to their axle ends.

Lift—In a poppet valve (see valve, poppet), the distance through which the valve is moved from its seated or closed position to its full open position, by the action of the valve gear. In a valve of given diameter, the lift thereof determines the area of opening and hence the rate at which gases can pass through it.

Lighting System, Electric—A system for the lighting of automobile lamps, consisting (A) of a source of electric current which may be (1) a storage battery carried upon the vehicle, and charged from an electric source, external to the car, or (2) a storage battery which is maintained in a charged condition by current supplied through automatic control devices, from a self-

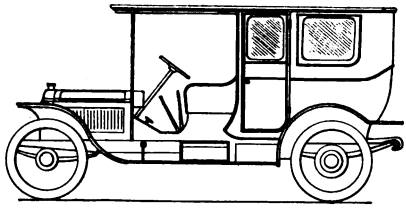
regulated, direct current magneto or dynamo, driven from the vehicle motor, or (3) an automatically regulated dynamo or magneto driven by the vehicle motor; (B) of the necessary wiring leading from the source of current to the lamps, the necessary switches to throw the circuits on and off, fuses for the protection of the circuits and measuring instruments, and (C) incandescent electric bulbs, usually of the tungsten type (see tungsten lamp), of candle power appropriate to the service required, usually ranging from 2 to 20 C. P., located within lamps (see lamp, electric). See also dynamo, constant voltage; and dynamo, constant current.

Lighting System, Gas—A system for lighting the lamps of automobiles, especially the headlights, consisting of a source of acetylene gas, either an acetylene generator (see generator, acetylen), or a gas tank (q. v.), carried upon the vehicle, connected through a valve or valves and metal tubing to acetylene burners located in lamps (usually of the projector type), one being carried upon each side of the front of a car or in a swivel projector (the searchlight) carried upon the dash.

Limit Gauge—A gauge used in the inspection of interchangeable parts (q. v.) of automobiles, the dimensions of which are required to conform very closely to a standard (usually to within a few thousandths of an inch). Two gauges of hardened steel are usually provided for each external dimension to be tested, one of which is of such size that the part will not pass within it and the other a few thousandths of an inch larger, within which the part to be tested must just pass. If the part will pass within the first gauge and will not pass within the second gauge, it is accepted as within the limit of accuracy, but if it will not pass through the first or will pass through the second gauge it is rejected as "off-size." The limit gauges for internal dimensions are similarly arranged. The minimum and maximum gauge for any one part are generally made in a single piece.

LIMIT GAUGE.

Limousine—A body, the portion of which to the rear of the driver's seat is permanently enclosed in a coachlike form. This closed part is glazed in front and rear, and at the sides, and entrance thereto is by means of a door on each side. The roof of the closed portion is extended forward well over the driver's seat and is usually joined by a glass wind shield arising from the dashboard. The driver's seat usually seats two, and the main enclosed seat three, while accommodations for two additional passengers are generally provided on chair seats placed forward of the main seat.



LIMOUSINE.

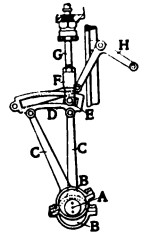
Liner—A shim (q. v.).

Line of Force—See field, magnetic.

Link—A part of the link motion (q. v.) of a steam engine.

Link Belt—A silent chain, see chain, silent.

Link Motion—A mechanism for operating the slide valve of a steam engine consisting of an arc-shaped link to each end of which is attached the outer end of an eccentric rod (q. v.), operated by an eccentric (q. v.), carried upon the engine crankshaft. The eccentrics are secured to the crankshaft at 180 degrees apart so that the two eccentric rods move in opposite phases, causing the link to oscillate about a point in its centre of length. A block, capable of sliding in an arc-shaped slot in the centre line of the link is fastened to the outer end of the valve rod which reciprocates the slide valve. The link can be moved in its own plane by means of a hanger, linkage and the reverse lever so that the block may be made to occupy any position in the link slot. When the block



LINK MOTION.

A, Engine Shaft; B, B, Eccentrics; C, C, Eccentric Rods; D, Slotted Link; E, Link Block; F, Fork, pivoted on E.; G, Valve Rod; H, Bell Crank operating the Linkage.

is placed in the centre of the slot, which is the centre of oscillation of the link, the valve is not moved by the engine and steam is not admitted, but when the block is at either extreme end of the slot, where the oscillation is a maximum, the slide valve is given its maximum motion and steam is admitted through the full piston stroke. When in one extreme position, admission is such as to turn the engine in one direction, and vice versa, and thus the mechanism acts as a reversing gear. When the block is in an intermediate position in the link, the movement of the valve is less, and steam is cut off (q. v.) at a fraction of the stroke.

Syn.: Stephenson's link motion. Locomotive type valve gear.

Linseed Oil Soap—A soap made from linseed oil, used in washing the painted and varnished surfaces of automobiles. It is capable of removing dirt and oil from such surfaces with a minimum of damage to their finish.

Live Axle—See axle, live.

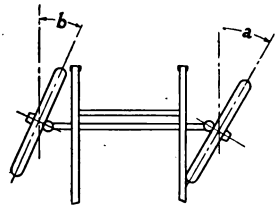
Live Storage—The housing of a car at a garage under an agreement that the full service customarily given a car at a garage will be rendered in connection with it.

Live Terminal—A terminal of a piece of electrical apparatus which is not grounded (see ground), and thus is at an electrical pressure above that of the ground. A live wire is a conductor leading to or from such a terminal. The live "side" of a piece of electrical apparatus is the ungrounded terminal thereof.

Local Action—Electro-chemical action among different parts of the same element of a battery cell, resulting from accidental differences of chemical constitution existing among them. It is generally caused by impurities in the material of the zinc element of a primary cell or by unintentional variations of the chemical state of a storage cell element. The currents set up by local action are uselessly dissipated in heat within the element and represent a loss in energy.

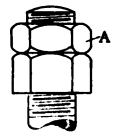
Lock (v.)—To set a brake so tightly that the wheel upon which it acts is prevented from turning and slides upon the road until the vehicle comes to rest. It occurs when the moment of the friction acting between the brake band or shoe and its drum exceeds the moment of the friction between the tire and the road.

Lock, Angle of—The maximum angle of deflection from the straight ahead position which can be imparted to a steering (road) wheel by means of the steering mechanism. The angle of lock of the wheel which is on the inside of the curve which the car is to turn is greater than that of the outside wheel, the prescribed condition being that horizontal lines drawn perpendicular to the planes of each wheel shall intersect the extended centre line of the rear axle at a common point. For cars of equal wheel-base (q. v.), the greater the angle of lock the smaller the circle in which turning can be effected. See turning radius.



ANGLE OF LOCK.
A, Inner Angle.
B, Outer Angle.

Locknut—A nut screwed upon a bolt or other threaded part and tightened against the outside surface of the regular holding nut to prevent the latter from working loose. A locknut may be a special form of holding nut, e. g., a nut with a split thread, the principle of most such nuts being that of creating sufficient friction between the nut and the threaded portion to resist any accidental tendency toward turning off.



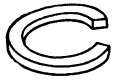
A, Lock Nut.

Lock Switch—An ignition switch which can be secured in the "off" position by means of a lock and can be moved into the "on" position only after being released by means of a key. Its use prevents the operation of a car by other than authorized persons.

Lockout—The condition existing in a sliding gear (q. v.) change speed device when the layshaft (q. v.) is not transmitting power or when it is thrown entirely out of gear, because of the direct drive (q. v.) being in use. In three speed gears, lockout is on the third speed and in some four speed gears it is on the third and in some on the fourth speed.

Lock Valve—A valve which can be locked in its closed position by means of a key. Sometimes used as a gasoline valve to prevent the use of a car by other than authorized persons.

Lock Washer—A kind of washer designed to be placed around the threaded part upon which a nut is screwed, between the nut and the surface against which it is to be tightened, to create friction between the nut and the surface and thus prevent the accidental turning off of the former. Such a washer is a split steel ring, the ends of which are slightly bent in opposite directions and somewhat sharpened, forming a spring washer, one end of which, when the nut is tightened, bears with considerable friction against the under surface of the nut and the other end bears upon the surface against which the nut is tightened.



LOCK WASHER.

Long Stroke Motor—A motor the piston stroke of which is large relatively to its bore. The term is a relative one only, but, as a purely conventional classification, it has been proposed to call any motor the stroke of which is more than 1.35 the bore a long stroke motor, thus for instance, a motor of 4 inch bore and a stroke of 5.5 inches is a long stroke motor, while one of the same bore and 4.25 inch stroke is a medium stroke motor, while a motor of the same bore and a stroke less than its bore is a short stroke motor.

Among the advantages claimed to appertain to the long stroke motor are greater output for a given bore, higher fuel efficiency, superior flexibility and longer life.

Lost Motion—Backlash (q. v.).

Louvre—One of a series of vertical slitlike openings in each side of a hood through which hot air from the radiator escapes.

Low Gear—First speed (q. v.).

Syn.: Low speed.

Low Speed Adjustment—That adjustment of a carburetor which is used to regulate the quality of the mixture delivered by it to the motor when the latter is running at low speed with the throttle only slightly opened. It may consist of a means of varying the tension of the spring which opposes the opening of the air valve under such conditions; of means for determining the degree of opening of the gasoline needle valve under low speed conditions or an equivalent device.

Low Speed Band—In a planetary (q. v.) change speed gear, the friction band which surrounds and acts as a brake or clutch upon a drum (the low speed drum), forming a part of the gear.

and which, when tightened, causes a planetary or epicylic motion of the pinions of the device which results in a low geared motion being imparted to the final drive mechanism of a car.

Low Speed Clutch—That clutch in an individual clutch (q. v.) change speed gear which, when in engagement, produces the lowest of the forward gears.

Low Speed Drum—In a planetary (q. v.) change speed gear the drum which, when held from turning by the low speed band (q. v.), allows the low speed to be secured.

Low Speed Motor—A purely relative term applied to a gasoline motor, the rotative speed of which is relatively low as compared with the generality of motors of the same horse power and used in a similar service, and the torque of which is relatively high as compared with the average of such motors.

In general, a motor which develops its rated horse power at a rotative speed lower than the average of motors of the same horse power.

Low Tension Current—A current produced by a relatively low electromotive force (q. v.), such as produced by batteries and by the primary windings of the magnetos and dynamos used upon automobiles. Such currents are not capable of discharging disruptively through air gaps of appreciable length. The term is used in contradistinction to the term high tension current (q. v.).

Low Tension Ignition—See ignition, low tension.

Low Tension Magneto—See magneto, low tension.

Low Tension Winding—That winding of an induction coil or of the armature of a high tension magneto, through which the low tension current circulates. See coil, primary.

Low Test—A term applied to gasoline which tests low on the Baumé scale, and thus is of considerable density and of relatively low volatility.

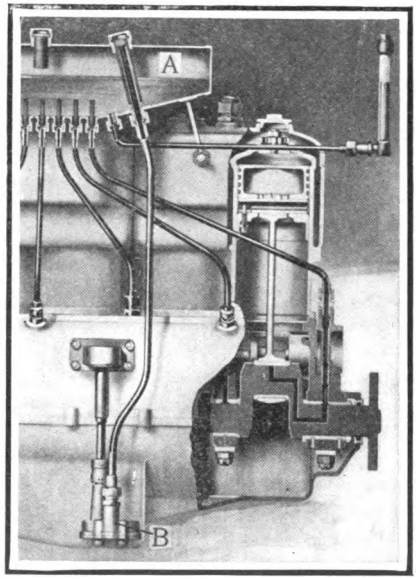
Lubricant—A slippery or unctuous liquid, viscous or powdered substance adapted to form a film between surfaces moving in contact, under pressure, and thus to reduce the friction acting between them. Mineral oils, non-fluid oils or greases of a mineral nature, graphite and graphite mixtures are the principal lubricants used in automobile practice.

Lubrication—The art of applying and maintaining between surfaces which move together under pressure—such as pistons in their cylinders and shafts in their bearings—a continuous

film of lubricant, for the purpose of reducing the friction acting between them and that of minimizing the wear, heating and loss of driving energy occasioned thereby.

Syn.: Oiling.

Lubrication, Automatic—Lubrication which is performed mechanically, without attention from the operator except to replenish the oil supply in a reservoir. The supply of oil to the working surfaces commences and ceases with the starting and



PUMP TYPE, CIRCULATION LUBRICATION. A, Tank; B, Pump.

stopping of the motor or other mechanism oiled. It is the opposite of hand lubrication.

Syn.: Mechanical lubrication.

Lubrication, Circulating System, Flywheel Type—A system of lubrication adapted to gas engines, the flywheels of which are enclosed in the crankcase or an extension thereof. The flywheel dips into the oil contained in the bottom of the casing and raises oil upon its surface which is caught and conducted by troughs or channels to the bearings and other working parts

and finally returned to the crankcase to be again lifted by the flywheel.

Lubrication, Circulating System (Pump Type)—A system of lubrication applied to gas engines of the enclosed crankcase type in which a considerable body of oil is rapidly circulated through the main bearings, under pressure created by an engine driven pump of the gear or plunger type, so that all parts of these bearings are constantly flooded with an excess of fresh oil, which, escaping therefrom into the crankcase, returns through standpipes into the oil reservoir (usually beneath and integral with the crankcase) from which the pump draws its supply.

Syn.: Flooding system, self-contained system.

Lubrication, Circulating System, Trough Type—A system of oil circulation applied to constant level, splash lubricated motors in which the crankcase is divided into several sections. Upon the wall of each section is a sloping trough which catches a portion of the splash and conducts it into the next section. At the end of the motor toward which all the troughs slope is a receiving pocket from which the oil drains back by gravity through a duct to the other end of the crankcase. The result is a circulation through the several sections and the maintenance of nearly the same level in the bottoms of them all.

Lubrication, Constant Level—A method of lubrication applied to vertical gas engines of the enclosed crankcase type, in which the supply of oil for lubricating the various parts is contained in the bottom of the crankcase and is maintained at a constant depth therein so that the moving parts shall always dip into it to the same extent, and thus always splash it about at nearly the same rate, speed being taken into account. Among the methods for automatically maintaining the level constant are the following: (1) A series of standpipes or overflow dams may be fixed in the bottom of the case, which drain to a reservoir, usually located under the crankcase. Oil is supplied to the case in considerable excess by a pump, and when the level is higher than the mouths of the standpipes it is returned to the reservoir. (2) A pipe may convey oil from an elevated, air tight reservoir to the crankcase, there terminating in a standpipe, the mouth of which is at the desired level. When the level falls below the mouth of the pipe air enters it and passing up to the reservoir displaces oil which is fed to the case until the level has been raised sufficiently to seal the mouth of

the pipe, when no further air can enter it and no more oil be fed. (Vacuum feed method.) (3) Oil may be fed to the crankcase by a lubricator (q. v.), at the same rate at which it escapes therefrom in the operation of the motor, thus maintaining the level. See lubrication, trough system.

Lubrication, Double—A system of lubrication in which two independent means of oiling each working surface are provided, so that, in event of the failure of one means the other is still effective, e. g., a gas engine all principal parts of which are oiled by individual feeds from a lubricator and in the crankcase of which is maintained an oil supply sufficient to oil all parts by the splash method.

Lubrication, Flooding System—See lubrication, circulating system (pump type), and lubrication, pressure feed.

Lubrication, Force Feed—See lubrication, pressure feed.

Lubrication, Force Feed Non-splash—A system of lubrication in which oil is supplied under pump pressure to the motor main bearings (q. v.), a part of the oil from the bearings entering channels formed in the crankshaft, passing therethrough to the crank pins (q. v.), lubricating them, and thence through channels in the connecting rods, through the hollow piston pins, lubricating their bearings and the cylinder walls. All important bearing surfaces are thus oiled directly and splash lubrication (see lubrication, splash) is not depended upon. The excess of oil returns to the oil reservoir and is recirculated. (See lubrication, circulating system, pump type.)

Lubrication, Gas Pressure Feed—A system of feeding oil to the working surfaces of a gas engine, in which gaseous pressure derived from the exhaust or the compression in a closed crankcase is caused to act upon a body of oil in a reservoir and forces it to delivery points within the motor, so long as the motor which sets up the pressure is in operation.

See lubricator, gas pressure.

Lubrication, Gravity—A form of gas engine lubrication in which the flow of oil from an elevated reservoir, under the influence of gravity, is depended upon to feed the various bearing surfaces or to replenish the supply in the crankcase of a splash lubricated motor.

Lubrication, Hand—Lubrication in which the oil supply in the crankcase of a splash lubricated motor is replenished at

intervals by means of a hand operated pump. The term is applied to all lubrication which is non-automatic, such as the oiling of parts with a squirt can.

Syn.: Manual lubrication.

Lubrication, Individual Feed—A system of engine lubrication in which oil is supplied from a common supply, directly to each bearing surface which requires it, instead of being supplied to the motor as a whole (as to a pool in the crankcase) from which it is distributed by splash or other means. The feeding and distributing functions are combined, by providing each of the main working surfaces with an individual oil lead through which oil is supplied to it from a lubricator (q. v.).

Lubrication, Mixture Method—A method of lubrication applied to gas motors which take their fuel charges through the crankcase, in which a certain proportion of cylinder oil, usually about one part in twenty by volume, is mixed with the gasoline in the fuel tank. The oil passes through the carburetor with the gasoline and is there broken into a fine spray and enters the crankcase, settling upon the working surfaces and lubricating them.

Lubrication, Pressure Feed—A system of lubrication in which oil is automatically supplied to the working surfaces of an engine under a positive pressure, usually created by a pump or series of pumps.

Lubrication, Self Contained—A system of gas engine lubrication in which the supply of oil and the means for supplying and distributing it are embodied in the engine itself, no auxiliary or external parts, such as a separate lubricator, being required. The term is specifically applied to circulating systems.

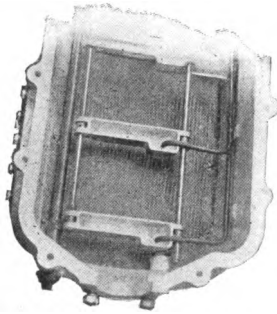
See lubrication, circulating system.

Lubrication, Single Pump System—See lubrication, circulating system (pump type).

Lubrication, Splash—A method of distributing lubricant to the working surfaces of motors of the enclosed crankcase type and to the working surfaces of any mechanism which is housed in a tight case. A supply of oil is maintained in the lower portion of the case at such a height that some moving portion or portions of the mechanism dips into it and, when in motion, splashes the oil into a mist which fills the case and settles upon the working surfaces, holes being drilled in the bearing caps to permit its entrance to the bearings. In a motor, the large ends

of the connecting rods or special splashers attached thereto effect the splashing, and in a gearset or gear driven axle, a gear, usually that of largest diameter, effects the splashing action.

Lubrication, Trough System—A method for maintaining an exactly constant splash level for the connecting rod ends to dip into. Under each rod is a trough of the required depth and set at the correct height, to which oil, in considerable excess, is constantly supplied by an engine driven pump, drawing from a reservoir or sump usually formed in the engine base. Oil is constantly overflowing back into the sump from the troughs, which are thus always full to the brim and a constancy of splash level is thus attained.



TROUGH SYSTEM LUBRICATION.

Lubrication, Vacuum Feed—See lubrication, constant level.

Lubrication, Variable Level System—A system of splash lubrication applied to gas engines oiled by circulating systems of the pump type, in which the oil level may be raised when the motor requires more oil, as when being driven at full output, and vice versa. This may be accomplished by raising the mouths of the standpipes (see lubrication, constant level), or by the use of a pivoted trough (see lubrication, trough system) under each connecting rod, the troughs being raised when a greater splashing effect is required and vice versa. The level may be raised manually or there may be provided an interconnection with the throttle mechanism which acts automatically to raise the level as the throttle is opened and vice versa. The system is designed to prevent a smoky exhaust and still to insure copious lubrication when heavy work is required of the motor.

Lubricator, Force Feed—An automatic device for forcing oil to the working surfaces of a machine, such as a gas engine. It usually consists of a reservoir which is kept filled with oil, located in proximity to the motor which it is to lubricate, through which runs a shaft slowly rotated by the motor. The shaft operates a series of small pumps immersed in the

oil, each of which draws oil from the reservoir and forces it at a predetermined rate through a metal tube to some working surface of the motor or to the crankcase. All the pumps make a working stroke for a given number of motor turns, and the rate of feed per pump stroke through each oil lead (usually from one to several drops) can be regulated by adjusting the pump stroke or in some similar manner. The feed to each lead can be observed through an individual sight feed glass. In some lubricators two pumps are used for each lead, one a measuring pump and the other a force pump. Such lubricators are largely used in individual feed systems and somewhat in constant level splash systems. Syn.: Mechanical lubricator, mechanical oiler.

Lubricator, Gas Pressure—A reservoir filled with oil, provided with outlets, each controlled by an adjustable needle valve, and feeding an oil pipe leading to some delivery point within a gas motor. A pipe, usually connected into the exhaust pipe at one end and at the other into the reservoir above the oil level, causes a gaseous pressure to be maintained upon the oil while the motor is in operation, and forces oil through the several delivery pipes to the motor. A small vent is usually provided in the cover of the reservoir to permit the pressure to escape and cause the cessation of the oil flow soon after the motor is stopped. A sight feed is usually included in each lead. Syn: Exhaust pressure oiler.

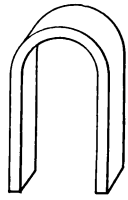
Lubricator, Gravity Feed—A reservoir of oil placed at a level higher that the motor or other mechanism which it is to supply with lubricant, and provided with one or more outlets controlled by adjustable needle valves, which supply oil by gravity, drop by drop, through sight feeds, to oil pipes leading to the various bearings and other points of friction or to the crankcase of the motor. A shut-off permits the supply to all the leads to be started and stopped at will. Syn: Oil cup, magazine oiler.

Lubricator Drive—The mechanical connection by means of which motion is transmitted from a vehicle motor to the pump operating shaft of its force feed lubricator. This may be a direct connection between an auxiliary shaft (q. v.) and the lubricator shaft; by a train of gears operated from an auxiliary shaft; by a belt or chain from a motor shaft; by a connecting

rod and crank, or an eccentric rod operated from a motor shaft which operates the lubricator shaft directly or through a ratchet and pawl mechanism or by other means.

Magnet—A mass of iron or steel or of certain other less common materials which is endowed with the property of attracting to it pieces of these metals, and which, when freely suspended, tends to place itself in a definite relation to the direction of the earth's magnetism.

Magnet, Horseshoe—A magnet formed of a straight bar bent into a U shape, thus bringing its ends or poles rather close together and concentrating the magnetic influence in the relatively narrow gap thus formed between the poles.



HORSESHOE MAGNET.

Magnet, Permanent—A magnet which retains its magnetic properties indefinitely after the magnetizing influence is withdrawn. Such a magnet is formed of special steel (usually tungsten steel), tempered to a glass hard condition and magnetized by contact with a powerful electromagnet or by means of an electric current circulated through a coil of wire placed about it. Permanent magnets are used to produce the magnetic fields of magnetos.

Magnetic Field—See field, magnetic.

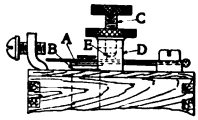
Magnetic Leakage—The passage of lines of magnetic force (see field magnetic) from pole to pole of a magnet through paths which do not permit of their useful effect being realized, e. g., when they pass outside of the conductors of a magneto armature and are therefore not cut by them. Leakage reduces the effectiveness of the magnetic fields of dynamos, magnetos and induction coils.

Magnetic Polarity—See polarity, magnetic.

Magnetic Spark Plug—See ignition, magnetic plug.

Magnetic Vibrator—An automatic device for producing rapidly recurring makes and abrupt breaks in the primary current of an ignition induction coil in order to create a close suc-

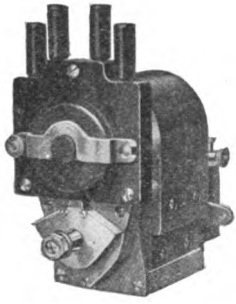
cession of high tension impulses in the secondary coil capable of producing igniting sparks. It consists of a small, soft iron armature, supported close to one end of the magnetic core of the coil, upon the free end of a light flat spring, to the stationary end of which is connected one end of the primary winding. An adjustable, platinum pointed screw is supported by a stationary metal arch spanning the spring and its point touches a platinum contact fixed upon the spring. A wire connected to the arch forms one terminal of the primary circuit. When current is applied to the primary circuit it passes through the coil and vibrator and the core of the coil becomes magnetized. The armature is then attracted and draws down the spring, separating the platinum contacts and abruptly interrupting the primary circuit. The magnetism in the coil thereupon dies away and the resiliency of the spring returns it to its initial position, bringing the platinum points again into contact and re-establishing the primary circuit. The above described actions are repeated rapidly and continuously so long as current is applied to the circuit, and a succession of sparks in the secondary results. (See coil, induction). Syn.: Buzzer, magnetic make and break, trembler.



MAGNETIC VIBRATOR.

A, Soft Iron Armature; B, Soft Iron Core; C, Platinum Pointed Screw; D, Arch; E, Platinum Contact.

Magneto—A mechanical generator of electricity, consisting of a permanent magnetic field (see magnet, permanent) between the poles of which is rotated by external power an armature (q. v.) or an inductor (see magneto, inductor type). The cutting of the magnetic lines of the field by the working conductors located therein generates in them by induction an electromotive force (q. v.), and in the operation of the machine mechanical energy is converted into energy in the electrical form. The magneto is almost universally used as a source of ignition current and occasionally in vehicle lighting, the vehicle motor driving the magneto.



MAGNETO.

Syn.: Magneto electric generator.

Magneto, Alternating Current—A magneto which delivers to its external circuit an alternating current (q. v.). Such a magneto has no commutator (q. v.), one end of its inductive winding usually being grounded or electrically connected to the frame of the machine, and the other being brought out through an insulated bushing to a contact upon which bears a brush (q. v.), from which the current is led to the live side of the working circuit. In its most common form the armature core is a shuttle or H-shaped mass of soft iron stampings, mounted upon the shaft and rotated thereby in close proximity to the pole pieces (q. v.) of the field. The inducing coil is of insulated wire, wound in the slot of the core. The action of a two-pole machine of this type is shown in the accompanying diagrams. In *a* lines of magnetic force passing through the core, magnetize the same and thread through the winding. In *b* the armature has been rotated, so as to cease to form a magnetic path from pole to pole, the core demagnetizes and the lines cease to thread through the winding, and in so doing cut the conductors, and a rapidly rising electromotive force is produced therein which dies away after its maximum is reached. In *c* the armature has been rotated so that the conditions depicted in *a* are reproduced, except that the magnetic lines thread through the winding in the opposite direction. In *d* the condition depicted in *b* is again attained, except that, on account of the reversed position of the winding the electromotive forces produced lies in the opposite direction. For each rotation of the armature two electrical impulses, alternating in direction and separated by periods of inactivity, are produced. Most magnetos used in ignition and lighting are of the alternating type.

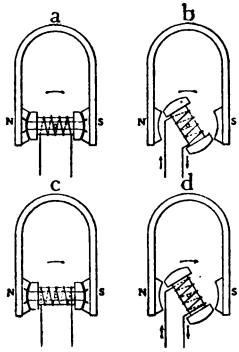


DIAGRAM ILLUSTRATING ACTION OF ALTERNATING CURRENT MAGNETO.

Magneto, Automatically Timed—A magneto in which is embodied means for automatically advancing (see advance) and retarding (see retard) the timing of its sparks in proportion as

the speed of the motor which it ignites increases or decreases, manual adjustment of spark position thus being obviated. See timer, automatically advanced.

Magneto, Direct Current—A magneto which delivers to its working circuit a direct current (q. v.), its shaft carrying a commutator (q. v.), which translates the alternating electromotive forces developed in its windings into a direct current at the brushes to which the external circuit is connected. Such a magneto is sometimes used as a substitute for a battery in the operation of ignition systems of the battery type and occasionally in vehicle lighting. It is usually provided with a governor (see governor, dynamo) to keep its voltage constant irrespective of speed changes in the vehicle motor which drives it.

Magneto, Double Spark—A magneto capable of producing two simultaneous sparks at two separate spark plugs in each cylinder of a gas motor, to effect double spark ignition therein (see ignition, double spark). Such a magneto is usually constructed with a single primary winding and make-and-break device (see magneto make-and-break) but with two separate secondary windings and distributors (see magneto distributor) and separate secondary wiring to the two sets of spark plugs.

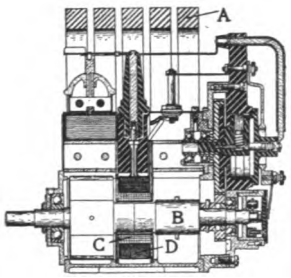
Syn.: Twin spark magneto.

Magneto, Flywheel Type—A magneto not constructed as a separate machine, but having its moving part built into and rotated by the flywheel of a gasoline motor.

Magneto, High Tension—An ignition magneto which develops within itself a high tension current suitable for jump spark ignition. In addition to the inducing winding, consisting of a relatively small number of turns of comparatively coarse wire, the armature carries a coil consisting of a very large number of turns of a very highly insulated, very fine wire, wound upon the coarse wire coil. The coarse wire coil has included in its external circuit a mechanical make and break device (see magneto, make and break), which is operated by the magneto shaft and which alternately acts to permit current to flow through the coarse winding, magnetizing the armature core, and to abruptly break this current, through a condenser. When the current is broken, the armature core loses its magnetism and a high tension electrical impulse, capable of producing a spark, is caused in the fine winding. One terminal of the fine wire or

secondary coil is grounded within the machine, and the other is led out through an insulated collector ring and brush to the rotating brush of the distributor (q. v.), from which the sparks produced are distributed to the cylinders of the motor in the proper sequence. A very commonly used type of magneto.

Magneto, Ignition and Lighting—A magneto of the direct current, constant voltage type (see dynamo, constant voltage) employed to charge a storage battery, used both for ignition and lighting service and embodying the timing and distributing mechanism of an ignition system which is an integral part of and driven by the magneto itself.



INDUCTOR TYPE MAGNETOS.

A, Magnet; B, Rotor; C, Primary Winding; D, Secondary Winding.

Magneto, Inductor Type—A magneto, the inducing conductors of which, instead of being rotated through the field upon the driving shaft, are stationary windings placed within the field. The cutting of them by the field is effected by the rotation, upon the magneto shaft, of a properly shaped mass of soft iron, which causes the lines of magnetic force to be alternately threaded through and removed from the winding. Since the windings do not move, no brushes or collector rings are required to lead the current from them to the external circuit.

Magneto, Lighting—See magneto, direct current and magneto, non-synchronous.

Magneto, Low Tension—A magneto which delivers to the external circuit a low electromotive force of the magnitude of that furnished by ignition batteries. Such a machine may be of the alternating, non-synchronous type (see magneto, non-synchronous), used to supply current to an ignition system of the vibrator coil type or for lighting. It may be of the alternating current, synchronous type, used to supply current to a contact spark ignition system (see ignition, contact spark); or it may be of the direct current type, used to furnish current to an ignition system as a substitute for a battery, or for lighting purposes.

Magneto, Low-high Tension—A type of alternating current, synchronous magneto for use in jump spark ignition, which develops within itself a low tension current only (see magneto, alternating current). In connection with it is used a separate, plain induction coil (see coil, plain), through the primary of which the low tension is led and transformed in its secondary into a high tension current, which latter current is conducted back to the magneto and distributed by the distributor, which forms a part of the machine. One side of the coil primary is grounded and the other side is connected, through the magneto make and break (q. v.) device, to the live side of the magneto winding, a condenser being connected around the make and break device. One side of the secondary winding of the coil is grounded and the other is connected to the rotating brush of the distributor (q. v.). A very commonly used type of magneto.

Magneto, Rotating Armature—A magneto the wire wound armature of which is the rotating part. (See magneto, alternating current for a description of this, the most common type of magneto). The term is used in contradistinction to magneto, inductor type (q. v.).

Magneto, Non-synchronous—An alternating current magneto driven in such a manner from the vehicle motor that the periods of occurrence of its current impulses bear no predetermined and sustained time relation to the instants at which ignitions are required by the motor. An alternating current magneto, operated by a non-positive drive, such as a belt or friction wheel, comes within this class. Such magnetos are used to energize ignition systems employing vibrator coils and to operate electric lights.

Magneto, Synchronous—An alternating current magneto, usually of the two impulse per rotation type (see description under magneto, alternating current), which is driven from its motor at such a speed relation therewith that each current impulse produced by it corresponds in time to the instant at which an ignition is required by the motor. This result is attained by driving the magneto from the motor by some positive means, such as a train of gears, producing the desired speed ratio between the magneto and the motor. All high tension and low-high tension magnetos and all low tension magnetos used with contact spark system are of this type.

Magneto Boot—A waterproof and dustproof protective covering designed to be placed around a magneto.

Magneto Bracket—A shelf-like base, generally formed integrally with the upper portion of a gas motor crank case, of such size and so positioned that a magneto may be mounted upon it so as to be conveniently driven from the motor. The magneto is usually positioned upon such a base by dowel pins (q. v.) and clamped thereupon by means of an adjustible, readily removable steel strap, passing over the tops of the magnets.

Magneto Breaker-Box,

Magneto Breaker-Cam,

Magneto Breaker-Bar,

See magneto, make and break.

Magneto Coupling—A means for attaching the shaft of a magneto to and in driving relation with the shaft which rotates it. It usually is some form of slightly flexible coupling such as the Oldham (q. v.), and thus allows for slight discrepancies in the alignment of the two shafts, and is usually so constructed as to allow of the convenient removal of the magneto. In some instances the coupling permits of angular adjustment between the magneto and driving shaft, and thus permits of altering the timing of the magneto.

Magneto Distributor—The distributor (q. v.) used in connection with a high or low-high tension magneto. It usually forms a part of the machine, being gear driven from the magneto shaft. In magnetos of the two impulse per rotation type, used with four and six cylinder motors, the distributor is geared to rotate at one-half the speed of the magneto shaft. Highly insulated cables with snap terminals lead from the stationary contacts of the distributor directly to the respective jump spark plugs, the order of connection being such that the required firing order (q. v.) is secured in the motor.

Magneto Distributor Gears—In a synchronous magneto the pair of gears, one upon the armature shaft and the other upon the distributor shaft, which drive the latter from the former at such a rate that the contact arm of the distributor (q. v.) makes one complete rotation for each two rotations of the four-cycle motor which it serves.

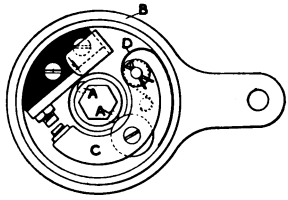
Magneto Drive—The means by which motion is communicated from a driving shaft to a magneto shaft. Synchronous magnetos of the two impulse per rotation type, used with

four cylinder, four cycle motors are usually direct driven from a geared auxiliary shaft running at crankshaft speed. Such magnetos when used with six cylinder, four cycle motors are gear driven at one and a half times crankshaft speed. When used with two cycle motors the magneto is driven at twice the speed, relatively to the crankshaft, required for a four cycle motor of the same number of cylinders. The drive is usually so adjusted that the magneto delivers its sparks not later than at the upper dead centre when the full retard is in use.

Magneto Induction Coil—The plain induction coil used in connection with a low-high tension magneto. It is generally mounted upon the dash in a coil box which carries the ignition switch, and contains the condenser, and often the safety spark gap and arrangements for a dual ignition system, but is sometimes contained in a waterproof, tubular casing, also containing the condenser, and designed to be located under the dash or at the magneto itself in the U-shaped space within the field magnets.

Syn.: Transformer, step-up coil.

Magneto, Make-and-Break—The means for alternately permitting current generated by a synchronous, alternating current magneto to flow in its primary circuit and charge the magnetic core and of abruptly breaking this current, discharging the magnetism of the core and thus inducing a high tension current in the secondary coil. A typical form of this device, applied to a two impulse per rotation magneto, is constructed as follows: The end of the magneto shaft carries a cam having two high spots diametrically opposite (the breaker cam), and within a relatively stationary, insulated shell, supported upon the shaft (the breaker box) is mounted a lever, pivoted at one end (the breaker bar or arm), so positioned that it is slightly oscillated by the cam twice in each rotation thereof. The breaker bar carries a platinum contact point, which can make



MAGNETO, MAKE-AND-BREAK.
A, A, Cams; B, Breaker Box; C, Breaker Bar; D, Spring.

contact with an insulated, adjustable, fixed, platinum pointed contact screw. These contacts are together so long as the low portions of the cam are acting upon the breaker arm, but when, twice in each rotation, the high parts of the cam strike the arm the latter is oscillated and the contacts are abruptly separated. The breaker bar is held against the cam by a spring and is grounded, and the mechanism is so set that the breaks occur only when current is flowing in the inducing winding.

Syn.: Interrupter.

Magneto Spark Advance—The means for altering the cyclical period in the operation of a motor at which the sparks produced by a synchronous magneto, take place in its cylinders. (See ignition, point of). Among these are the following: (1) The non-rotating portion of the make-and-break device may be rotated through an arc upon the magneto shaft, by the spark control lever, thus altering the angular position of the armature and hence the cyclical period of the engine at which the cam causes the current to be broken. (2) The magneto shaft may be coupled to its drive shaft by means of a key and spiral keyway arrangement, or by some equivalent construction by means of which the angular position of the armature and breaker cam may be altered at will, by movements of the timing lever, thus varying the cylindrical period at which the cam acts to break the circuit. (3) The magneto and the non-rotating portion of the make-and-break mechanism may both be rotated, in respect to the magneto shaft, thus securing sparks of maximum intensity at all angles of advance.

Main Bearing—A principal shaft bearing. Specifically one of the bearings which support the crankshaft of a motor. (See bearing.)

Malleable Iron—Cast iron of a good grade which, after being cast into the desired form, is annealed by being heated and cooled very slowly, by which process the metal is rendered comparatively soft, malleable and flexible. Sometimes spoken of as "semi-steel." Used mostly for small fittings not required to possess great strength or rigidity.

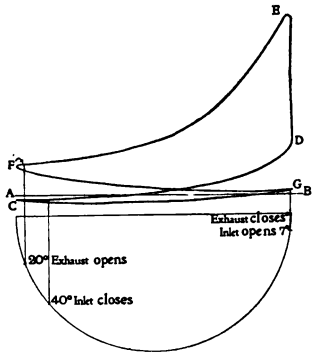
Manganese Bronze—A bronze of high strength and toughness, castings of which are sometimes used, for example, for the portions of crank and gear cases which are most severely stressed. A specification for this metal calls for copper 60 per cent., zinc

40 per cent. and iron and manganese in small variable proportions.

Manifold—See intake manifold, exhaust manifold, water manifold.

Manifold Clamp—See exhaust manifold clamp.

Manograph—A form of indicator especially adapted to exhibit the operative peculiarities of a high speed heat motor. Its essential part consists of a mirror, delicately suspended in such a manner that there may be simultaneously imparted to it angular deflective movements in two planes at right angles one to the other. A reducing mechanism, driven by the motor crankshaft, deflects the mirror back and forth on an axis in one plane, in correspondence to the back and forth motion of the motor piston, while a diaphragm, acted upon by the pressure in the motor cylinder, acts to deflect the mirror about an axis in a plane at right angles to the former one to one or to the other side of a zero position (that of atmospheric pressure), in proportion as the pressure acting upon the motor piston is greater or less than atmosphere. The plane occupied by the mirror is thus determined by the resultant of two deflective motions acting at right angles. A beam of light is directed upon the mirror, and is reflected upon a darkened ground glass, and thus describes, as the plane of the mirror varies, a luminous figure from which may be determined the pressure acting at any point in the motor cycle. The reflected beam may be received upon an otherwise darkened photographic plate, and a permanent record of the motions of the reflected beam thus be obtained, from which prints, known as manograph records or cards, may be obtained. Used in testing vehicle motors.



MANOGRAPH RECORD.

Syn.: Optical indicator.

Manograph Record—The photographic record of the performance of a heat motor, made with a manograph. In the somewhat idealized record, from a 4-cycle gas engine, re-

produced herewith, *A B* represents the atmosphere line; *G C* the admission line, showing a negative pressure and the area enclosed by it representing negative work; *C D* the compression line, the area under which represents negative work; *D E* the combustion line; *E F* the expansion line, the area under which represents useful work; *F G* the exhaust line, the area under which represents negative work. Pressures above atmosphere are indicated by the height of the perpendicular, let fall to line *A B* from the point in question upon the curve, and negative pressures are indicated by the height of the perpendicular erected at the point in question to line *A B*.

Master Clutch—A principal clutch in contradistinction to a subsidiary one, e. g., the clutch which controls the transmission of power to a change speed gear of the individual, jaw-clutch type, as distinguished from the separate clutches which act to engage the gears appertaining to each particular speed ratio.

Master Gears—The principal gears of a device, such as a differential gear (q. v.).

Master Link—A specially constructed link of a driving chain, the connection or disconnection of the parts of which connects or disconnects the ends of the chain and permits it to be secured upon or removed from its sprockets.

Master Vibrator—See ignition, master vibrator.

Mean Effective Pressure—The average useful pressure acting upon the piston of a steam or gas motor during a cycle of its operation. It is obtained from a manograph record (q. v.) by dividing the length of the same (the length representing the stroke) into a considerable number of equal parts and drawing at each division point a perpendicular to the atmospheric line. The length of each perpendicular from the atmospheric line to its point of intersection with any one of the lines of the diagram represents a pressure. The effective pressure at each division point is the algebraic sum of the pressures acting thereat, pressures which represent useful work accomplished by the fluid upon the piston being taken as positive and pressures (either above or below atmosphere) which represent work done upon the fluid by the piston being taken as negative. When the effective pressures acting at all the division points are obtained, they are averaged by finding their sum and dividing it by the number of division points,

the result being the mean effective pressure. Abbreviation: M. E. P. See manograph record. See also planimeter. For the relation of M. E. P. to H. P. see horse power, indicated.

Measuring Pump—See gasoline measuring pump. A similar pump is used for dispensing lubricating oil. The term is also applied to the small individual pumps of mechanical lubricators, which measure a predetermined quantity of oil to be forced through a lead to a bearing.

Mechanical Lubricator—See lubricator, mechanical.

Mechanical Make and Break—A device for mechanically closing and opening at predetermined periods, a primary ignition circuit, as distinguished from one electromagnetically operated.

Mercury Arc Rectifier—See rectifier.

Mesh (v.)—To position a pair of gears in correct driving relationship, so that the teeth of one act upon the teeth of the other with a minimum of sliding friction and do not bottom (q. v.). In most common forms of gears, correct mesh is obtained when their pitch surfaces are in tangency. See under "pitch." Used also as a noun.

Mirror—A slightly concaved mirror supported upon an automobile in front of the operator, in which are reflected, in miniature, objects behind the car, thus enabling him to observe traffic to the rear, without turning around.

Miss (v.)—In the operation of an internal combustion motor, the failure of an explosion to occur, as intended, in each cycle of operations, resulting in reduced output, irregular turning effort and usually in loss of fuel. It is generally caused by the failure of the igniting spark to pass through the charge or by the absence from the cylinder of a combustible fuel charge. Used also as a noun.

Syn.: To misfire, to skip, to miss explosions.

Misalignment—The failure of parts to be in alignment (q. v.).

Mixing Chamber—The part of a carburetor in which the fuel and air come together with the vaporization of the former and the mixture of the resulting vapor with the air required for its combustion. See carburetor.

Syn.: Vaporizing chamber.

Mixing Tube—In the burner of a steam vehicle, the tube in which the sprayed fuel becomes mixed with the air required for its combustion. See burner; burner jet.

Mixture—The aeriform fuel of an internal combustion motor, consisting of air mingled with a certain proportion of an inflammable gas or vapor. In automobile practice, the mixture consists of air impregnated with gasoline vapor. See fuel, gasoline; lean mixture; overrich mixture.

Mixture Pipe—See intake pipe.

Monobloc Casting—A single casting in which are included all the cylinders of a gas motor. See cylinder, block cast.

Motor—The headings under this general term refer to internal combustion motors or engines of the four cycle type, unless otherwise specified.

Motor, Air-Cooled—A motor, the cylinder walls of which are maintained at a temperature sufficiently low to permit of effective lubrication and to prevent binding of the parts, self-ignition (see ignition, self) and too great reduction of the charge weight taken into the cylinders, by means of the convective influence of currents of cool air directed upon the cylinders and attached heated parts. See air-cooling; blower-cooled.

Motor Ball Bearing—A motor, the crankshaft of which rotates upon ball bearings, the cam shaft and the large ends of the connecting rods being sometimes thus supported. See crankshaft, ball bearing; bearing, annular ball.

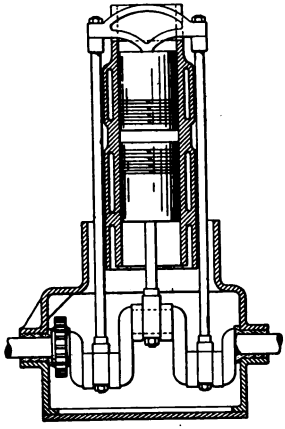
Motor, Block—A motor, the cylinders of which are cast en bloc. See cylinder, block cast.

Motor Compound—A motor in which the exhaust gases from a cylinder in which combustion occurs is directed into a closely adjacent secondary or low pressure cylinder of larger diameter in which the final expansion of the gases to atmospheric pressure does work upon a piston acting upon the same crankshaft upon which the primary cylinder acts. Two four-cycle cylinders, firing at intervals of 360 degrees, may be used, their exhausts acting upon the piston of the same large diameter low pressure cylinder upon each down stroke thereof, all three cylinders acting upon the same three throw crankshaft.

Motor, Double Cylinder—A motor consisting of two cylinders acting upon a common crankshaft. The two cylinders may be arranged (1) upon the same side of the crankshaft, with their axes parallel and perpendicular to the crankshaft. (2) They may be arranged upon opposite sides of the crank-

shaft with their axes in the same plane and perpendicular to the crankshaft (see motor, opposed cylinder). (3) They may be arranged with their axes making an acute angle one with the other and perpendicular to the crankshaft. In (1) a double throw crankshaft is used (see crankshaft, double throw) and the cylinders fire at 180 degrees apart, or the two throws are placed upon the same side of the shaft and the cylinders fire at 360 degrees apart. In (2) a double throw crankshaft is used and the cylinders fire at intervals of 360 degrees, four cycle cylinders here being assumed. In (3) both cylinders act upon a single crank (see crankshaft, single throw). See also motor *V* type. Syn.: Two cylinder motor Type (3) and occasionally type (1) are sometimes known as twin motors, type (2) as a double opposed motor.

Motor, Double Diameter Piston Type—A motor with a double diameter cylinder (see cylinder, double diameter), within which reciprocates a double diameter or two-stepped piston. Such a motor may be a two-cycle motor (q. v.) or a four-cycle motor. In the latter case, the annular space between the large diametered portion of the piston and the step in the cylinder forms one combustion space and the space between the head of the small piston and the cylinder head another combustion space. Each of these combustion spaces is fitted with the usual valves and spark plug, and the combination constitutes two power cylinders acting upon the same piston and crankshaft, which alternately produce power impulses at intervals of 360 degrees of crank angle.



Double Piston Motor.

Syn.: Differential piston motor.

Motor, Double Piston—A motor in the cylinder of which reciprocate, in opposite directions, two pistons, one acting through an ordinary connecting rod and the other through a suitably designed yoke, upon the same crankshaft. The charge is admitted, compressed and fired in the space between the heads of

the two pistons, the working pressure acting upon them simultaneously and forcing them toward their respective ends of the cylinders. Superior running balance is claimed for this construction which is, however, little used.

Motor, Eight Cylinder—A motor, usually of the *V* type (see motor, *V* type) with four pairs of cylinders, each pair acting upon one of the cranks of a four throw crankshaft. (See crankshaft, four-throw.)

Motor, Electric—See electric motor.

Motor, Explosion—An internal combustion motor (q. v.)

Motor, Forced Induction—A motor operated upon the forced induction (q. v.) principle.

Motor, Four Cycle—A motor which operates upon the four stroke cycle (q. v.).

Motor, Four Cylinder—A motor with four cylinders, acting upon a common crankshaft. (1) The four cylinders may be arranged with their axes parallel and perpendicular to the crankshaft and act upon a four-throw crankshaft (see crankshaft, four-throw), the power impulses occurring at intervals of 180 degrees of crank angle, (see firing order) four cycle cylinders being assumed. (2) The cylinders may be arranged in two *V* placed pairs, the two cylinders of each pair acting upon one crank of a double-throw crankshaft (see crankshaft, double-throw), producing power impulses as in (1). (See motor, *V* type.) (3) The cylinders may be arranged in two opposed pairs (see motor, opposed cylinder), each pair acting upon one crank of a two-throw crankshaft, the power impulses being spaced as in the two other types.

Motor, Gasoline—A motor using gasoline (q. v.) for fuel.

Motor, High Compression—A motor employing a compression pressure higher than the average adopted in motors otherwise similar. The term is purely a relative one, but motors carrying more than about 75 pounds compression pressure per square inch may be so considered. See compression.

Motor, High Speed—A motor, in the output of which rotative speed is relatively a larger factor than torque—the accepted type in automobile practice on account of its large output per unit of weight.

Motor, Horizontal—A motor, the axes of the cylinders of which lie in a horizontal plane. Such motors are mostly of the opposed type and are placed either under a car body, with

the crankshaft transverse to the car length or under a hood with the crankshaft longitudinally with respect to car length.

Motor, L Head—A motor constructed with L type cylinders (see cylinder, L type).

Motor, T Head—A motor constructed with T type cylinders (see cylinder, T type).

Motor, Long Stroke—See long stroke motor.

Motor, Low Compression—A motor employing a compression pressure lower than that of the average of motors otherwise similar. The term possesses a relative significance only, but a motor employing a compression pressure less than 70 pounds per square inch may be so called.

Motor, Low Speed—See low speed motor.

Motor, Multicylinder—A motor constructed with more than one cylinder, the several cylinders acting upon the same crankshaft.

Motor, Non-Poppet valve—A motor in which valves other than poppet valves are employed. (See motor, rotary valve; motor, sliding sleeve, and motor, piston valve.)

Motor, Opposed Cylinder—A two or four cylinder motor in which the cylinders are located upon opposite sides of the crankshaft with their axes in the same plane and perpendicular to the crankshaft. (Two cylinder type.) The cylinder axes are usually slightly displaced from a straight line to enable their connecting rods to act upon the two throws of the crankshaft (see crankshaft, double throw). Such a four cycle motor gives two equally spaced power impulses in each two rotations.

(Four cylinder type)—The four four-cycle cylinders are arranged in two opposed pairs, the two cylinders of each pair acting upon the same throw of the double throw crankshaft. Such a motor delivers four equally spaced power impulses in each two turns of the crankshaft.

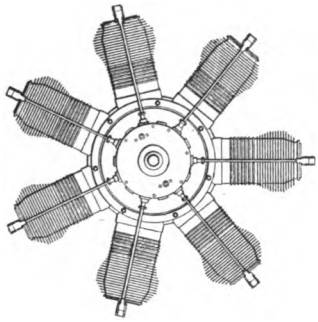
Motor, Overhead Valve—A motor, the valves of which are located in its cylinder heads. (See valve, overhead.)

Motor, Piston Valve—A motor, the valves of which are of the piston type. (See valve, piston.)

Motor, Pocketed Valve—A motor, the valves of which are located in pockets or chambers communicating with the cylinder spaces. (See valve, pocketed.)

Motor, Poppet Valve—A motor, the valves of which are of the poppet type. (See valve, poppet.)

Motor, Revolving Cylinder—A motor, the cylinders of which revolve as a unit, while the crankshaft remains stationary, power being transmitted from the shaft of the cylinder unit, which is revolved by the reaction of the pistons, transmitted through their connecting rods to the fixed crankshaft. The axes of the cylinders are on equally spaced radii from the crankshaft and may be three, four, five or more in number, joined to a central crankcase. Such engines are frequently air-cooled, exhaust directly into the atmosphere and receive their charges from the stationary carburetor through piping, including a rotating joint. No flywheel is usually provided, as the cylinders themselves act in this capacity.



ROTARY CYLINDER MOTOR.

Motor, Rotary Valve—A motor fitted with a valve or valves of the rotary type. (See valve, rotary).

Motor, Short Stroke—See long stroke motor.

Motor, Single Cylinder—A motor with one cylinder acting upon a single throw crankshaft (see crankshaft, single throw) delivering one power impulse in each two rotations.

Motor, Six Cylinder—A motor with six cylinders arranged upon the same side of the crankshaft, with their axes in the same plane and perpendicular to the crankshaft, acting upon a six-throw crankshaft. (See crankshaft, six-throw.) In such a motor, power impulses are delivered at intervals of 120 degrees of crank angle. (See firing order.) Also a motor of the V type (see motor, V type) with six cylinders in three pairs, each pair acting upon one throw of a three throw crankshaft (see crankshaft, three-throw) delivering power impulses spaced as in the other type.

Motor, Truck Piston Type—A motor in which the upper end of the connecting rod is directly connected to and pivots in the piston, it being secured thereto by the piston pin (q. v.),

no piston rod, crosshead (q. v.) or crosshead guides being required. The lower end of the piston is necessarily open, and the connecting rod angularity (q. v.) is so proportioned with regard to the inside diameter of the piston that the former clears the latter. The piston performs the crosshead function and the cylinder the guiding function. (See piston, trunk.) This is the accepted type of internal combustion motor for vehicle use.

Motor, Sliding Sleeve—A motor, the valve action of which is effected by sliding sleeves. (See valve, sliding sleeve).

Syn.: Knight type.

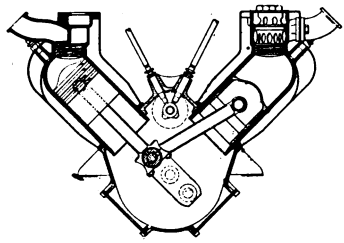
Motor, Three Cylinder—A motor with three cylinders arranged upon the same side of the crankshaft with their axes in the same plane and perpendicular to the crankshaft. (See crankshaft, three throw.) Such a motor delivers a power impulse in each 240 degrees of crank movement.

Motor, Twin Cylinder—A motor of the double cylinder V-type. The term is occasionally applied to a double cylinder motor of the type first described under motor, double cylinder.

Motor, Two Cycle—See two-cycle motor.

Motor, Two Cylinder—See motor, double cylinder.

Motor, V Type—A motor the cylinders of which are arranged in two equal sets, the axes of the cylinders of one set converging toward the axes of the other set and nearly or exactly intersecting at the crankshaft axis, perpendicularly thereto. The angle between the axes of the two sets is most commonly 90 degrees. The cylinders of one set are nearly opposite the respective cylinders of the other set, and each two oppositely placed cylinders act upon the same throw of the crankshaft. Referring to V motors of the 90 degree type: The two cylinder (twin) motor delivers to its single throw crankshaft two power impulses in each two rotations spaced at angles of 270 degrees and 450 degrees.



V Type Motor.

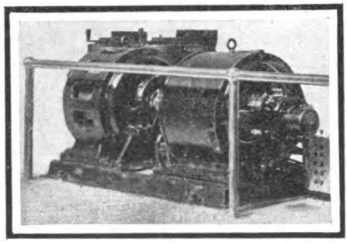
Motor, Vertical—A motor the cylinders of which are placed with their axes in a vertical position. The accepted type in automobile construction in which the motor is located under a hood, with its crankshaft lengthwise of the vehicle.

Motor, Water Cooled—A motor the cylinder walls of which are maintained at a temperature sufficiently low to permit of effective lubrication and to prevent self-ignition, by the circulation of water about them through jackets enveloping them. See water cooling, water jacket.

Motor Air Compressor—An air compressor, operated by a motor, usually electric, used in garages for charging a tank with compressed air to be used for inflating tires. The motor is usually started and stopped automatically as the pressure in the tank rises above or falls below a predetermined amount.

Motor Buggy—See high-wheeled car.

Motor Generator—An apparatus for transforming electrical energy in the alternating form into electrical energy in the continuous form or vice versa, or for transforming electrical energy at one voltage into that at another or for accomplishing both results simultaneously. It consists of an electric motor operated by electrical energy of the character which is to be converted, which drives a dynamo capable of generating electrical energy of the desired character, the two machines usually being arranged upon the same bedplate and direct connected.



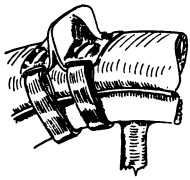
MOTOR GENERATOR.

It is used in garages for converting alternating into direct current or high voltage into low voltage current adapted to charging vehicle and ignition batteries.

Syn.: Generator set.

Mud Guard—See fender.

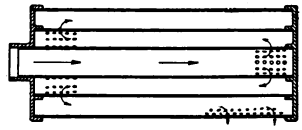
Mud Hook—A traction increasing device intended for temporary use in very deep mud or snow, consisting of a narrow paddle-shaped piece of metal applied crosswise of the tire tread and securely fastened to the wheel felloe so that when the wheel rotates the edge of the mud hook cuts deeply into the road surface and secures a hold thereupon. Several such hooks are usually applied to each driving wheel and are removed as soon as a firm road surface is reached.



MUD HOOK.

Mud Pan—See sod pan.

Muffler—A device for suppressing the noise of the escape of the exhaust gases from an internal combustion motor, consisting of means for permitting said gases gradually to expand in confined spaces, with resulting decrease in their pressure and temperature, so that they are finally emitted into the outside air at a pressure but little above atmosphere. Its construction may comprise a series of closed, concentric, cylindrical chambers communicating from one to the other by somewhat devious passages. Gases from the engine exhaust pipe are usually first admitted to the largest chamber and then successively to the progressively smaller chambers, expanding and cooling in each until they are emitted from the last chamber, through the final escape pipe, in a greatly expanded condition and without explosive violence. The muffler is usually supported under the rear of the vehicle frame, with the escape pipe in a horizontal or slightly upcurved position.



MUFFLER.

Syn.: Silencer.

Muffler Cut Out—A valve opening into the outside air from the exhaust pipe of an internal combustion motor at a point between the muffler and the motor, which, when open, permits the exhaust gases to escape directly into the air without passing through the muffler. Opening the valve allows the sound of each explosion to be

heard, and enables the operator to detect any irregularity therein. If the muffler develops back pressure (q. v.), opening the valve eliminates it and thus adds to the effective output of the motor. The cut-out valve is usually operated by a linkage controlled by a pedal set in the footboard or by a hand lever located upon the heelboard.

Muffler Explosion—An explosion produced by the accidental ignition of combustible gases contained in a muffler. When a motor rotates without burning its charges, they are exhausted into the muffler, filling it and the exhaust pipe so that when, subsequently, a cylinder fires its charge, its burning exhaust gases, meeting the explosive mixture in the piping and muffler, may explode it.

Multiple Battery—A battery, the cells of which are arranged in multiple series connection (q. v.), the number of series groups used being proportioned to the capacity of the cells and the severity of the service demanded. For a given draft of current by the external circuit, the larger the number of series groups, the smaller the current demanded from each cell, and the longer the life of the battery and the greater its freedom from polarization.

Used in ignition and in vehicle lighting on a small scale.

Multiple Coil Ignition—See ignition, multiple coil.

Multiple Connection—In an electric battery, that method of connecting cells in which the positive poles of all cells are connected to the same lead wire and the negative poles of all cells to the other lead wire, producing a battery, the voltage of which is that of a single cell and the internal resistance of which is equal to the internal resistance of a single cell divided by the number of cells in the battery. In the case of electric lamps, electric motors or other electrical translating devices, that method of connection in which one lead wire from the source of supply is conducted to one terminal of each device, and the other lead wire to its other terminal, thus dividing the current supplied among the devices in circuit. Syn.: Parallel connection.

The opposite of series connection.

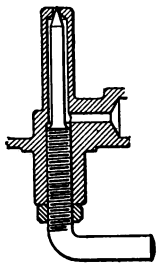
Multiple Series Connection—In an electric battery, the combination of a number of groups of cells, the cells of each group being in series connection (q. v.), and equal in number. The positive terminal of each group is connected to one lead wire and the negative terminal of each group to the other lead wire.

The voltage of such a battery is that of one cell multiplied by the number of cells in each group and its internal resistance is equal to the internal resistance of one series group, divided by the number of groups.

Multiple Threaded Screw—A screw which is cut with a number of uniformly spaced parallel helices instead of with a single helix, a thread of very coarse pitch being thus produced, while, at the same time a sufficient number of threads are always in engagement with those of the nut. Such a screw provides for a rapid rate of motion, relatively to its multiple threaded nut in proportion to their relative rotation and may be so designed that reversibility of action between the screw and nut may be obtained in almost any desired degree. Used in steering devices (q. v.) of the worm and sector and screw and nut type and in worm drives.

Mutilated Thread—See breech-block joint.

Needle Valve—A valve for controlling the flow of a fluid, usually consisting of a stem provided with a more or less tapered point, adapted to tightly fit in a somewhat conical seat. When the stem is thus seated the flow of fluid is cut off, and, as the tapered end of the stem is gradually withdrawn from its seat, a passage is progressively opened, the area of which is capable of close regulation. Used in carburetors, lubricators, gasoline shut-offs, gas tanks, etc.



NEEDLE VALVE.

See carburetor needle valve and carburetor float valve.

Negative Plate—That plate of a battery cell into which the current seems to flow from the external circuit. In a primary cell this is the carbon or copper plate and in an accumulator the spongy lead or iron-oxide plate.

Negative Terminal—That terminal of any electrical apparatus into which current seems to flow from the external circuit.

Neutral Position—That position of the mechanism of a sliding pinion change speed gear in which no driving effort is transmitted from the rotating motor to the wheels, although the clutch is in engagement, for the reason that no gears are in engagement. Also the position of the gear shifting lever, which corresponds to the above described condition in the gearset.

That condition of a planetary or individual clutch change speed gear in which no clutch is in engagement and the position of the control devices which correspond therewith.

Neutralize: (v.)—To place a change speed gear in the neutral position.

Nickel Babbitt—A white metal of which bushings (q. v.) for bearings are made and for which the following is a specification: Copper, 64 per cent.; tin, 5 per cent.; lead, 30 per cent., and nickel, 1.0 per cent.

Nickel Steel—See steel, nickel.

Nickel Chrome Steel—See steel, nickel-chrome.

Nipple—A term specifically applied to the points of attachment of the branches of an intake or exhaust manifold (q. v.), which are properly formed to fit in their respective port openings, the joints being either ground tight or packed by gaskets and held in place by clamps or otherwise. Also a pipe fitting consisting of a short length of pipe threaded externally at both ends.

Non-Conductor—Electric—A substance through which electricity cannot appreciably flow at ordinary electrical pressures. Used in electrical devices to prevent the escape of electricity from the wires or other conductors to which it should be confined. Glass, porcelain, rubber, mica, vulcanized fibre and silk are among the best non-conductors. Syn.: Insulator, dielectric.

Non-Fluid Oil—See grease.

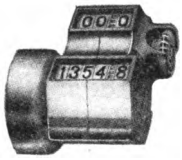
Non-Freezing Solution—See anti-freeze solution.

Non-Return Valve—See check valve.

Number Plate—A plate, usually of sheet steel, conspicuously inscribed with the registration number of a car and the name of the State in which it is registered, two of which are usually required by law to be carried at all times affixed respectively upon the front and rear of a car so that the ownership of the car may be readily ascertained by reference to a list of registrations. The rear number plate must be illuminated at night by the tail lamp, according to most automobile laws. Syn.: Number Pad.

NUMBER PLATE.

Odometer—An instrument for continuously recording the distance traveled by a vehicle. It is essentially a mechanical counter and recorder of road wheel revolutions, which automatically, by means of a suitably designed clockwork train converts wheel revolutions into miles and fractions thereof, and indicates the same upon a suitable dial. It is usually combined with a speedometer (q. v.) and is driven by suitably proportioned gearing from a non-driving (usually front) wheel through a flexible shaft (q. v.), the instrument itself generally being mounted upon the vehicle dashboard.



ODOMETER.

Odometer, Hub—An odometer contained within the hub cap of a non-driving road wheel of a vehicle, and thus requiring no special driving mechanism. A suitable connection of the indicating mechanism to a part, such as a knuckle, which does not rotate, is provided, so that the instrument is positively driven. By sealing the hub cap in place, tampering with the indications of the instrument can be prevented.

HUB ODOMETER.

Odometer, Trip—An odometer which can be set back to zero at will, so that the distance traveled by the car to which it is attached from the time of resetting to any later time can be read off directly, no subtraction of readings being necessitated. It is usually combined in the same case with an ordinary totalizing or season odometer.

Offset (n.)—In general, a bend or angle in a generally straight mechanical part, which causes a portion of it to lie out of alignment with, but generally parallel to, the remainder of the part. Specifically: In a motor, the perpendicular distance from the axis of a crankshaft to the extended axis of its cylinder, frequently expressed as a fraction of the stroke length.

See crankshaft, offset.

The perpendicular distance from the axis of a camshaft to the extended axis of its cam follower.

See camshaft, offset.

Offset (v.)—To adopt an offset construction, as in the positioning of a crankshaft or camshaft.

Offset Camshaft—See camshaft, offset.

Offset Crankshaft—See crankshaft, offset.

Offset Screwdriver—A special form of screwdriver with an offset in its blade, used to turn screws which are inaccessible to an ordinary screwdriver.

Ohm—The unit of electrical resistance, being the resistance offered by a column of pure mercury 106.3 centimetres long and one square millimetre in cross section when at the temperature of melting ice.

Ohms Law—The law connecting a steadily impressed electromotive force (E) (q. v.), the resulting current flow (C) and the resistance (R), namely $E=CR$, $R=\frac{E}{C}$ and $C=\frac{E}{R}$. The first equation means that the electromotive force in volts acting between any two points in such a closed circuit is the product of the current in amperes and the resistance of the circuit, in ohms, between the two points chosen. The second equation means that the resistance in ohms between any two points of such a closed circuit is the quotient of the electromotive force. in volts, acting between those two points by the current flowing in amperes. The third equation means that the current, in amperes, flowing in such a circuit is the quotient of the total impressed electromotive force, in volts, by the total resistance of the circuit in ohms.

This law applies to steady currents only and not to alternating or pulsating currents.

Oil, Castor—The oil expressed from the castor bean and used as a cylinder lubricant in internal combustion engines which operate at high speed and temperature for considerable periods of time, as in racing.

Also used to treat the facings of leather lined clutches.

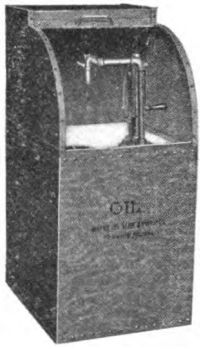
Oil, Cylinder—See cylinder oil; cylinder oil, gas engine and cylinder oil, steam.

Oil, Neatsfoot—An animal oil especially adapted to preserve the qualities of leather and hence used to render soft and pliable the facings of leather lined clutches.

Oil, Non-Fluid—See grease.

Oil Bath—A body of oil contained in a tight case in which mechanical parts operate in such a manner as to be flooded with the oil and lubricated thereby.

See lubrication, splash.



OIL CABINET.

Oil Cabinet—A stationary case containing a supply of one or more grades of oil with means for drawing the same and often with means of measuring the amount drawn. Used in garages for conveniently handling oil without waste.

Oil Cup—A cup of metal or of metal with glass sides, filled with oil and arranged to feed a bearing into which the outlet of the cup is inserted. Generally an adjustable needle valve permits the flow of oil to be started and stopped and regulated and a sight feed (q. v.) is often provided below the cup to permit the rate of feed to be observed.


OIL CUP.

Oil Gauge—See gauge, oil, and gauge, oil pressure.

Oil Groove—A special form of oil way, consisting of a continuous spiral or circular groove cut in the working surface of a motor piston rather near the crank end thereof, to aid in distributing lubricating oil evenly about the whole of the piston surface and sometimes so designed as to prevent excess oil from reaching the combustion space.

Oil Gun—A syringe used to handle lubricating oil. Similar to a grease gun (q. v.).

Oil Lead (pron. leed)—A small diameter tube, usually of copper, used to convey oil from the point of supply to a delivery point, e. g., from the reservoir of a force feed lubricator to an oil-hole in a bearing cap. Also a cored passage in a motor crank case through which the oil in a circulating system of lubrication is distributed. An oil duct.

Oil Level—The depth at which the oil available for splash lubrication is maintained in the bottom of a crank case or other housing. See lubrication, constant level and lubrication, splash

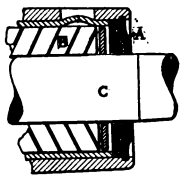
Oil Pan—A name appled to the lowest section of the crankcase of a vertical internal combustion motor, the function of which is to retain lubricating oil and not to support the crank-

shaft. It is usually readily removable to permit the bearings to be inspected.

Oil Pocket—A depression formed in the bottom of the crank case of a splash lubricated motor, directly under each connecting rod and which holds a supply of oil into which the rod tip dips at each revolution, with resulting splashing about of the lubricant. Syn.: Oil well.

Oil Pump—A pump used to force or lift lubricating oil. It may be of the plunger, gear or vane type driven usually through gears from the motor to the lubrication system of which it supplies oil, and is sometimes an integral part of the same. See lubrication, circulating system, pump type. The term is also applied to the individual pumps of a lubricator (force feed) (q. v.), to a hand pump, used to replenish the oil supply in a crank case, to transfer oil from an auxiliary oil tank to the reservoir of a circulating system, or to lift oil from a stationary oil tank.

Oil Retainer—A device to prevent the escape of lubricating oil from a bearing, consisting of a felt washer (q. v.) secured in the outboard end of the bearing and fitting tightly about the shaft or an expansible metal ring similarly fitted. It may also consist of a metal ring fastened to the shaft in such a manner as to throw off any excess of oil, centrifugally, into a pocket formed in the bearing support from which it is returned to its source.

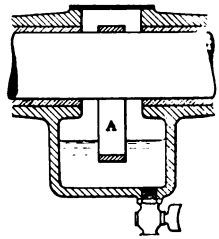


OIL RETAINER.
A, Felt Washer.
B, Roller Bearing.
C, Shaft.

The term is also applied to a small self closing oil tube adapted to be screwed into a part requiring lubrication so that oil fed into it from a squirt can flows into the oil hole of the bearing and is prevented from escaping, while dust is at the same time excluded.

Oil Ring—A ring loosely fitted about a shaft within a bearing standard, adapted by its rotation to distribute oil over the bearing surfaces. See ring oiler.

A more or less sharp edged ring fitted upon a shaft, adapted to throw off excess oil centrifugally in such a manner as to prevent its escape from the housing of the bearing. See oil retainer. A cir-



A, Oil Ring.

cular groove cut around the lower end of a motor piston to aid in distributing the oil. See oil groove. A hollow ring of hook shaped cross-section, fastened in the cheek (q. v.) of a crankshaft so as to closely encircle the adjacent end of the neighboring main bearing (q. v.) and adapted to catch oil escaping from the bearing and to guide it to a channel in the crankshaft cheek through which it is forced, centrifugally, to the adjacent crank pin (q. v.) bearing.

Oil Strainer—A filter of fine metal gauze, employed in circulating lubrication systems (see lubrication, circulating system) to remove sediment from the oil. It is made of large area and readily removable for cleaning and is usually placed in the path of the oil returning from the crank case to the sump (q. v.) or oil reservoir. Syn.: Oil filter.

Oil Trough—A small metal trough sometimes formed in or affixed to the inside of a motor crank case for the purpose of collecting and conducting splashed oil from one part of the case to another, as from one compartment to another or from a portion of the inside surface of the case to a bearing.

See lubrication, trough system.

Oil Way—A groove or channel formed in a bearing cap or in the bearing surface of a bushing adapted to conduct oil from the point of supply to the frictional surfaces and to permit of its distribution thereupon.

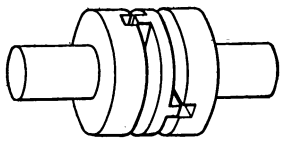
Oil Well—See oil pocket.

Oildag—The trade name applied to deflocculated graphite (q. v.) in a form suitable to be added to oil and used as a lubricant. Somewhat used in the lubrication of vehicle motor cylinders.

Oiler—See lubricator.

Oiling—Lubrication (q. v.).

Oldham Coupling—A device for connecting in driving relationship two shafts which are approximately in the same straight line, so as to provide a slight degree of flexibility at the junction and thus prevent binding due to accidental misalignment. It usually consists of two circular flanges, fixed respectively to the two shaft ends, in the abutting faces of each of which is a dia-



OLDHAM COUPLING.

metral groove, the grooves in the two flanges being located at right angles one to the other. A disc-like floating member, carrying upon its two faces diametral projections placed at right angles one to the other, is so held between the two shaft flanges that the projection on one of its sides engages with the groove of one flange, and the projection on its other side engages in the groove in the other flange. A slight sliding action of the projections in the grooves corrects binding effects due to faulty alignment.

Syn.: Hookham coupling. See flexible coupling.

Oscillate (v)—With reference to a mechanical part, to swing to and fro upon a point which is fixed relatively to the part in question as, for example, the connecting rod (q. v.) on the piston pin (q. v.)

Otto Cycle—See four-stroke cycle.

Output—The rate at which energy is given out by a prime mover or by a machine used to transform energy from one form to another. Mechanical output, as from a gas or steam engine, or an electric motor, is expressed in horse power (q. v.), and electrical output, as from a dynamo or magneto, is expressed in watts (q. v.) or kilowatts. In the case of a storage battery, it is the average rate at which energy is given out by it during discharge multiplied by the time occupied by the discharge. Antonym: Input.

Ovalization—In the case of the cylinder bore of a gas or steam engine, the departure from a truly cylindrical form to a more or less elliptical form, occasioned by the greater wearing action of the piston in the plane of the connecting rod movement as compared with the wearing action in other planes. This action, to which the piston is also subject, tends to increase leakage between the piston and the bore. (v.) Ovalize.

Overcharge (v.)—To pass charging current through an accumulator cell, after the reversible chemical changes in the plates, which are effected by charging, have been practically completed. It results in loss of electrical energy, excessive evolution of gas and spraying of the electrolyte, with an excessive rise of temperature and often in shedding of the active material. Also used as a noun.

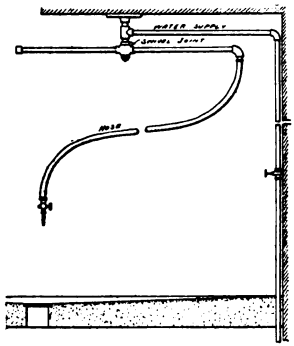
Overflow Dam—In a circulating system of lubrication (see lubrication, circulating system) of the constant level type, a raised portion of the metal of the crankcase bottom, over which

oil flows back from the crankcase to the sump, the height of which regulates the depth at which oil is carried in the oil pockets (q. v.).

Overhead Camshaft—See camshaft, overhead.

Overhead Valves—See valve, overhead.

Overhead Washer—A device used in washing vehicles, consisting of a horizontally placed arm of pipe, hung from the ceiling of a garage over the washstand, so arranged as to swing upon a vertical axis and connected to a water supply. A flexible hose is connected to one end of this swinging arm and its nozzle may thus conveniently be carried to any side of the vehicle to be washed, the arm following the motions of the hose.



OVERHEAD WASHER

Overheat—In reference to an automobile part, to rise in temperature to such an extent that it fails to function properly or may become damaged. An overheated bearing may run hard from failure of lubrication and may become melted or may cut its shaft. An overheated motor cylinder may become cut from failure of lubrication and may self-ignite its charges. An overheated dynamo or motor may destroy its insulation and burn out.

Overload (v.)—To demand from a prime mover or other machine an output in excess of that which it is intended to afford (nominal overload), or of that which it can give out without danger of failure or undue wear and tear. To impose upon a structural part a load greater than that which it can repeatedly withstand without permanent deformation or liability of early failure. A gasoline motor may be considered overloaded when the resistance against which it is working becomes so great that, with full gas supply and most advantageous ignition, its speed falls greatly below normal. An electric motor is overloaded when the resistance against which it is working is so great that the current called for is capable of dangerously overheating it.

Overload Capacity—In an electric motor, the difference between its nominal or rated output and the output which it can deliver, temporarily at least, without damage. Overload capacity is usually expressed as a percentage of the rated output.

Overrich Mixture—A fuel mixture containing a larger proportion of combustible vapor and a smaller proportion of air than are present in a mixture of normal quality. See gasoline.

Packing—See gasket and stuffing box.

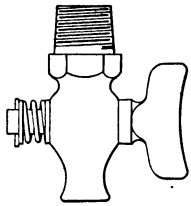
Pasted Plate—See plate, pasted.

Pedal, Adjustable—A pedal, so constructed that its length and sometimes its inclination and that of its footpiece (pad) may be adjusted to suit the convenience of operators of widely differing stature.

Peen (v.)—To change the form of a malleable metal by causing it to flow slightly under repeated, rather light blows of a hammer with a specially formed head. The process is used in expanding metal parts and is related to the processes of upsetting and riveting. Peening tends to make a metal more dense. Spelled also pein.

Peen Hammer—A hammer with a spherical or otherwise specially formed head used in peening or riveting.

Petcock—A small cock or valve, which, when opened, permits the escape of a fluid from a chamber, e. g., the compression cock (q. v.) inserted into the cylinder of a gas or steam engine.



PETCOCK.

Petrol—The English equivalent of the American term gasoline (q. v.).

Phosphor Bronze—A reddish metal of excellent wearing qualities principally used for bearing bushings, but, when rolled or drawn into wire often used for small springs, for which the following is a specification: Copper, 80 per cent.; tin, 10.0 per cent.; lead, 10.00 per cent.; phosphorus, 0.05 to 0.25 per cent.

Pick Up (v.)—When applied to the action of a vehicle motor, to increase in speed under load. When applied to the action of a clutch, to accelerate the mechanism driven thereby to the speed of the prime mover.

Picric Acid—A substance of acid nature, explosive by heat, which is sometimes dissolved in gasoline with the intention of increasing the rapidity of combustion of the charge in vehicle

motors, and hence of securing increased output, as in racing. Tri-nitro-phenol, $C_6H_3N_3O_7$.

Pilot Light—A small flame of fuel vapor and air employed in connection with the burner (q. v.) of a steam vehicle to initially heat the vaporizer of the main burner so that it can gasify the fuel; to keep the main burner hot enough to enable it at once to start into action after being turned off and also to ignite the gas issuing from the main burner. The pilot light of a steam vehicle is usually kept burning so long as the car is likely to be called into service at any moment.

Pilot Light Valve—The valve, usually located within reach of the operator of a steam car, which controls the supply of fuel to the pilot light.

Pin—Specifically, a small metal pin used to hold together two related parts by being tightly driven into a hole drilled through both the parts after they are put together in their proper relative positions, the ends of the pin often being slightly upset to prevent its loosening. Used to fasten cams, small gears and such parts upon their shafts and to hold together parts which are to be united by brazing.

Pin (v.)—To fasten together by pins.

Pin, Split—See cotter pin.

Pin, Taper—A pin of a slightly conical form, which can be driven very securely into its hole.

Pinch (v.)—With reference to the air tube of a pneumatic tire: To catch a portion of its wall between other parts of the tire or of the rim, thus preventing the tube from assuming its normal shape when inflated and producing sharp creases therein at which breakage may finally occur with consequent deflation.

Pinion—The smaller of a pair of gears (q. v.). In change speed gears (q. v.) a pinion is known by the function it performs, e. g., the smaller of the two gears which are meshed to secure the low speed being known as the "low speed pinion" and the "reverse pinion," "intermediate speed pinion," etc., being similarly designated.

Pinion, Driving—Specifically, the pinion forming a part of the final drive of a gear driven car. Usually of the bevel type in cars with longitudinally placed shaft drive and of the spur

or herringbone type in cars the wheels of which are driven from a transverse shaft.

Pinion Frame—A part of a differential gear (q. v.) or a planetary gear (q. v.).

Pinion Shaft—A term specifically applied to the shaft of a gear driven car, which carries the final drive pinion. In a bevel gear driven car this is a longitudinal shaft, the rear end of which at least is supported in the axle housing.

Piston—The member which reciprocates (q. v.) within the cylinder of a gas or steam motor or a pump and is directly acted upon by and directly acts upon the working fluid. It fits closely and slides freely in the cylinder bore (q. v.). The piston of a motor imparts reciprocating motion to the connecting rod (q. v.) or piston rod (q. v.), the outward end of which is made fast to it, and during the working portion of the cycle (q. v.) the useful pressure of the fluid acts upon the head of the piston, and the resulting motion thereof is converted, by means of the other reciprocating parts, (q. v.) into rotation of the crankshaft. During the remainder of the cycle the piston head acts upon the working fluid.

Piston, Double Diameter—A piston the external surface of which is stepped or formed with two superposed, coaxial, cylindrical portions of different diameter, which respectively reciprocate in the two appropriately diametered bores of a double diametered cylinder.

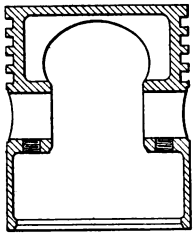
Syn.: Differential piston. See cylinder, double diametered. Used in some two cycle engines.

Piston, Ported—A form of piston, occasionally used in two cycle motors, through the wall and head of which are cut ports, which, when they register with corresponding ports in the cylinder wall, permit the transference of the charge from the pump chamber to the combustion space.

Piston, Steam Engine Type—A piston into which is rigidly fastened the upper end of the piston rod. (q. v.).

Piston, Spherical Head—A piston, the head of which is inwardly concaved, taking somewhat the form of a spherical arc and sometimes used in motor cylinders of the dome head type in order to attain a nearly spherical compression space.

Piston, Trunk—A piston, which not only performs the usual functions of transmitting the working pressure to the other reciprocating parts, but also that of a crosshead (q. v.), the cylinder wall acting as the crosshead guide (q. v.). No piston rod is used with this type, the piston being hollow, open at its crank end and quite long in proportion to its diameter and the piston pin (q. v.) being secured in its walls. The accepted type in internal combustion vehicle motors.



TRUNK PISTON.

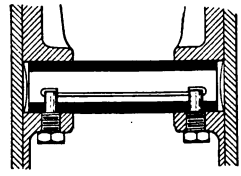
Piston Barrel—The side wall part of a piston, which forms its working surface in distinction to the head portion. The barrel is usually made very slightly less in diameter near the head end than at the crank end, to allow for the greater expansion of the former in service, and occasionally the central portion of the barrel is made very slightly less in diameter than either end portion so as to confine the bearing to the end portions.

Piston Boss—One of the two diametrically opposite projections formed upon the inside of the barrel of a trunk piston (see cut under piston, trunk) to form supports for the ends of the piston pin (q. v.). See boss.

Piston Displacement—In a steam or gas engine, the total volume swept by the piston or pistons thereof in a single full stroke. It is usually expressed in cubic inches and is the product of the area of the cylinder bore in square inches, the stroke in inches and the number of cylinders. Piston displacement may be used as a factor in estimating motor output.

Piston Head—The closed end of a piston which forms the surface upon which the pressure of the working fluid acts.

Piston Pin—The pin, inserted diametrically through the walls of a trunk piston, in a position parallel to the crankshaft, to which is secured the head end of the connecting rod, and which transmits the motion of the piston to and from the same. The connecting rod may be free to oscillate upon the piston pin, in which case the ends of the latter are fastened in two



PISTON PIN AND LOCK

diametrically opposite bosses formed in the inside of the piston barrel or the connecting rod may be rigidly fastened upon the pin, the ends of which oscillate in the piston bosses.

Syn.: Wrist pin.

Piston Pin Lock—The device employed to prevent accidental endwise movement of the piston pin in the piston walls, which might cause the obtruding end of the pin to score the cylinder wall. A set screw in each piston boss, clamping one end of the pin, with the screws wired together to prevent their turning out, is one of many forms of this device.

Piston Ring—A form of metallic packing employed to render a motor piston gas tight in its cylinder. Such a ring is cut from a hollow cylinder of cast iron of about the same external diameter as that of the cylinder bore and is severed or split at one point so as to permit it to be sprung into a circumferential groove formed in the working surface of the piston in which it fits closely, laterally. The ring being free to open at the point where it has been cut, is capable of expanding and filling any slight space between the piston and its bore. Three or four such rings are commonly placed in parallel grooves between the piston pin and head of a gas motor piston, and an additional one is often placed in a similar groove on the crank side of the piston pin. The rings are usually prevented from rotation in their grooves by loosely pinning them to the piston wall, and the cuts in the several rings are so located as not to be in the same straight line.

Piston Ring.

Piston Ring, Compound—A piston packing composed of more than one ring in each groove, for instance of a wide ring in the bottom of the groove and two rings of one half its width placed side by side over it in the outer part of the groove, the splits in the three rings being spaced at equal angular intervals around the groove and so held by pins.

Piston Ring, Diagonally Cut—A piston ring which is split by cutting it through in a plane usually making an angle of about 45 degrees with the plane of the ring and passing through the ring's centre. When such a ring expands in service, a less wide passage for the escape of gases is formed between its ends than were the cut made squarely across the ring.

Piston Ring, Eccentric—A piston ring, the inside and outside circumferences of which are slightly eccentric, giving it a progressively varying thickness. It is usually split at its thinnest point, and, in use, produces a more even expanding action than does a concentric ring.

Piston Ring, Lap Ended—A piston ring, which is split, by sawing half way through its width from one edge, and half way through its width from the other edge, the two cuts being a slight distance apart and their inside ends being connected by a longitudinal cut in the plane of the ring. The ends of the ring thus lap one past the other. This method of cutting is adopted to reduce the escape of gas at the split.

Piston Ring Groove—A circumferential groove, usually of rectangular section, formed in the working surface of a motor piston to receive and hold an expanding packing ring.

Piston Rod—The reciprocating rod which transmits the motion of a motor piston to and from its crosshead (q. v.) one end of the rod being secured in the piston and the other in the crosshead. A part of some steam vehicle engines.

Piston, Side-thrust—The pressure between a piston and its cylinder walls, acting at right angles to the direction of piston motion, and in the plane of the connecting rod movement, when the connecting rod is inclined to the cylinder axis. In a gas engine, it is mainly due to that component of the reaction of the connecting rod upon the piston, which acts during the power stroke (q. v.), forcing the piston against one wall of the cylinder and to that component of the reaction of the piston upon the connecting rod which acts during the compression stroke (q. v.), forcing the piston against the opposite wall of the cylinder. Its ultimate effect is to wear the piston and cylinder out of round. See ovalization. See crankshaft, offset.

Piston Speed—The rate of travel of the piston of a steam or gas motor, generally stated in feet per minute. It is obtainable by the use of the following formula: $L = \frac{Sn}{6}$, or 0.166 Sn, where L is the piston speed in feet per minute, n the number of revolutions of the crank shaft per minute and S is the piston stroke in inches.

Piston Stroke—The range of motion of the piston of a steam or gas motor measured from its extreme position in one direction

to its extreme position in the opposite direction. Expressed in inches or millimeters.

See long stroke motor; short stroke motor.

Piston Travel—That portion of the working surface of a motor cylinder which is swept over by its piston and equal in length to the piston stroke, plus the length of the piston.

Piston Valve—See valve, piston.

Pit—A vault or depression built in the floor of a garage, over which a car can be driven when inspection or repair of its under parts is required and in which a workman can stand upright while doing the required work. It is usually built of brick or concrete and drained.

Pit (v.)—Referring to the working surface or seat of a gas engine valve; to become covered with minute rough depressions caused by the scaling off of particles of the metal under the action of hot gases. Pitting tends to prevent perfect tightness between a valve and its seat.

Pitch (v.)—To so adjust the operative relationship of two meshed gears that they run together most advantageously, with a minimum of noise, wear and loss of energy, being neither too deeply nor too lightly meshed. Theoretically this condition is attained when their pitch surfaces are tangent one to the other.

Pitch, Chain—In a sprocket chain, the length of a complete link, that is, the linear distance from a certain point on a link to the corresponding point on the next link, expressed in inches. The pitch of a sprocket is the straight line distance from the point of intersection of the pitch circle with the centre line of one tooth to the corresponding point of the next tooth, expressed in inches.

Pitch, Circular—In a spur gear, the linear distance from the centre of one tooth to the centre of the next tooth or the distance from one side of one tooth to the corresponding side of the next tooth, measured as an arc of the pitch circle. Usually expressed in inches.

Syn.: Circumferential pitch.

Pitch, Diametral—In a gear, the quotient obtained by dividing the number of teeth by the diameter of the pitch circle, in inches; being thus the number of teeth per inch of pitch diameter. Diametral pitch is expressed by numbers e. g. A 40 tooth gear having a pitch circle of 8 inches diameter is one of $40 \div 8 = 5$ pitch. Automobile gears are known by their diametral pitches.

Pitch Circle—In a spur gear, the imaginary circle, which, if rolled without slippage upon the pitch circle of a mated gear, would produce the same relative angular velocities as are realized in the two gears when they work together in practice.

Pitch Diameter—The diameter of a pitch circle.

Pitch Surface—In a gear, the imaginary surface which, if rolled without slippage upon the pitch surface of a mated gear would give rise to the same angular velocities as are realized when the two gears run together in practice. It is a cylindrical surface in spur gears and a conical surface in bevel gears.

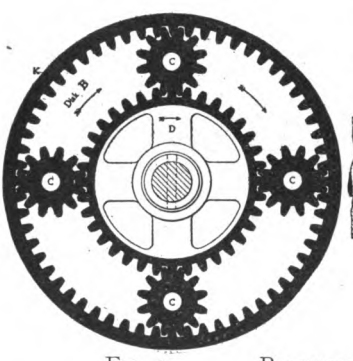


FIG. 1.

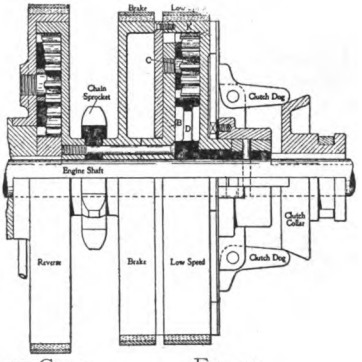


FIG. 2.

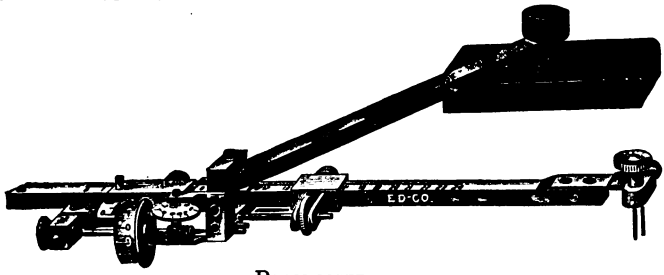
PLANETARY GEAR.

Planetary Gear—A form of change speed gear (q. v.) usually affording two forward speeds and a reverse motion and embodying the epicycle or sun-and-planet movement. In principle, it consists of a spur gear *D*, fast to the motor shaft, a number of symmetrically disposed spur pinions *C*, supported upon studs in a frame rotatable on a sleeve upon the motor shaft and in mesh with gear *D*, and an internal gear cut upon the inside of a drum *K*, also rotatably sleeved upon the motor shaft, which gear is also in mesh with pinions C. See Fig. 1. If the motor shaft and gear *D* is rotated while drum *K* is held from turning, pinions *C* will simultaneously roll on *D* and the internal gear, but, on account of the teeth of *D* being less numerous than those on *K*, they and the pinion frame will revolve around *D* in the same direction with it but at a less angular velocity, dependent upon the tooth ratios. If, on the other hand, the motor shaft be rotated as before, and the pinion frame be held

from rotation, K will be rotated by the pinions in the direction opposite to that of D, but at a fraction of D's speed determined by the tooth ratios. If there be loosely mounted upon the motor shaft, the sprocket of a chain final drive or its equivalent, the low gear will be secured when, by suitable mechanism, operated by the control devices, the sprocket is made fast to the pinion frame and drum K is held from turning. The reverse will be secured when the sprocket is made fast to drum K and the pinion frame is held from turning and the sprocket will be directly driven at motor speed and the high gear secured when it is made fast to the motor shaft and the gear combination is locked from turning and permitted to rotate as a unit. In practice, two separate combinations of gears as above described are employed, one for the low speed and one for the reverse motion. See Fig. 2. The planetary gear is employed upon some cars which are likely to be roughly handled, for its operation requires no meshing of gears.

Syn.: Epicyclic gear, sun-and-planet gear.

Planimeter—An instrument for mechanically measuring plane surfaces, however irregular in contour, and used in determining the areas of manograph cards (q. v.), when the mean effective pressure (q. v.) of a motor is to be calculated.



PLANIMETER.

Plate—One of the elements of a voltaic or storage cell. See negative plate, positive plate.

Plate, Formed—An accumulator plate or element consisting of a metallic grid or frame, usually of lead alloy, upon the surface of which the active material (q. v.) of the cell is gradually produced by the electrochemical actions consequent upon the passage of electric current into and out of the cell.

Syn.: Plante type plate.

Plate, Ironclad—A form of positive accumulator plate consisting of a number of vertical metal rods, united at their upper and lower extremities, respectively by a metal frame, each rod having molded about it a cylinder of active material about the outside of which is fitted a perforated hard rubber tube. Freedom from shedding of active material under heavy charges and discharges is the principal advantage secured by this construction.

Plate, Pasted—An accumulator plate or element consisting of a metal supporting grid or frame affording interstices in its structure into which the active material (q. v.) is forced in the form of a paste applied under pressure.

Syn.: Faure type plate.

Point—In reference to an electric vehicle controller. One of the several operative positions or notches in which it may be placed by the operator, corresponding to one of the forward or reverse speeds, the "off" position, etc.

Points of Carbon—The number of hundredths of one per cent. of carbon which is present in a steel. Thus 30 point carbon steel is steel containing 0.30 per cent. of carbon.

Polarity, Electric—The direction in which an electric current is considered to flow, which is from the positive (+) to the negative (—) pole of an electrical device. When the poles are identified the polarity of the current is known.

Polarity, Magnetic—In the case of a magnet, that pole thereof which attracts the south-seeking end of a compass needle is called the north (N.) pole and vice versa.

Polarity Test—A test to determine which pole or conductor of an electric circuit is positive and which is negative, made use of in determining how to connect a storage battery to its charging circuit.

If the ends of two wires attached respectively to the two poles of the circuit be held somewhat apart in a glass filled with slightly salted or acidulated water, that wire at which the most gas is given off is connected to the negative pole and vice versa.

Polarization—The reduction of output occasioned in a primary electric cell by the collection of hydrogen gas upon the carbon or copper plate, the effect being due not only to the development of a counter electromotive force (see electromotive force, counter) but to an increase in the internal resistance.

In storage cells a very high rate of discharge sometimes so coats the plates with gas that they do not make a good contact with the electrolyte and a sort of polarization results. See depolarizer.

Pole, Electric—See negative terminal, positive terminal.

Pole Magnetic—One of the two ends of a magnet where free magnetism exists and between which magnetic force acts. See polarity, magnetic.

Pole Piece—A piece of soft iron fixed to the pole of a magnet and adapted to conduct magnetic force into an armature (q. v.) with a minimum of loss. In the case of a horseshoe magnet, the pole pieces attached to the two poles respectively are so shaped as partly to surround, and very closely to approach the part upon which the magnetic force is to act, e. g., the armature of a magneto, dynamo or electric motor.

Poppet Valve—See valve, poppet.

Popping in the Carburetor—See backfiring.

Port—In general, a passage for the flow of a fluid. Specifically, a valve controlled passage, through which gases enter or leave the cylinder of a gas motor. They are usually cored out in the process of casting the head of the cylinder and communicate from the combustion space through the cylinder wall to the outside thereof. See exhaust port and inlet port.

Positive Plate—That plate or element of a battery cell out of which the current seems to flow to the external circuit. This is the zinc plate in a primary cell, the peroxide of lead plate in a lead accumulator and the nickel oxide plate in an alkaline or Edison type accumulator.

Positive Terminal—The terminal of any electrical device out of which the current seems to flow. In a battery cell it is the terminal attached to the positive plate.

Syn.: Positive pole.

Potential, Electrical—See electromotive force, with which it is generally synonymous in practice.

Pound (v.)—In a motor or other mechanism to produce in operation a series of abnormal blow-like sounds, usually caused by looseness or lost motion (q. v.), between related parts which is alternately developed and taken up as they operate together, causing the striking together of the parts. A crankshaft loose in its bearings is likely to pound.

Power Stroke—That stroke in the cycle (q. v.) of a gas motor during which the working fluid imparts useful energy to the piston. In a four cycle (q. v.) gas motor, it is considered the third stroke of the cycle and is an outward piston stroke (downward in a vertical motor). Shortly before the commencement thereof, the spark occurs and the gaseous charge, just previously compressed by the piston (see compression stroke), is ignited and reaches its maximum pressure at the beginning of the power stroke, expanding during its progress and doing work upon the piston until the exhaust valve (q. v.) opens.

In a two cycle motor each outward stroke (downstroke in a vertical motor) is a power stroke, and is simultaneous with the compression of the charge by the lower face of the piston, or by a separate piston, preparatory to its being transferred to the combustion space.

Syn.: Working stroke, expansion stroke.

Power Tire Pump—See tire pump, power.

Pre-expansion—The expansion of the charge while entering a gas motor cylinder caused by heat derived from the cylinder, ports and valves. It reduces the weight of charge which a cylinder of given dimensions will draw in and thus reduces the output of the motor. Its effect is especially noticeable in motors which run very hot.

Preheating—The practice of warming the air used to form the charge of a gas motor before it reaches the carburetor, by means of a hot jacket placed around the air inlet pipe or by drawing the air from around the hot exhaust pipe (see hot air intake). It is adopted in order to compensate for the heat absorbed in the vaporization of the fuel and thus to facilitate complete evaporation.

The term is also applied to the practice of supplying heat to the charge while it is being formed in the carburetor passages and while it is passing through the intake pipes, hot air and hot water jackets around these parts being resorted to. See carburetor, exhaust jacketed; carburetor, water-jacketed; Intake pipe, jacketed.

Pre-ignition—Premature ignition. (See ignition, premature.)

Pressed Steel—Sheet steel which is pressed into the desired shape while hot, by means of powerful dies. Generally used for vehicle frames and extensively employed for crank cases, housings of various kinds and other parts in preference to thin

castings on account of its superior strength for a given weight. Pressed steel housings are usually made of two or more parts, the edges of which are united by autogeneous welding (q. v.) to form the desired finished shape.

Pressure of Explosion—The maximum pressure attained by the burning gases in a gas motor cylinder usually amounting to from 250 to 350 pounds per square inch in a motor working at full power.

Pressure Feed—See fuel feed, pressure and lubrication, pressure feed.

Pressure Gauge—See under gauge.

Prime (v.)—In a carburetor, to supply an excess of liquid fuel to the air passages, so that an ignitible mixture may be drawn by the motor when cranked at a speed too low to cause sufficient fuel to be atomized by the carburetor spraying nozzle (q. v.). Priming is usually effected by temporarily raising the fuel level (q. v.) so that fuel spills out of the spraying nozzle into the air passages.

Syn.: To flood the carburetor; to tickle the carburetor.

In a motor, to supply liquid fuel directly to the combustion spaces of the cylinders so that an ignitible mixture may be formed by it and the entering air and explosions be obtained, although a sufficiently rich mixture cannot be delivered to the cylinders by the carburetor at practicable cranking speed.

Primer—A device for priming a carburetor, usually by raising the level in the float chamber. See carburetor float depressor. A device for furnishing liquid gasoline to the intake manifold or cylinders consisting of a small reservoir filled with gasoline, fitted with a hand pump and a delivery pipe leading to the intake manifold or branched piping leading to the combustion spaces of the cylinders, check valves (q. v.), or stopcocks usually being inserted in the delivery pipes. The pump and tank are usually attached to the dashboard and a few pump strokes serve to prime the motor and to facilitate starting by the crank or on the spark.

Priming—The fuel supplied to prime a carburetor or motor. Gasoline or a mixture of gasoline and sulphuric ether.

The name given to drops of unvaporized water present in wet steam, as steam from a foaming or over full boiler. The

presence of excessive priming causes loss of efficiency in a steam engine, and the collection of excessive water in its clearance spaces may cause knocking or possible damage to the cylinder.

Priming Cock—A small cock with a cup shaped top, inserted into the clearance space of a gas motor cylinder. The cock when opened permits gasoline poured into the cup to enter the clearance space as priming. The same cock may act as a compression cock.

Syn.: Priming cup.

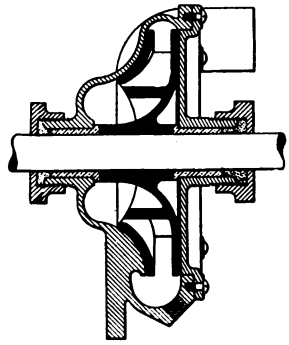
Progressive System—See sliding gears, progressive.

Propeller Shaft—The drive shaft (q. v.) of a shaft driven car.

Protected Terminals—See spark plug, protected terminal.

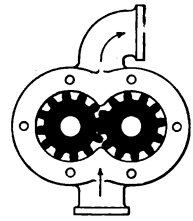
Pump—See air pump, oil pump, gasoline measuring pump, water pump, tire pump.

Pump, Centrifugal—A form of rotary, non-positive pump, dependent for its action upon centrifugal force. It consists of a narrow, somewhat ring-shaped housing with an inlet near its axis and an outlet arranged tangentially to its outside edge. The ring-shaped portion of the housing is usually of increasing cross-section toward the outlet. On a transverse, power-driven, axial shaft, within the housing is rotated a wheel (the runner or impeller), composed of a hub and several radiating blades, usually concaved in the direction of rotation, which when in operation, draws in liquid through the inlet which is forced centrifugally toward the outside of the housing and expelled through the discharge. Used as a circulating pump (q. v.) in water cooling (q. v.) systems, being driven from the motor through an auxiliary shaft (q. v.).



SECTIONAL VIEW OF CENTRIFUGAL PUMP.

Pump, Gear—A pump consisting of a liquid-tight housing so formed as to enclose two meshed gears with practically no clearance between their faces and the housing wall. The inlet is placed in a space provided where the gear faces come out of engagement, when running, and the outlet is placed in the corresponding space where the teeth engage. When the shaft supporting one of the gears is rotated, the other gear also rotates and a partial vacuum is formed at the inlet where the teeth recede, liquid being drawn thereinto. As the teeth of the two gears unmesh, liquid is carried along between them and the casing and is delivered by them into the discharge outlet as they mesh.



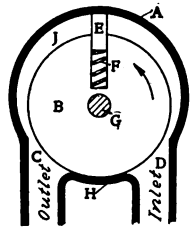
GEAR PUMP.

Used as an oil pump in lubricating systems (see lubrication, circulating system) and occasionally as a water pump in water cooling systems.

Pump, Plunger—A pump identical in principle with the common domestic force pump, used to pump oil in lubricating systems, to pump air in fuel feed systems, etc.

Such a pump is usually operated by an eccentric (q. v.) upon one of the engine shafts.

Pump, Sliding Vane—A form of positive rotary pump in which one or more sliding vanes perform the function of pistons. One form consists in principle of a somewhat disc-shaped liquid tight housing *A*, within which rotates on a power driven shaft *G*, a disc *B*, of practically the same thickness as the inside of the housing. Shaft *G* is somewhat eccentric with the centre of the housing, and the diameter of *B* is such that it moves with very slight clearance over the housing at *H*. A crescent-shaped water space *J* is thus formed. A vane *E*, of practically the same width as the thickness of the housing, is inserted in a radial slot in *B*, and is pressed outwardly by a spring *F*, so that its end is always in contact with the housing, causing it to act as a piston sweeping the space *J*. When



SLIDING VANE PUMP.

B is rotated, as shown by the arrow, liquid is drawn in through inlet *D* and kept in motion by vane *E* until it is discharged at outlet *C*. Such pumps are used in lubricating systems. (See lubrication, circulating system, pump type.)

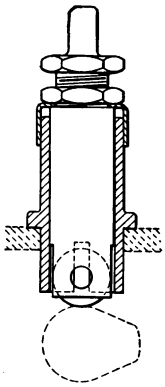
Pump Bracket—A support, usually formed integrally with the upper part of a gas motor crankcase, to which the water pump (q. v.) is secured so as to be conveniently driven from the motor.

Pump Drive—The mechanical connection by means of which a circulating pump (q. v.) is driven from a vehicle motor. It is usually by means of a flexible coupling (q. v.) connecting one of the auxiliary shafts (q. v.) of the motor with the pump shaft. See water pump.

Pump Lubrication—See under lubrication.

Puncture—The accidental piercing of the wall of the air tube (inner tube) of a pneumatic tire allowing the air to escape and the tire to deflate. It is usually occasioned by some sharp object in the roadway being forced through the tire casing and tube when the tire rolls over it.

Push Rod—In general, a rod which transmits a pushing effort from one part of a mechanism to another. Specifically, a guided rod which transmits the opening motion from a cam (q. v.) to the poppet valve stem of a gas motor having pocketed valves (see valve, pocketed), or from a cam to the rocker arm (q. v.) of an overhead valve (q. v.) motor. A means for adjusting the length of the pushrod is usually provided to permit of regulating the clearance (q. v.) in the valve operating mechanism.



PUSH ROD.

Pushrod Guide—A slide, usually fixed in the upper surface of a cam shaft housing, directly over a cam, in which a valve pushrod reciprocates.

Pushrod Guide Yoke—A removable yoke secured to the upper surface of a gas motor crankcase over a cam shaft, which acts as a clamp to hold the pushrod guides (q. v.) in place. Such a yoke is usually two armed and each arm bears upon a guide.

Pushrod and Spring Housing—A thin, readily removable, tubular housing, usually of aluminum, which encloses an individual pushrod (q. v.) and the valve spring (q. v.) of the poppet valve (see valve, poppet) which it operates, thus muffling the valve noise, excluding dust and retaining lubricant. (See valve gear, enclosed.)

Quadrant—A sector shaped stationary part, consisting of a portion of a circle with radial supporting arms, employed to guide the motion of a control lever and to hold it in any desired position. See gear shifting quadrant, brake latch, throttle lever and spark lever.

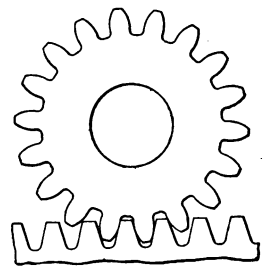
Quartz Powder—Finely pulverized quartz or silica used as an abrasive in grinding motor valves to their seats.

Quill—A sleeve (q. v.).

Race (v.)—In a gas motor: To rotate at excessively high speed unloaded; all the mechanical energy developed being dissipated in friction among the parts and in internal losses in the parts resulting from abnormally severe inertia stresses.

Race—In a ball bearing, a single line of balls and the parts they roll upon.

Rack and Pinion—A mechanism for transforming rotary into straightline motion or the reverse, usually consisting of a small spur gear (the pinion) the teeth of which are in mesh with corresponding teeth cut upon one edge of a straight bar (the rack) guided so as to move in its axis of length. Rotation of the pinion produces rectilinear motion in the rack, which motion may be transmitted to some other part as in a steering gear. (See steering device, pinion and rack.)



RACK AND PINION.

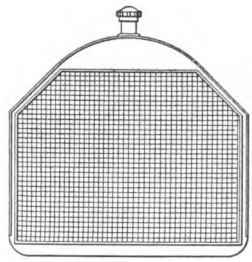
Radiation—Specifically, the area of the heat dissipating surfaces exposed in a radiator. Usually expressed in square inches.

Radiator—A device for dissipating into the surrounding air the excess heat imparted to the cylinder walls of a gas motor. (See water cooling.) It consists of an arrangement of passages, the exposed surface of which is very large in proportion to their cross section, through which water from the water

jackets (q. v.) of a motor is caused to circulate so long as the motor is in operation. The water in the jackets becomes heated by contact with the cylinder walls and flows through piping to the radiator, through the numerous small passages of which it circulates. The external surfaces of these are exposed to a draft of relatively cool air (see fan and flywheel, fan-spoked), which abstracts the heat from the water within by convection, which then circulates back to the jackets through piping to again become heated.

Syn.: Cooler.

Radiator, Cellular—A form of radiator in which the water to be cooled trickles through thin passages among tubes through which cool air is caused to pass. Such a radiator is built up of a large number of short, thin walled copper tubes, usually of square or hexagonal section, parallelly arranged to form a construction of the desired shape. The ends of the tubes are usually slightly enlarged and the aggregation of tubes is secured together by solder at both ends, or the respective ends of all the tubes are sweated into a stamped metal frame. Narrow spaces are left between adjacent tubes through which the water passes from a tank or header at the top of the radiator to another header at the bottom, from which it is returned to the jackets. The side walls of the outside tubes are soldered to the frame of the radiator.



CELLULAR RADIATOR.

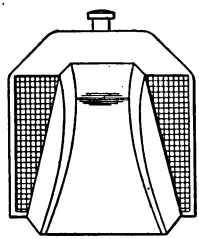
Syn.: Honeycomb radiator.

Radiator, Coil—A radiator consisting of a close coil of thin walled copper or brass tubing, usually provided with radiating flanges (see radiator, finned tubular) through the convolutions of which the jacket water is circulated and which is exposed to the air. The coil is generally of somewhat rectangular form and may be simply held together by clamps or may be mounted in a frame of conventional shape.

Radiator, Continuous Flange Type—A radiator of the finned tubular type in which a series of continuous pieces of thin metal form the cooling flanges for all the parallel tubes, each continuous

flange being threaded around and soldered to all the tubes. A multiplicity of small separate flanges is thus avoided.

Radiator, Dashboard Mounted—A radiator mounted vertisally upon the vehicle frame close to the front surface of the dashboard and to the rear of the motor, the cooling air being drawn in through apertures in its sides and expelled backwardly and downwardly under the footboard. Generally used with motors covered by hoods of the sloping type (see hood, sloping).



DASHBOARD MOUNTED RADIATOR.

Syn.: Renault type radiator.

Radiator, Finned Tubular—A radiator constructed of thin walled (usually copper) tubing, the external surface of which is very greatly increased for the purpose of radiating and convecting the heat of the jacket water passing through them, by closely spaced sheet metal flanges, fins or gills soldered, at short intervals, to the outside of the tubing. The fins are usually of thin sheet copper, sometimes corrugated, threaded around the tubing, and may be circular or square or of the continuous type (see radiator, continuous flange type).

Syn.: Flanged tube or gilled tube radiator.

Radiator, Flat Tubular—A form of radiator built up of thin walled tubing the external surface of which is made very large as compared with its sectional area, for the purpose of heat dissipation, by flattening it so that the passage within it is quite narrow.

Radiator, Front Mounted—A radiator which is mounted upon the extreme front of a chassis frame, forward of its motor and forms the forward end of the hood space. (See hood, straightline.)

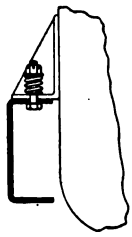
Radiator, Honeycomb—A name applied to radiators of the cellular type (q. v.), especially to those in which tubes of hexagonal section are used.

Radiator, Tubular—A radiator consisting of a combination of tubes surrounded by cooling air, through which the jacket water is circulated, in contradistinction to a radiator of the cellu-

lar type (q. v.) in which the cooling air passes through tubes, around which the jacket water flows.

Radiator, Underhung—A radiator carried attached to the under side of the vehicle frame. Usually of the coil type.

Radiator Bracket—A bracket attached to each side of the bottom of the frame of a vertical, front mounted radiator, by which it is secured, respectively, to the two side members of the vehicle frame. Sometimes the brackets are of the trunnion type, thus relieving the radiator of stresses.



RADIATOR BRACKET.

Radiator Casing—The ornamental sheet metal casing surrounding the essential parts of a radiator.

Radiator Draw-off—A cock or tap inserted in the bottom of a radiator through which the water may be drawn off.

Radiator Fan—See fan.

Radiator Filler Tube—A tube, inserted in the tank at the top of a radiator, and closed by a cap (the filler cap), through which water is supplied to the cooling system.

Radiator Frame—The structural part of a radiator which holds together the tubes and headers and by which the whole radiator is mounted upon the vehicle.

Radiator Overflow—A means for providing for the escape of steam and the excess volume of water created by expansion from the tank of a radiator, usually consisting of a pipe inserted into the tank and terminating below the radiator.

Radiator Spreader—A device placed in a radiator tank (q. v.) to distribute the circulating water evenly among the radiator passages.

Radiator Tank—A tank, usually forming the upper portion of a radiator, from which water is distributed to the cooling passages and which holds a supply of water to compensate for that lost by evaporation or otherwise.

Radiator Tie Rod—The rod commonly used to give support to the top of a front mounted radiator, one end of which is se-

cured to the dashboard and the other to the top of the radiator frame, a turnbuckle being generally provided to permit the length of the rod to be adjusted.

Radius Rod—See distance rod.

Rake—Upward and backward inclination of a vehicle part, as of the steering post.

Rating Formula—A mathematical formula, by the application of which the output of a gas motor may be calculated when such data as its cylinder bore, piston stroke and number of cylinders are known. E. g., The formula H. P.$=\frac{d_2 \ S \ n}{10}$ where d is the bore in inches, S the stroke in inches and n the number of four cycle cylinders, is an example of such a formula.
See horsepower *A. L. A. M.*

Reach Rod—A structural member of the running gear of some motor vehicles, the function of which is to connect the rear axle with the front axle.
Syn.: Perch.

Ream (v.)—To finish a hole to size by means of a reamer (q. v.). Some motor cylinders are reamed after being bored.

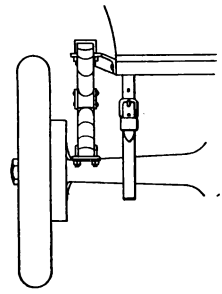
Reamer—A metal working tool, consisting of a fluted cylindrical bar carrying longitudinally arranged cutting edges upon its cylindrical surface which, when inserted in a bored hole and forced therethrough with a rotary motion, enlarges the diameter thereof very slightly, by taking a light chip from the walls of the hole, leaving it nearly true and of approximately the same diameter as the reamer itself, which is usually of a standard size. If the reamer is slightly conical (taper reamer) instead of cylindrical, it produces a taper hole, such as required for the reception of a taper pin, for instance.

Rebound Check—See shock absorber, recoil strap.

Reciprocate (v.)—With reference to a mechanical part. To move alternately backward and forward.

Reciprocating Parts—Strictly, parts which reciprocate (q. v.) only, such as a motor piston, piston rod and crosshead, but the term is often applied to parts which not only reciprocate but oscillate (as a motor connecting rod).

Recoil Strap—A continuous strap or loop, generally of leather, used to check the recoil of vehicle springs. Two such straps are often used, passed around the rear of an automobile frame, respectively, at or near the two sides thereof, and also loosely looped, respectively, around the two ends of the rear axle casing. The body is free to lower relatively to the axle, but if it tends to rise far above its normal position the straps are tightened, and the rebound of the body away from the axle is stopped. Sometimes applied to act between the upper and lower members of a full elliptic spring to prevent their separating abnormally.



RECOIL STRAP.

Syn.: Rebound strap, jump strap, limit strap.

Rectifier, Alternating Current—A device for converting alternating current (q. v.) into direct current (q. v.) to permit the charging of storage batteries by electrical energy derived from an alternating current supply. The electrical arrangements are usually such that the flow of current in both directions is utilized, but matters are so arranged that the flow in the battery to be charged is in a constant direction.

Syn.: Alternating current converter. See motor generator.

Rectifier, Aluminum Cell—A form of rectifier making use of the property possessed by an electrolytic cell employing aluminum plates of permitting current to flow through it in one direction only ("electric valve" action), to convert an alternating into a pulsating direct current.

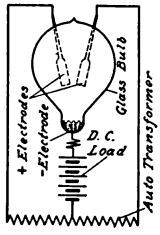


DIAGRAM OF MERCURY VAPOR RECTIFIER.

Syn.: Chemical rectifier or converter.

Rectifier, Mercury Vapor—A form of rectifier making use of the property possessed by the electric arc in mercury vapor of permitting current to pass through it in one direction only ("electric valve" action), to convert an alternating into a direct current.

Syn.: Electrolytic rectifier, electrolytic converter, mercury arc converter.

Rectifier, Vibrating Armature Type—A form of rectifier consisting of a vibrat-

ing armature (q. v.) under the control of an alternating current electromagnet, which automatically reverses the circuit connections of a storage battery under charge from an alternating current supply each time the current reverses its direction, and thus causes a pulsating direct current to be supplied to the battery. Used to charge ignition and lighting batteries.

Syn.: Commutating rectifier.

Relief Cock—See compression cock.

Relief Valve—A valve the function of which is to automatically open and relieve the pressure in a fluid containing system, when it exceeds a predetermined value, by allowing the excess of fluid to escape or to be sent through a by-pass (q. v.) to the low pressure side of the system. The point of action of such a valve is usually regulated by the tension of the spring which seats it.

A relief valve is sometimes employed in pressure fuel feed systems which make use of exhaust gas or air pressure, it being arranged to act when the desired pressure in the system is exceeded.

Reserve Tank—See auxiliary fuel tank, auxiliary oil tank.

Reserving Valve—See fuel valve, reserving.

Resistance, Electrical—The hindrance offered by a substance forming part of an electric circuit to the flow of electricity through it. It may be regarded as similar to the frictional resistance offered by a pipe to the flow of water. Good conductors (q. v.) offer comparatively little resistance, while insulators on non-conductors (q. v.) are of extremely high resistance. The resistances of rods or wires of a given material are directly proportional to their lengths and inversely proportional to their sectional areas. The unit of electrical resistance is the ohm (q. v.). For the mathematical relations of current, electromotive force and resistance in direct current circuits, see Ohm's law.

Resistance, External—The resistance offered by an electric circuit (see circuit, closed) not including that of the current source (battery or dynamo).

Resistance, Internal—The resistance offered by a current source, e. g., the resistance of the plates and electrolyte (q. v.) of a battery or that of the armature winding (q. v.) and other parts of a magneto or dynamo which are included in the main circuit.

Resistance Control—A method for controlling the speed of an electric vehicle (see controller) in which the voltage applied to the motor is varied by means of resistance inserted into or withdrawn from the motor circuit by the controller. Other things remaining the same, the greater the resistance in circuit the lower the voltage at the motor, and the lower its speed and vice versa. Resistance control is wasteful and is used only as an auxiliary method in connection with more economical methods. See field commutation control and controller, series parallel.

Syn.: Rheostat control.

Retard (v.)—In reference to ignition timing: To so arrange matters that the spark occurs later in the cycle (q. v.) of the motor. The opposite of advance. See ignition, delayed.

Retread (v.)—With reference to pneumatic tires. To replace the tread (see tire tread) of a tire which has been worn out or damaged in service or which has proven defective.

Reverse Band—The friction band, acting upon the reverse drum (q. v.) of a planetary gear, which, when tightened by the control mechanism, secures the reverse motion of the car.

Reverse Clutch—In an individual clutch change speed gear, the clutch which, when engaged, secures the reverse motion of the car.

Reverse Drum—In a planetary gear (q. v.) the drum which, when held from turning by the reverse band, secures the reverse motion.

Reverse Gear—The mechanism by means of which backward motion of a motor car is secured. In gasoline cars the direction of rotation of the motor being constant, the reverse mechanism is embodied as a part of the change speed gear, and when in action causes the final drive shaft thereof to rotate in a direction opposite to that in which it rotates when forward speeds are in use. As steam engines and electric motors can rotate in either direction, reversing their directions of rotation reverses the direction of car movement. See planetary gear and friction drive for the principles involved in their reverse actions. In gearsets of the sliding gear, (q. v.) direct drive (q. v.) type, reverse motion is generally secured by sliding one of the gears on the final drive shaft (commonly the low speed gear) into mesh with an idler (q. v.) or intermediate gear, which is in mesh with a gear carried by the layshaft (q. v.). The inclusion of the idler in the gear train causes the final drive shaft to rotate in the same direction

as the layshaft, while on forward speeds the opposite is the case. In individual clutch systems a separate gear and clutch, usually on the driven shaft and a gear on the motor shaft, with an idler in mesh between them, are put into operation to secure the reverse. In steam vehicles the reversal of the direction of rotation of the motor and hence reverse motion of the vehicle, is usually obtained by manipulation of the valve gear by the link motion (q. v.). In electric vehicles the motor is reversed by reversing the direction of current, either through the fields or through the armature.

Reverse Idler—The pinion which, in sliding gear and individual clutch gear sets, by acting as an intermediate rotating member between two main gears, causes the reversal of rotation of the final drive shaft. See idler.

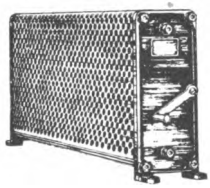
Reverse Latch—A safety device designed to prevent a sliding gear (q. v.), change speed gear, from being unintentionally placed in the reverse position. It consists of means for normally blocking the reverse slot or position of the gear changing quadrant (q. v.), so that the gear shifting lever cannot be made to enter it until the operator presses a button or thumb-piece upon the lever handle, which releases the latch.

Syn.: Reverse gate.

Reverse Lever—A lever, the operation of which causes a car to back. In some electric vehicles the reverse lever performs the reversing function in conjunction with the controller handle, and in some steam cars a reverse lever is employed which acts upon the link motion and varies the point of cut-off (q. v.) as well as reversing the engine.

Reverse Pedal—A pedal the operation of which causes a vehicle to back, as in some planetary geared cars and some steam and electric vehicles.

Rheostat—A device for introducing resistance into an electric circuit for the purpose of varying the current flowing therein. It usually consists of a frame containing coils of rather high resistance wire, such as iron or German silver, and provided with means by which the current may be passed through the whole or any part of the coils, and much or little resistance thereby be introduced. Used in regulating the charging current supplied to storage batteries, in regulating the



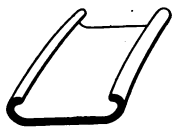
RHEOSTAT.

current in the field coils (q. v.) of dynamos and hence the voltage produced, and as an auxiliary in the speed control of electric vehicles. (See resistance control.)

Rib—A thickened portion of a casting, usually rather narrow, extending over portions thereof where the stresses acting are severe and serving as a reinforcement to make the part more rigid. In castings which must be light, such as crank and gear cases, the walls are cast rather thin, and strength and stiffness are secured by providing ribs along lines where failure might otherwise take place.

Ride (v.)—Faulty action of a sprocket chain. See climb.

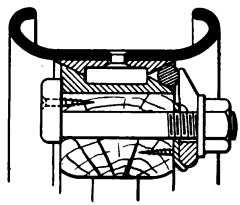
Rim—A ring shaped channel secured around the outside of the felloe of a vehicle wheel and designed to secure thereto a solid rubber or pneumatic tire.



SECTION OF CLINCHER RIM.

Rim, Clincher—A rim of somewhat crescent shaped section, with incurved edges adapted to hold the shoulders or beads of a tire casing of the clincher type (see tire, clincher. It may have several equally spaced holes through it to receive the retaining bolts, which assist in holding the tire to the rim.

Rim, Demountable—A form of rim upon which is mounted a fully inflated pneumatic tire and which can quickly be substituted for another similar rim, the tire upon which has becomed damaged. One or more demountable rims, with their inflated tires, are carried upon a car, and in event of tire trouble it is only necessary to loosen the fastening devices which secure the rim to be changed to its wheel, take it off and attach in its place one of the spare rims and tires. The labor of changing tires and inflating them upon the road is thus avoided. The demountable rim is bolted to a steel band shrunk upon the felloe or fastened thereto by some equivalent device, and the tire is held thereupon by either the clincher or quick detachable method.



DEMOUNTABLE RIM.

Rim, Quick Detachable—A rim built up of several ring-like parts, so arranged that the part holding one edge of the tire may readily be detached, allowing the tire to be slipped off for repairs or replacement. The parts of the rim are held together by some form of locking device, and in event of tire trouble it is only necessary to release the locking device and remove the ring which holds the outside edge of the tire when the tire can be removed without the use of force which the removal of a clincher shoe from a solid rim entails. The tire being repaired, it can be replaced upon the rim without the use of great force, the outside ring put in position and the locking device tightened.

QUICK DETACHABLE RIM.

Syn.: Separable rim.

Rim, Separable—See rim, quick detachable.

Rim, Universal—A rim of the quick detachable type, adapted to hold any standard make of pneumatic tire casing, whether of the clincher or straight bead type (see tire bead), an easily effected rearrangement of the parts permitting either style of casing to be utilized.

Rim Cutting—The penetration of the edges of a rim into the outside wall of a pneumatic tire caused by continued pressure between them. It is usually caused by underinflation, by some defect in the rim or by the use of a casing and rim not adapted one to the other. Its effect is to weaken the wall of the casing so that a blowout ultimately occurs.

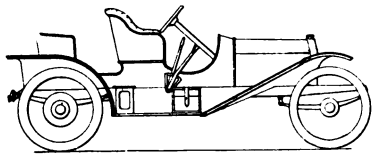
Ring Oiler—A device for oiling shaft bearings, consisting of a small, oil filled reservoir formed in the bearing stand and a metal ring, loosely threaded around and resting upon the shaft and dipping into the oil. As the shaft rotates the ring is also rotated by friction with the shaft, and carries up oil from the reservoir, which it distributes over the shaft. Used in electric vehicle motors and elsewhere. See oil ring.

Road Resistance—See tractive resistance.

Road Test—A test to determine the operative condition of a motor car by driving it upon the highway under service

conditions. A road test generally forms a part of the factory testing routine, and develops and permits the rectification of defects which might otherwise come to light only after the car was in a customer's hands.

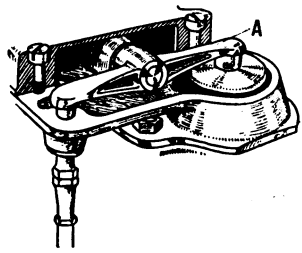
Roadster—A body somewhat resembling the runabout, but usually fitted with a single or double rumble seat. A hooded dash is ordinarily used.



ROADSTER.

Robe Rail—A metal rod or leather strap, supported upon the back of the front seat of a motor car, upon which carriage robes, coats, etc., are intended to be hung.

Rocker Arm—In general a lever pivoted near its centre and given a rocking motion by a rod or other device, acting upon one end, which motion is imparted by the other end of the lever to some other mechanical part. Specifically a part of the mechanism generally employed to open overhead valves (see valve, overhead), the rocker arm being pivoted in a bracket affixed to the cylinder head, a push rod (q. v.) communicating the cam movement to one end thereof, and the other end of the rocker arm acting directly upon the stem of its valve.



ROCKER ARM (A).

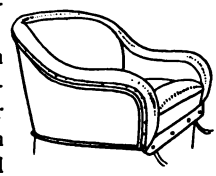
Syn.: Walking beam.

Roller Bearing—See bearing, roller.

Root Circle—In reference to a gear: An imaginary circle drawn through the bottoms of the tooth spaces.

Rubber Cement—Pure rubber or rubber compounded with a small proportion of sulphur, dissolved in a volatile liquid such as benzene, used in applying a coating of pure or vulcanizing rubber to surfaces, as in the manufacture and repair of tires.

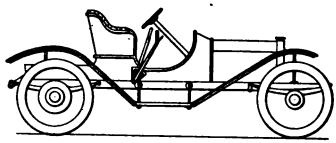
Rumble Seat—A small seat, usually single but occasionally for two, located to the rear of the principal seat and ordinarily intended for casual rather than regular use. Mainly used upon cars of the runabout and roadster types.



RUMBLE SEAT.

Run In (v.)—To operate a mechanism for the purpose of smoothing up the working surfaces of its moving parts by their mutual frictional action. Motors are "run in" and inaccuracies of adjustment and manufacture smoothed out by operating them for a considerable period by external power or their own power, a plentiful supply of oil being provided. The same treatment is applied to gear sets, rear axles and other parts.

Runabout—A body primarily intended to accommodate two persons upon a single seat which is usually located considerably further to the rear of the chassis than is the front seat of a touring car. A rumble seat, an artillery box, a trunk platform or gasoline and oil tanks may occupy the space to the rear of the seat or a sloping back enclosing luggage space may be used.



RUNABOUT.

Running Board—A continuous step, extending horizontally, at a convenient height, between the front and rear fenders (q. v.) on each side of a motor car, usually made of pressed steel or aluminum or of steel or wood, covered with linoleum or some similar material and supported by irons from the frame. It is useful not only as a step, but as a protection to the passengers from flying mud and as a support for tool and battery boxes and gas tanks or generators.

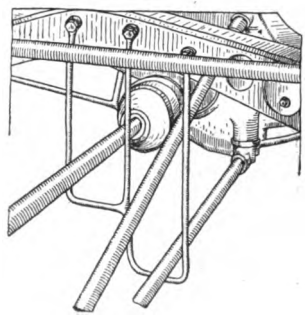
Running Gear—A term applied collectively to the combination of motor car parts which is common to all wheeled vehicles, such as the frame and other structural parts, wheels, springs, axles and their immediate attachments.

Rush (v.)—To speed up a car, thus increasing its momentum, in order that the energy of motion thus imparted to it may be

expended in assisting the motor to overcome a temporarily increased road resistance, such as a short hill or a short stretch of mud or sand.

Safe Starting Position—That position of the timer (q. v.) and spark lever (q. v.) of an ignition system corresponding to a timing of the spark sufficiently retarded so that the danger of the operator's receiving a back kick (q. v.), when cranking the motor, is obviated.

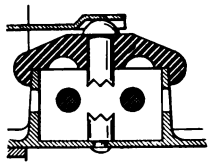
Safety Loop—A metal loop attached to and extending down from the frame of a shaft-driven car so as to encircle the driveshaft at a slight distance below it. Should the driveshaft break away at its forward end it would be caught by the safety loop and prevented from falling and catching in the roadbed with the possibility of damaging the mechanism or of overturning the car.



SAFETY LOOPS.

Safety Plug—A circuit closing plug which can be removed from a socket upon an electric vehicle, when it is to be left unattended, thus breaking the electric circuit from the battery to the motor and thereby preventing the starting of the vehicle until the plug is replaced. The term is also sometimes applied to the fusible plug (q. v.) used in steam vehicle boilers.

Safety Spark Gap—A pair of discharge terminals (q. v.) arranged at a suitable distance apart, connected respectively to the two ends of the secondary coil (see coil, secondary) of an ignition induction coil (see coil, induction), or of a high tension magneto armature (see magneto, high tension), so that, in case the high tension wires leading from the coil become detached from their spark plugs, the discharge can take place harmlessly at the safety spark terminals, rather than destructively through the insulation of the coil. The safety spark



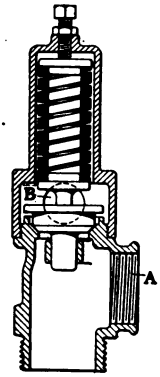
SAFETY SPARK GAP.

gap is usually housed or enclosed in wire gauze, so that the spark thereat cannot ignite stray gasoline vapor.

Safety Spark Retarder—An automatic device for preventing the starting crank of a motor car from being used unless the spark timer is set in the safe starting position (q. v.).

Safety Starting Crank—See crank, safety starting.

Safety Valve—A valve, which, when opened, permits the escape of steam from a boiler when the pressure within it exceeds a predetermined point, thus preventing further increase of pressure, and obviating the danger of an explosion. Such a valve is normally held to its seat by an adjustable spring and automatically opens when the steam pressure acting against it overbalances the spring tension.



SAFETY VALVE.
A, Connection to Engine; B, Outlet to Atmosphere.

Syn.: Pop valve; escape valve.

Saturate (v.)—To completely or nearly completely charge with magnetism a mass of iron or steel, such as the field or armature core of a dynamo.

Saturated Mixture—Air which has taken up all the fuel vapor which it can retain. In certain forms of carburetor (see carburetor vaporizing tube) a saturated, or at least a very greatly overrich mixture is first formed, which is diluted with air before reaching the cylinders.

Scale (v.)—With reference to a gas motor valve: To loosen thin portions thereof or of the seat, under the oxidizing action of the hot gases, lack of tight seating being the result.

Scale (n.)—An adherent substance which gradually forms upon the inside surfaces of the water spaces of steam boilers and of gas motor water jackets and radiators, and which is the result of the action upon the metal of mineral and organic impurities in the water. Scale retards the passage of heat to and from the water and thus reduces the efficiency of the apparatus, and in the case of steam boilers sometimes causes their burning out. Caustic alkali solutions are often used as scale removers.

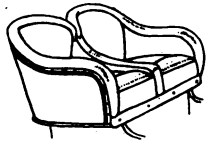
Scavenge—In the operation of a gas motor, to expel the products of combustion from the cylinders prior to the entrance of a fresh fuel charge. In four-cycle motors this is accomplished by the inward stroke of the piston, known as the exhaust stroke (q. v.), and the tendency for the burned gases to leave the cylinders is sometimes augmented by the use of an exhaust manifold, ejector type (q. v.). In two-cycle (q. v.) gas motors the incoming charge is generally depended upon to displace the burned gases, thus scavenging them out of the cylinder through the exhaust port, which is located opposite to the admission port. See deflector plate. In some two-cycle motors a special charge of fresh air, admitted ahead of the fuel charge, is depended upon to scavenge the cylinder.

Scavenging Stroke—See exhaust stroke.

Score (v.)—With reference to the action of one moving part upon another, to cut or abrade their working surfaces, e. g., a motor piston sometimes scores its cylinder walls, forming grooves in their respective surfaces and destroying the tightness of their fit. Scoring is usually caused by lack of lubrication, or by the accidental protrusion of some moving part against a smooth surface, as of the wrist pin against the cylinder bore.

Scrape (v.)—To finish the working surface of one part into perfect fit with that of another related part by removing, by means of a hand tool (scraper), the inequalities of the surface of the part which is not true, e. g. Bearing bushings are often scraped until they fit the shafts which run in them.

Seat, Divided—A motor car front seat, which is divided into two seating compartments for the operator and a passenger respectively, by a central upholstered partition, which gives support to the occupants' bodies and prevents their jostling together.



Divided Seat.

Second Gear—That arrangement of a change speed gear which secures a speed ratio between the final drive and the motor next higher than that secured by the low gear (q. v.). In three speed gearsets this is synonymous with the intermediate gear (q. v.).

Syn.: Second speed.

Secondary Battery—See accumulator.

Secondary Coil—See coil, secondary.

Secondary Commutator—A distributor (q. v.).

Secondary Gears—Synonymous with half-time gears (q. v.) and cam gears (q. v.).

Secondary Shaft—Synonymous with cam shaft (q. v.) and half-time shaft (q. v.).

Secondary Wiring—Wiring used to convey a secondary or high tension current (q. v.). See high tension wire.

Sector—A portion of a gear, consisting of an arc of its toothed circumference, its hub and spokes; which is used, in mesh with a worm or spur pinion, in steering devices (see steering device, worm and sector) and in other gear combinations in which one of the gears does not perform a complete rotation. The term is also applied to control lever guides. (See quadrant.)

Seize (v.)—In reference to bearing surfaces, to adhere together so that they cannot be moved one upon the other. If no film of lubricant is maintained between the surfaces and they are operated together under pressure, heat is developed and metal particles of one surface enter superficially into the metal of the other surface and the surfaces stick together, leaving them rough and in an inoperative condition when they are separated.

Selective System—See sliding gears, selective.

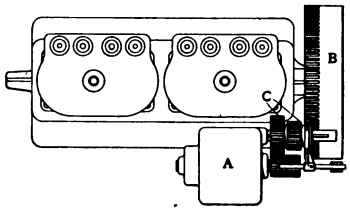
Selector—In a sliding gear change speed device of the selective type, a fork carried upon the end of a crank which rotates one of the gear shifting shafts (q. v.), and with which the gear shifting lever (q. v.) engages when it is moved out of its neutral position. Two selectors are commonly employed, located upon opposite sides of the neutral position, each selector controlling the movement of the shaft which shifts its respective pair of sliding gears.

In a self-starting device, an indicator which shows which cylinder is in the firing position.

Self-Contained—With reference to a mechanism: Capable of performing its functions without the co-operation of apparatus external to it, e. g. The self contained lubrication system, requires no piping, reservoirs, pumps, etc., external to the motor in which it is used. (See lubrication, circulating system.) The term is sometimes used in the sense of "compact" merely.

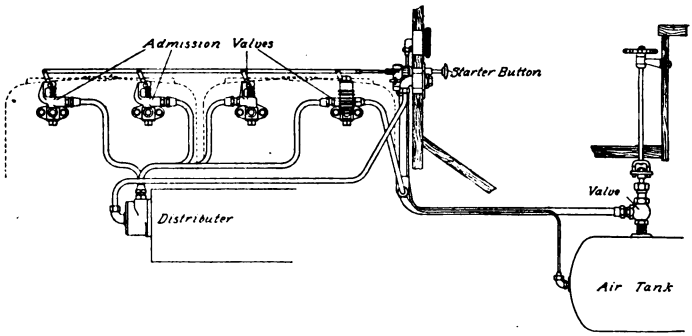
Self-Starter—A device designed to obviate the necessity of cranking a gas motor in order to set it into operation, consisting of means for turning over the motor by mechanical instead of human energy, until it commences to fire its charges and operate normally.

Self Starter, Electric Motor Type—A self starter, which starts a gas motor into rotation by means of an electric motor supplied with current from a storage battery carried upon the car. When starting is to be effected the armature pinion (q. v.) of the electric motor is thrown into mesh with a large gear upon one of the gas motor shafts and current is turned on to the electric motor and, when the gas motor is in normal operation the armature pinion is thrown out of gear. The electric motor and storage battery usually act as parts of the vehicle lighting and ignition system when not in use as parts of the self starting system.



ELECTRIC TYPE SELF STARTER.
A, Motor Generator; B, Flywheel with Teeth cut on its Periphery; C, Intermediate Shift Gears.

Self Starter, Gas Pressure Type—A self starter in which gaseous pressure, admitted from a storage tank carried upon the car, through a hand operated cock, a distributing valve (see valve, distributing) and check valves to the compression spaces of the several cylinders, successively, when on their working strokes, causes the motor to rotate and to draw its charges, which are fired by the spark, thus causing the regular operation of the motor to commence, when the self starting pressure is cut off by closing the cock. Either air pressure created by a

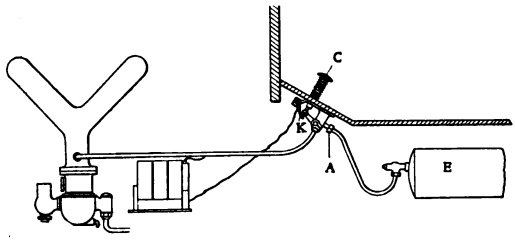


GAS PRESSURE TYPE SELF STARTER.

power driven air pump or exhaust gas pressure obtained from one cylinder, through a check valve, is used. The distributing valve is gear driven at one-half engine speed.

Syn.: Compressed air starter.

Self Starter, Ignition Type—A selfstarter which charges with a combustible fuel mixture the cylinders of a gas motor either (1) by introducing it into each cylinder individually, or (2) into the intake pipe, at the moment after ignition has been interrupted and the motor is stopping. In (1) a hand operated distributor valve (see valve, distributor), controlling the flow of acetylene from a gas tank, delivers a measured quantity of gas through a separate pipe and check valve to the combustion space of each cylinder, and in (2) the act of the operator, which interrupts the ignition, also opens a valve permitting acetylene to enter the intake pipe and to be sucked into all the cylinders during the final rotations of the motor. After the cylinders are thus charged, the motor may be set in operation by starting on the spark (q. v.). Syn.: Spark self-starter, acetylene self starter.



IGNITION TYPE SELF STARTER.

E, Acetylene Tank; C, Foot Button, which, on being pushed down when the Motor is stopped, opens the Valve A, allowing a charge of Acetylene Gas to be drawn into the Cylinders during the last few strokes of the Motor, and at the same time short circuits the Magneto at K. A manipulation of the Spark Lever will start the Motor.

Self Starter, Spring Type—A self starter which starts the motor into rotation by utilizing the mechanical energy stored in a coil spring, which can be made to act upon the crankshaft. The spring is automatically rewound by the power of the motor when it is operating normally.

Semi-Selective System—See sliding gears, semi-selective.

Separator—A thin sheet of perforated, non-conductive material, such as hard rubber, celluloid or wood placed between neighboring positive and negative plates of a storage cell to keep the plates out of contact and to prevent the space between them from being bridged by active material (q. v.) shed (q. v.) from the plates.

A device to prevent water accidentally present in gasoline from reaching the carburetor. See filter.

A device for removing cylinder oil from the water collected in the condenser of a compound steam vehicle motor, the difference in specific gravity of the two liquids being made use of to effect the separation.

In a ball bearing, a thin metal cage in which the balls are loosely held so that they cannot roll one upon another.

Series Connection—The connection of several electrical devices in circuit so that the same current passes through them successively. Battery cells are connected in series when the positive terminal of one is joined to the negative terminal of a second, and the positive terminal of the second cell to the negative terminal of a third cell. and so on, until all are connected. The electromotive force (q. v.) of such a series connected battery is equal to the electromotive force of one cell, multiplied by the number of cells and its internal resistance (see resistance, internal) is equal to the internal resistance of one cell multiplied by the number of cells.

Syn.: Tandem connection.

Series wound—See dynamo, series wound and electric motor, series wound.

Set Screw—A means for locking in fixed relative position two parts which are capable of sliding or rotating one within the other. It consists of a screw with a hardened and sometimes cup-shaped or otherwise specially formed point, which is threaded in a hole drilled in the outside part and which can be screwed down tightly against the surface of the slidable or rotatable inside part so that it cannot move, a small depression or "spot" being made in the surface against which the screw is set to receive its end.

Settling Pocket—A depression, formed in the bottom of a liquid containing chamber, in which collects relatively heavy foreign matter present in the liquid and from which it can be

drawn off through a cock or plugged opening. Used in gasoline tanks, oil tanks and gasoline separators (see filter).

Shaft Drive—A method of transmitting the power of a motor to the driving wheels of a car in which a shaft, rotated by the motor, drives the wheels by means of gears.

In cars propelled by front mounted motors, with their shafts longitudinal of the car, the drive shaft (q. v.) is longitudinally placed; connected at its front end to the clutch or final shaft of the change speed gear and driving the rear axle by bevel or worm gearing (see bevel gear drive; gear, worm; driveshaft, single jointed; drive shaft, double jointed.) In a few commercial vehicles the drive shaft is transversely placed, and each end thereof carries a spur pinion which meshes with a large internal gear bolted upon one of the driving wheels.

Shed (v.)—With reference to the active material (q. v.) of storage battery plates, to fall away from the grids (q. v.), to which it is attached, with the result of reducing the capacity of the cell and possibly of shortcircuiting (q. v.) it. The action is caused by deformations of the grids occurring when very heavy currents are passing.

Shield—A continuous guard, usually of sheet steel, filling the space between the running board (q. v.) and fenders (q. v.) and the body of a car, designed to prevent road splash from reaching the body and the passengers.

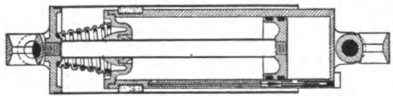
Syn.: Splash apron.

Shift Gears (v.)—To change gears (q. v.).

Shim—A piece of thin material, usually sheet metal, placed between two parts of a mechanism to adjust their distance apart, e. g., shims are used between bearing caps (q. v.) and bearing brackets (q. v.) to regulate their distance apart when they are bolted together, and thus to adjust the pressure of their bearing surfaces upon the shaft which they hold. When a shaft has worn its bearings, by taking out one or more shims under each side of the bearing cap, the looseness may be corrected.

Shock Absorber—A device designed to reduce the severity of the road shocks communicated from the running gear to the body of a vehicle by regulating the action of the springs—especially by checking the violence of their recoil.

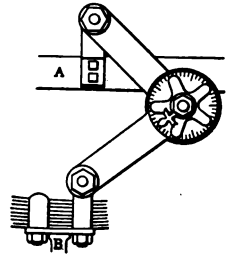
Shock Absorber, Dashpot Type—A type of shock absorber in which sudden and extensive movements of the springs are resisted and retarded by fluid pressure, acting in a dashpot (q. v.), the cylinder and piston of which are respectively attached to the vehicle frame and the axle.



SECTIONAL VIEW OF DASHPOT TYPE SHOCK ABSORBER.

Gradual movements of the springs are permitted by the escape of the fluid from the cylinder (if air is used) or by its being by-passed (q. v.) around the piston (if oil or glycerine are used), but abrupt movements are checked by the pressure of the fluid acting upon the dashpot piston.

Shock Absorber, Friction Type—A type of shock absorber which dampens the action of the springs, preventing their excessive movement and vibratory action by imposing a constant or progressively increasing friction which resists their movement. In a common form of this type the friction is applied between adjustably spring pressed discs placed at the pivot of a toggle joint, formed by two arms, one end of one of which is pivotally attached to the vehicle frame, and one end of the other to the axle, their other ends being united at the friction joint. As the vehicle body raises and lowers, relatively to the axle, the toggle joint opens and closes and the friction at its pivot gives the desired dampening action.



FRICTION TYPE SHOCK ABSORBER.
A, Frame; B, Axle.

Shop Test—A test to which an automobile and its component elements are subjected to determine its fitness for use, before it is delivered to the purchaser by its manufacturer. Such a test may include any or all of the following operations or others: The running of the motor upon a test stand with a dynamometer (q. v.) to measure its output, a test of the efficiency and quietness of operation of the change speed gear and rear axle unit, and a test of the completed chassis, under power, the output at the wheels being measured by a dynamometer.

Syn.: Factory test.

Short-Circuit—The passage of an electric current by a path shorter than that over which it is intended it should normally flow, thus withdrawing from the circuit a portion of the conductor through which it should pass. An accidental short-circuit is usually caused by the failure of the insulation between some of the conductors forming the circuit, as by the action of a high electromotive force, the current thus being afforded a short path from one conductor to another through the ruptured insulating material. A short-circuit may be intentional, as in the act of shutting off a high-tension magneto, a short path being afforded from one terminal of the low tension winding to the other around the make-and break, thus preventing the interruption of current by the latter and stopping the production of sparks.

Short Stroke Motor—See long stroke motor.

Shoulder—An abrupt increase in the size of a mechanical part, especially an abrupt increase in diameter of a shaft, used to limit the endwise motion thereof or for some other purpose.

Shunt Wound—See dynamo, shunt wound.

Shutter—See air damper.

Shuttle Wound—A term applied to magneto and dynamo armatures, the conductors of which are wound in two longitudinal, diametrically opposite slots, of somewhat rectangular section around a shuttle shaped or H section armature core (see core, magnetic), as thread is wound upon a shuttle.

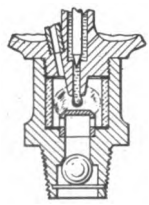
Side Member—One of the two members of a vehicle frame which form the sides thereof. See frame.

Side Curtains—See top, cape.

Side Slip—See skidding.

Side Sway—The two-and-fro motion of a car upon its springs, in a horizontal plane, sometimes experienced at high speeds.

Sight Feed—A visual indicator used to demonstrate the flow of a liquid, usually of oil, in a lubricating system, consisting of a small chamber into which are connected a pipe through which oil is delivered from the source of supply, and another pipe through which the oil flows to a bearing or other point of application. The chamber is provided with a transparent window through which the flow of oil may be observed. The sight feed is usually



SIGHT FEED.

located within view of the operator, as upon the dashboard, and there is sometimes incorporated with it an adjustable needle valve to regulate the rate of flow of the oil. Syn.: Telltale.

Silicon Steel,

Silico Manganese Steel,

Silico Vanadium Steel—See steel.

Sill—One of the main members of a vehicle frame, particu larly when of wood.

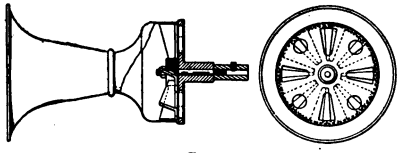
Simpling Device—A term applied to the piping and valves used in connection with a compound steam engine (see steam engine, compound) to permit the temporary admission of live steam to the low pressure cylinder to increase the output of the engine. When the simpling device is in use the engine operates as a two cylinder simple engine.

Single Coil Ignition—See ignition, single coil.

Single Motor Equipment—In an electric vehicle, the use of a single motor driving the traction wheels through a differential gear (q. v.) and suitable reduction gearing in contradistinction to double motor equipment (q. v.).

Single Spark Ignition—See ignition, single spark.

Siren—A kind of alarm or signaling device sometimes used upon automobiles. It consists of a perforated, hollow cylindrical member rotatably fitted within a stationary cylindrical housing provided with corresponding perforations. As these parts rotate relatively their perforations pass each other and sound waves, the pitch of which varies with the rotative speed, are produced which are directed by a horn shaped resonator. The rotating member may be driven by a small battery energized electric motor or by means of a friction pulley which is pressed into contact with the flywheel of the vehicle motor.



SIREN.

Skidding—The abnormal sidewise movement and unintentional change of direction of a motor vehicle caused by one or both pairs of its wheels moving upon the roadway in directions other than those in which they are being steered—that is, slipping sideways. It is occasioned by lack of adhesion of the wheels to the roadway, due to the slippery condition of the latter and

may be brought about by changing a vehicle's course too sharply at too high speed, by applying the brakes or power too suddenly when the two traction wheels are upon unequally slippery footing or by driving upon the sloping side of a crowned road. The liability of skidding can be reduced by driving very slowly over slippery roads, by avoiding sharp turns of the steering wheels and sudden and powerful brake applications, by keeping to the flat portion of the roadway, and by the use of anti-skid devices (q. v.), tire chains (q. v.), and anti-skid tires (q. v.).

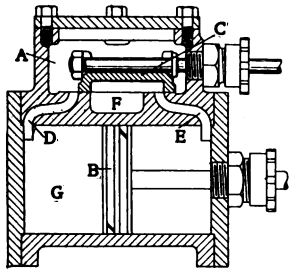
Syn.: Side Slip.

Skip (v.)—To miss (q. v.).

Sleeve—A hollow internally cylindrical member fitted closely around another cylindrical member, the two members being capable of sliding or rotating relatively to each other.

Slide—The crosshead guide (q. v.).

Slide Valve—A valve commonly used in double acting steam vehicle engines of a somewhat D shape, and arranged to slide over the two admission ports, and the single central exhaust port in the inside wall of the steam chest (q.v.). It is given a reciprocating motion by means of the valve stem (q. v.) and a link motion (q. v.). In the accompanying diagram *A* is the steam chest, *C* the slide valve. *D* and *E* the ports of the head and crank ends of the cylinder respectively, *F* the exhaust port, *G* the cylinder, and *B* the piston; the valve being represented in its extreme right hand position, steam being admitted to the head end through port *D*, and being exhausted from the crank end through ports *E* and *F*. As it moves toward the left, steam is cut off from the head end by the closing of port *D* (see cut-off, point of), and thereafter acts expansively therein until exhaust occurs. Exhaust from the crank end is terminated by the closing of port *E*, and compression takes place at that end of the cylinder. As the valve moves still further to the left, steam is admitted to the crank end through port *E*, and exhaust takes place from the head end through ports *D* and *F*. The valve then commences to move back



Sectional View of Steam Engine, Showing Slide Valve C.

toward the right, causing cut off in the crank end, compression in the head end, exhaust in the crank end, and admission in the head end. Syn.: *D* valve.

Sliding Gears—A type of change speed gear (q. v.) in which the several speed ratios between the motor and the final drive shaft are obtained by throwing into mesh, at will, any one of several pairs of spur-gears, the ratio of the number of teeth of the two gears of each pair being different and so chosen as to provide the required series of gear ratios (q. v.). One gear of each pair is carried upon a shaft driven by the motor, and the other gear of each pair is carried upon the parallelly located final drive shaft of the gearset. One gear of each pair is arranged to be meshed with its mate by sliding it along its shaft so that the sides of its teeth enter the tooth spaces of the other. See gear case, and headings under gear shifting.

Syn.: Clash gears. Sliding gear transmission. Sliding pinion system.

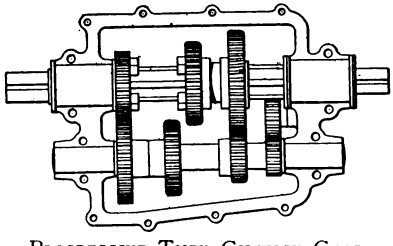
Sliding Gears, Direct Drive Type—A type of sliding gear change speed device, a common three speed form of which consists of a short shaft (the primary shaft) driven from the motor through the clutch and carrying a gear which is in constant mesh with another gear upon a parallel shaft (the layshaft) (q. v.) which latter is thus constantly rotated so long as the primary shaft is in motion. In alignment with the primary shaft and having one of its bearings upon the inner end thereof, is a shaft (the final drive shaft of the gear-set) which is squared or feathered (see squared shaft and keying, multiple), upon which are mounted and held from turning thereon two gears of different diameters, which can be slid along the shaft—the larger being the low and reverse gear and the smaller the intermediate gear. Upon the layshaft are secured two forward speed gears, the larger the intermediate gear and the smaller the low gear, so located that the corresponding sliding gears can be meshed with them. Upon the inside face of the primary shaft gear is fixed one member of a jaw clutch (see clutch, jaw) or internal-external gear clutch (q. v.), and the other clutch member is carried upon the neighboring side of the sliding gear next to the end of the final drive shaft (usually the intermediate gear). The low and intermediate speeds are secured by meshing one or the other of these pairs of gears, the drive being from the primary shaft, through the constantly meshed gears, to the lay-

shaft and therefrom, through the meshed pair of gears to the final shaft. The reverse motion is usually secured as described under reverse gear (q. v.). The direct drive (q. v.) is secured by sliding the two members of the above described clutch into engagement, when the final drive shaft rotates as a unit with the primary shaft, the layshaft then rotating idly or, in some designs, being entirely disconnected and remaining motionless. In some gear sets of this type the sliding gears are on the layshaft and their mates upon the final drive shaft.

Sliding Gears, Indirect Drive Type—A type of sliding gear change speed device, in which two gears are in action on all forward speeds, consisting of a primary shaft, rotated by the motor, upon which are secured as many spur gears of differing diameters as there are forward speed ratios to be secured and a parallel shaft (the final drive shaft of the gearset) which is squared or feathered (see keying, multiple) upon which are mounted, so that they cannot rotate upon it but can be slid along it, an equal number of corresponding gears. The gears are so spaced upon their shafts that only those two corresponding to one particular speed can be meshed at any one time. By meshing the largest gear on the final shaft with the smallest gear on the primary shaft the lowest gear is secured and by meshing the smallest gear on the final shaft with the largest gear on the primary shaft the highest gear is secured; the intermediate speeds being secured by the meshing of gears of intermediate tooth ratios. The reverse is secured as described under reverse gear. In some gearsets the sliding gears are carried on the primary shaft and the fixed gears on the final shaft.

Syn.: Panhard system.

Sliding Gears, Progressive—A type of sliding gear change speed device, the sliding gears of which are all moved simultaneously when gear changes are made, and starting from the neutral position (q. v.) the several speeds are engaged in a fixed succession as the combination of sliding gears is progressively shifted It is thus necessary when passing from one speed

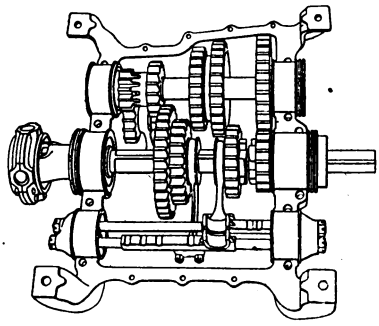


PROGRESSIVE TYPE CHANGE GEAR.

to a speed not next to it in order, to momentarily mesh the gears of intervening speeds. The whole set of sliding gears is shifted by a gear shifting fork (q. v.) and gear shifting shaft (q. v.) or equivalent devices by means of a gear shifting lever (q. v.) moved over a gear shifting quadrant (q. v.).

Syn.: Progressive transmission.

Sliding Gears, Selective—A type of sliding gear change speed device the sliding gears of which are moved in pairs, the movement of a pair in one direction engaging one of its gears with its mate, and its movement in the opposite direction from the neutral positon (q. v.), engaging the other gear with its mate. Each sliding pair is moved by a separate gear-shifting fork (q. v.) and gear-shifting shaft (q. v.) actuated by the gear-shifting lever (q. v.) operating in a gear-shifting gate (q. v.) in conjunction with a selector (q. v.). In three speed selective gearsets of the direct drive type, one sliding pair usually comprises the low and reverse sliding gears and the other pair the intermediate sliding gear and the direct drive clutch. The selective system permits any speed to be engaged or disengaged without the necessity of meshing and unmeshing the gears belonging to any other speed.



SELECTIVE TYPE CHANGE GEAR.

Sliding Gears, Semi-selective—A type of sliding gear change speed device in which the forward speeds are secured upon the progressive system (see sliding gears, progressive) while the reverse is secured on the selective system (see sliding gears, selective) by moving the gear-shifting lever from the neutral position of the quadrant into a special slot which causes it to engage a selector (q. v.) through the action of which and a shaft and fork the reverse gears are meshed.

This arrangement is designed to obviate the danger of engaging the reverse speed when the engagement of a forward

speed is intended, the reverse slot being usually guarded by a reverse latch (q. v.).

Syn.: Semi-selective transmission.

Sliding Key Gear System—A modification of the individual clutch system (q. v.) of gear changing in which, instead of employing a separate clutch to fasten one gear of each pair to its shaft, each of these gears is secured to its shaft at will by sliding a key, movable in a slot in the shaft, into a keyway in the hub of the gear to be made fast.

Sliding Sleeve—See valve, sliding sleeve.

Sliding Shaft—The squared or feathered shaft of a sliding gear change speed device along which the gears are slid. See sliding gears; squared shaft; keying, multiple.

Slip Cover—A covering of durable fabric which can be fastened closely over the upholstery of a car to protect it from dust and wear. The fabric cover which fits around the top, when it is folded down, is sometimes also so called.

Slip Joint—An arrangement designed to prevent the undue stressing of a member, the ends of which are attached to points, the distance apart of which may alter The member is divided at some point in its length, and the end of one part is arranged to telescope within the end of the other part, and thus alter its length by the required amount. In the drive shafts (q. v.) of some cars such a joint is sometimes used (generally incorporated with a universal joint q. v.) to permit the shaft to change its length and still maintain its driving effect, as its support upon the frame and the rear axle approach and recede under spring action. There may also be a slip joint in the drive shaft housing.

Slow Speed—See first speed. See also headings under "low speed."

Smooth-On—A kind of cement used to unite iron parts and to fill cracks therein or to replace small parts of the same, which have been broken away.

Snap Gauge—See limit gauge.

Sod Pan—A protective covering, fitted under the engine, clutch, gearbox, and other parts of an automobile to prevent water and road dirt from being splashed upon them, usually consisting of sheet metal so formed as to fill the space between the front and side members of the frame, from which it is supported, and to extend to the rear of the frame supported

mechanism just clearing the under sides of the parts to be protected. Sometimes the pan is a thin casting, forming a web between the supporting arms of the power plant.

Syn.: Pan, underpan, under protection.

Soot (v.)—With reference to the end of a spark plug within a cylinder, to become covered with carbon or carbonized material, deposited from the fuel or the lubricating oil, with the result that the sparking current leaks across the insulation of the plug, through the carbon coating, instead of passing as a spark between the points of the plug.

Sootproof Spark Plug—See spark plug, protected terminal.

Spacer—A distance piece used in journals which contain two ball or roller bearings, as in wheel hubs, to keep the two bearings in correct position.

Spare Wheel—A road wheel, fitted with a fully inflated tire, adapted to be carried upon a car and quickly and readily to be substituted for one of the wheels of the vehicle, the tire of which, or the wheel itself has become damaged.

Spark—See ignition.

Spark, Early, Late—See advance; retard; ignition, premature; ignition, delayed.

Spark Coil—An induction coil used to produce sparks for ignition purposes. See coil, induction; coil, self induction, and other headings under coil.

Spark Gap—The space between the discharge terminals (q. v.) of a spark plug (q. v.) of the jump spark type, through which the spark passes in the surrounding gas. The width of the spark gap varies from slightly less than $\frac{1}{32}$ to rather over $\frac{1}{16}$ inch, depending upon whether a magneto, high tension (q. v.) or a coil, vibrator type (q. v.) supplies the sparking current.

Syn.: Sparking distance.

Spark (timing) Lever—The small lever, usually mounted upon the steering post, by means of which and a suitable linkage connecting it with the timer (q. v.), the magneto make and break (q. v.) device or the igniter mechanism of a contact spark system (see ignition, contact spark), the point of ignition (see ignition, point of) can be adjusted. The lever usually moves over a notched quadrant by which it is held where it is set.

See advance, retard.

Spark Linkage—The mechanism which transmits the advancing and retarding movement of the spark (timing) lever (q. v.) to the timer (q. v.) or magneto make and break (q. v.).

Spark Plug—A device adapted to be inserted, gastight, into the compression space of a gas motor cylinder, through a hole provided for the purpose in the cylinder wall, and supporting, within the cylinder, two spark points or discharge terminals (q. v.), insulated from each other, between which the electric spark passes in the midst of the compressed gaseous charge and ignites the same. Upon the outside of the plug is provided a binding post to which the live wire of the ignition circuit is connected.

Spark Plug, Jump Spark Type—A type of spark plug used in all high tension ignition systems (see ignition, high tension) consisting of a threaded iron plug of such size as to screw gastight into a threaded hole in the cylinder wall and bored with a central, shouldered, axial hole. To its inside rim is affixed the grounded (q. v.) discharge terminal and within the shouldered hole is placed a hollow, generally cylindrical, shouldered insulating bushing of porcelain, mica or other non-conductive heat-resisting substance, which is made gastight in the iron plug by a gasket clamped by a ring nut. Its outer end extends for some distance outside the iron plug and its inner end is not more than flush with the inner end thereof. In an axial hole in the bushing is a metal stem or wire, bearing upon its inner end the live discharge terminal (q. v.), the end of which is brought into sparking distance with the end of the grounded discharge terminal, and upon the end of this stem as it emerges from the outside end of the bushing is provided a binding post. The sparking current enters at the binding post, passes down the central stem to the live discharge terminal, jumps across the spark gap (q. v.) to the grounded discharge terminal and thence into the iron part of the plug, to the cylinder and to ground (q. v.). Syn.: High tension spark plug.

JUMP SPARK TYPE SPARK PLUG.

Spark Plug, Low Tension—An igniter (q. v.). See ignition, contact spark.

Spark Plug, Magnetic—See ignition, magnetic plug.

Spark Plug, Magneto Type—A form of jump spark plug, the discharge terminals of which are more massive than those used in battery ignition systems in order that they may not be rapidly fused and volatilized by the very hot spark produced by the current from high tension magnetos. See arc flame.

Spark Plug, Protected Terminal—A jump spark plug so constructed that the internal end of the insulating bushing is somewhat protected from lubricating oil and soot (q. v.) by being located in a recess formed by the extended shell-like inside end of the iron portion of the plug.

PROTECTED TERMINAL SPARK PLUG.

Syn.: Sootproof plug.

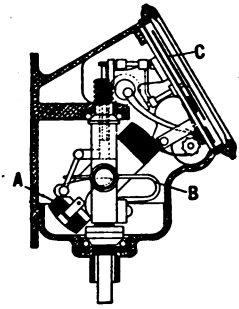
Spark Plug Hole—A threaded hole in the cylinder wall of a gas motor, usually in the wall of the compression space, into which the spark plug is screwed. It is generally a hole drilled and tapped in a valve cap (q. v.).

Spark Shaft—The shaft, within or attached to the steering column, which transmits the movements of the spark (timing) lever to the rest of the spark linkage.

Sparking Points—See discharge terminals and contact point.

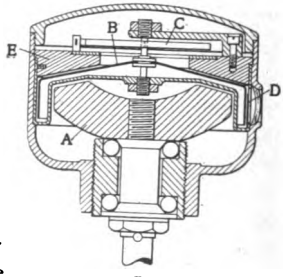
Speedometer—An instrument for indicating, at any instant, the rate of motion of a vehicle, usually reading in miles per hour. It consists of some kind of rotary mechanism, driven from one of the road wheels of the vehicle (usually a front wheel), at a speed always bearing a constant relation to the road wheel speed. By means of the rotary mechanism, an indicator, which is returned to zero by a spring or gravity when the vehicle stops, is caused to assume a position upon a graduated scale dependent upon the rate at which the rotary mechanism and, hence, the vehicle is moving at any instant. The indicating portion of the speedometer is placed within view of the operator and an odometer is generally combined therewith. It is driven by means of the speedometer gears and speedometer shaft (q. v.).

Speedometer, Centrifugal Type—A speedometer, the rotary portion of which comprises a pair of rotating weights which are drawn toward one another by a finely adjusted spring. Centrifugal force, acting upon the rotating weights, causes them to overcome the spring, and move apart in proportion to their speed of rotation and hence in proportion to the speed of the vehicle, and, as they move apart, under increasing speed, they act to move a needle over a scale graduated in miles per hour.



SECTIONAL VIEW OF CENTRIFUGAL TYPE SPEEDOMETER.
A, Centrifugal Ring; B, Spring; C, Pointer.

Speedometer, Magnetic Type—A speedometer in which the mechanism operated by the road wheel rotates a magnetic field (see field, magnetic) within the inductive influence of which is a light and delicately pivoted metal cylinder in which is developed electrical eddy currents that tend to cause the cylinder to rotate in proportion to the rate of rotation of the magnetic field and in the same direction therewith. The tendency of the metal cylinder to rotate is resisted by a delicately adjusted spring, and, in action, the cylinder rotates through a certain angle and takes up a position dependent upon the speed of the magnetic field and of the vehicle at any particular instant. A scale, graduated in miles per hour, is carried by the cylinder and a stationary pointer indicates upon it the vehicle speed.

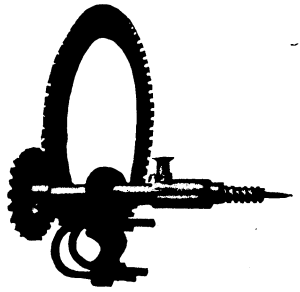


MAGNETIC SPEEDOMETER.
A, Permanent Magnet; B, Metal Cup; C, Hair Spring; D, Scale on Rotating Cup; E, Armature.

Speedometer Gears—The gears which give motion to a speedometer shaft and speedometer. As usually arranged, a relatively large spur gear is bolted to a front wheel hub flange and a smaller gear or pinion is held in mesh with this upon the end of a short horizontal shaft, originating in a housing supported upon the steering knuckle arm of the road wheel. Upon the inside end of this shaft, within the housing, is a bevel or spiral gear in mesh

with another similar gear on a short horizontal shaft at right angles with the first named shaft, and to the outer end of which the speedometer shaft is connected.

The spur gears are usually of fibre or other non-sonorous material, and their tooth ratio can be altered to enable the same speedometer to give correct indications when used with road wheels of differing diameters.



SPEEDOMETER GEARS.

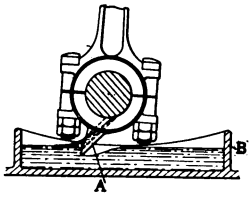
Speedometer Shaft—The flexible shaft (q. v.) which is connected at one end with the speedometer gears and at its other end with the rotating member of the speedometer itself, constituting the driving connection between them. Its flexibility is required to allow for the motion of the vehicle springs and for the turning of the front road wheels in steering.

Spider—A construction consisting of a central hub and several radiating arms upon which operative parts are fastened. See brake spider, clutch spider, steering wheel.

Spin (v.)—With reference to the driven member of a clutch, to continue to rotate after it has been disengaged from the driving member, rotating with it the primary and lay shafts of a sliding gear change speed device, and thus rendering the meshing of gears noisy and difficult. The greater the weight and diameter of the driven member and attached parts, the greater the tendency to spin, which is overcome in some cars by the use of a clutch brake (q. v.).

Spiral Gear—See gear, helical.

Splash Basin—An oil pocket (q. v.).



SPLASHER (A)
B, Oil Trough.

Splash Lubrication—See lubrication, splash.

Splash Plate—A baffle plate (q. v.) used in the lubricating system.

Splasher—A scoop-like projection attached to the end of a moving part, such as a connecting rod tip, designed to dip into a pool of oil and to splash it over adjacent parts. Connecting rod splashers are often tubular, oil being

supplied through them to the rod bearings as well as being splashed over cylinder walls, etc. Syn.: Scoop.

An extension of the fenders, usually of enameled leather, hung from their lower ends nearly to the ground, and intended to cut off road splash. Also other extensions of the mud guards around the front of the car to protect the radiator and elsewhere.

Spline—A key (q. v.).

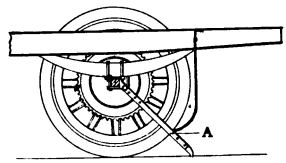
Split Pin—See cotter pin.

Spoke, Bossed—A wheel spoke which is of enlarged cross section at that part of its length where the bolt holding a brake drum or sprocket passes through it.

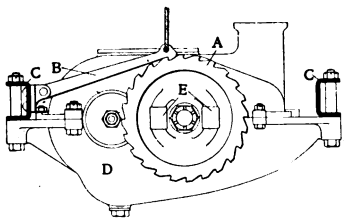
Spot—The slight depression formed in a shaft to receive the point of a set screw (q. v.).

Sprag—A form of emergency brake, designed to prevent an automobile from running down hill backward, should the regular brakes prove ineffective. Syn.: Drop brake.

Sprag, Drop Type—A sprag, consisting of an iron rod pivoted at its front end upon one of the rear cross members of the frame, and with its rear end pointed and normally held up by a cable, out of contact with the road. When it is required, the cable is released by the operator, and the pointed rear end falls into contact with the roadway. If the vehicle starts to back, the pointed end catches in the surface of the road and forms a prop, which prevents further backward movement of the vehicle.



SKETCH SHOWING DROP SPRAG A.



SPRAG, RATCHET TYPE.

Sprag, Ratchet Type—A sprag consisting of a ratchet toothed drum fastened upon the jackshaft, rear wheel hub flange or upon the final drive mechanism at some point, and a pawl or detent, securely fastened to some stationary part, which can be dropped upon the ratchet drum by the operator. The pawl is so placed as to catch the teeth and hold the

drum, and hence the car, from backward motion, but so as not to resist forward motion. When ascending a dangerous hill the operator may drop the pawl, as a precaution, raising it again when level ground is reached. Syn.: Hill pawl.

Spray (v.)—With reference to a storage cell, to throw out electrolyte in the form of minute drops, carried by bubbles of gas which burst at the surface of the liquid. See gas (v).

Spraying Carburetor—See carburetor, atomizing.

Spraying Nozzle—See carburetor spraying nozzle.

Spring—See clutch spring, brake spring, accelerator.

Spring—One of the elastic members by which the frame, its attached mechanical parts and the body are supported upon the axles of a motor car, in order to prevent jolts arising from rough roads from being transmitted to these parts and the passengers. Four springs of the leaf type (see spring, leaf type) are commonly employed, generally arranged parallel to the frame side members, and supporting each side of the front and rear of the frame upon the respective ends of the front and rear axle. Or three springs may be used, two supporting the respective sides of one end of the frame upon the ends of one axle and the third supporting the centre of the other end of the frame upon the other axle.

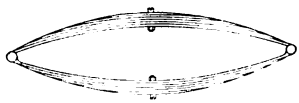
NOTE.—The following definitions under "spring" refer to vehicle springs unless otherwise stated.

Syn.: Vehicle spring, body spring.

Spring, Cross—A leaf spring arranged crosswise of a vehicle, its ends being shackled to the ends of the rear or occasionally of the front axle, and its middle point being secured to the centre of the rear cross member, or occasionally of the front cross member of the frame.

Spring, Eccentrated—A spring of the half elliptic type, the point of attachment of which to the axle is not midway between its ends.

Spring, Full Elliptic—A compound spring, consisting of two half-elliptic leaf springs arranged with their concave sides facing one another, and with their corresponding ends secured together, thus forming an approximate ellipse. The centre of one spring member is fastened to the vehicle frame and



FULL ELLIPTIC SPRING.

the centre of the other spring member to the axle. In the ordinary full elliptic spring the ends of the two spring members are simply pivoted together by means of an eye-bolt (q. v.), but in the double scroll ended full elliptic spring (see spring, scroll ended) one of the members is a double scroll ended half-elliptic spring and the other an ordinary half-elliptic spring, the ends of the two members being secured together by means of shackles. In the double shackle type of full elliptic spring, two single scroll elliptics are used, the scroll end of one being shackled to the plain end of the other.

Syn.: Double elliptic spring.

Spring, Half Elliptic—See spring, leaf type. Syn.: Semi-elliptic spring.

Spring, Inclined—A vehicle spring the ends of which are not in the same horizontal plane, the front end being higher than the rear end, thus rendering it capable of deflection under backward as well as upward forces transmitted to it by the axle when the wheels strike road obstructions.

Spring, Leaf Type—A composite spring in the shape of an arc of rather large radius, built up of a number of long, flat, slightly curved, relatively thin and narrow strips or leaves of highly elastic steel of graduated lengths, superposed and fastened together in alignment at or near their centres of length, the longest or main leaf being upon the concave side and the shortest leaf upon the convex side of the assemblage. The thickness of each leaf is usually reduced toward its ends. Such a spring is supported by the two ends of its main leaf and through the point at which its leaves are fastened together, and is so mounted upon the vehicle that its load tends to straighten it, the longer leaves yielding first and the shorter leaves successively deflecting as the load is increased, a progressively increasing resistance to its deflection thus being developed. A spring constructed as above is a semi-elliptic or half-elliptic spring, and the joining together of two or three such springs produces the various types of compound spring.

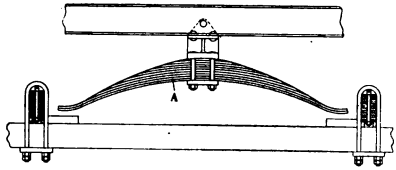
Leaf Type Spring (Semi-Elliptic).

Syn.: Laminated spring.

Spring, Offset—A spring which does not lie directly under a frame member, but slightly outside thereof, being fastened thereto by spring-hangers or irons extending outward from the

frame, and which are sometimes up-curved so as to bring the frame lower relatively to the axle than it would otherwise be.

Spring, Overload—A spring arranged as an auxiliary to a regular spring, and which is normally out of action, but which comes into play when extreme deflections of the regular springs are caused by excessive loads and rough roads. Such a spring may be attached to the frame and arranged to bear upon the axle only under overload conditions, thus relieving the regular springs. Used upon some commercial vehicles. Syn.: Auxiliary spring.

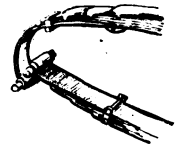


Overload Spring (A).

Spring, Platform—A compound spring, consisting of three half-elliptic members, viz., a cross spring and two longitudinally arranged springs, the three members being shackled together at their ends, thus forming a hollow square. The centre of the cross member is fixed to the middle of a frame cross member, and the free ends of the side springs are pivoted to the respective side members of the vehicle frame, while their centre points are made fast to the two ends of the axle.

Syn.: Three point spring suspension.

Spring, Scroll Ended—A leaf spring the form of which departs from a uniform curve in that one or both ends are sharply bent, in the general direction of curvature, into the form of a scroll, hook or C shape, the acute curvature being confined mainly to the principal leaf.



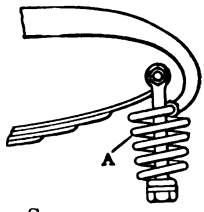
Scroll-Ended Spring.

Spring, Side—A long leaf spring, arranged longitudinally under a side frame member with its front and rear ends secured to the front and rear axles, respectively, and its centre point fastened at or near the middle of one of the frame side members, a similar spring being used under the other side member. A nearly obsolete type.

Spring, Spiral Type—A spring of the coiled, helical or spiral type wound of highly elastic steel wire, occasionally used instead of a spring of the leaf type, such springs acting between the ends of the frame members and the axles.

Syn.: Coil spring, helical spring.

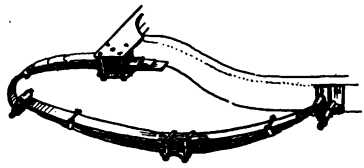
Spring, Supplementary—A spring employed to supplement the cushioning action of a vehicle spring. It may be a spring or combination of springs of the spiral type, acting between the axle and the frame, or a spring or pair of springs of the spiral type, or a combination of a scroll and spiral springs interposed between one end of the regular vehicle spring and its point of support upon the frame or between the adjacents ends of two members of a compound vehicle spring.



SUPPLEMENTARY SPRING (A).

Syn.: Equalizing spring, spring shock absorber, auxiliary spring, secondary spring.

Spring, Three-quarters Elliptic—A type of compound spring intermediate between the half-elliptic and the full-elliptic types, consisting of a half-elliptic member fastened at about its centre to the axle and at one end to a frame side member. Its other end is connected, usually by a shackle, to the thin end of one-half of a semi-elliptic spring member, usually of the scroll type, the thick end of which is rigidly secured to the frame side member.

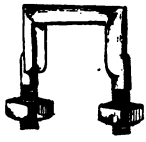


THREE-QUARTER ELLIPTIC SPRING.

Spring, Underslung—A spring which is secured to the under side of the axle instead of to the upper side thereof, this method of attachment being adopted in order to lower the frame relatively to the axle.

Spring, Valve—See valve spring.

Spring Centre Bolt—The bolt which passes through and secures together the leaves of a leaf spring, generally at or near centre of the length thereof. Its use is not necessary when nibbed or dented leaves are employed. (See spring leaf, nibbed.)



SPRING CLIP.

Spring Clip—A device for fastening the fixed point of attachment of a leaf spring to its support upon the axle or frame, generally consisting of a U-shaped steel forging, with threaded ends, of a spread equal to the width

of the spring. Two such U-shaped fittings are straddled over the spring and their threaded ends are passed through holes in the spring seat (q. v.) of the axle or in the support on the frame, and nuts are turned onto the threaded ends until the spring is firmly clamped in place.

Syn.: Spring saddle.

Spring Drive—An elastic member consisting of a combination of springs, through which the turning effort acts, sometimes introduced into the transmission system of a motor car to cushion the shocks to the mechanism occasioned by sudden clutch engagements or by irregularities in the action of the motive power, or interposed between a magneto or other auxiliary and its drive to lessen noise and shock.

Spring Eye—A hole formed in each end of the main leaf of a spring, in a direction perpendicular to the plane of movement thereof, through which the spring eye-bolt (q. v.) passes, and which forms the point of attachment of the spring to a spring hanger (q. v.), to a spring shackle (q. v.) or to another spring. The ends of the main leaf are enlarged, in forging, to permit of the drilling of the hole, in which is usually fitted a bronze bushing within which the eye-bolt rotates.

Spring Eye-bolt—A bolt used to secure the end of a leaf spring to a spring hanger, or to secure together the connected ends of two members of a compound spring, and upon which the spring end rotates as the spring deflects. It is passed through the spring eye and suitable holes in a spring hanger or through the eyes of two connected spring members, and is usually drilled with grease or oil ways and provided with a grease cup or spring oiler.

SPRING EYE-BOLT.

Spring Hanger—One of the fittings attached to a vehicle frame or formed integrally therewith, which act as supports for the vehicle springs. The hangers supporting the front ends of the front springs and the rear ends of the rear springs (spring horns) are usually the specially formed, forged ends of the frame side members, while other hangers are suitably formed fittings riveted to the

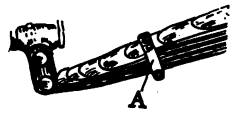
SPRING HANGER.

frame members, adapted to receive a spring eye-bolt and to support a spring eye or a spring shackle, or adapted to form a spring seat and to receive a spring clip.

Spring Leaf, Nibbed—A spring leaf, in the metal of which are formed a series of indentations which raise a portion of the metal on one side and form a corresponding concavity upon the other. In assembling a series of such leaves to form a spring, the projections of one leaf are fitted into the dents in the next leaf, and the leaves, when clipped together, are thus prevented from moving out of alignment or sliding one upon another, and the use of a spring centre bolt, with its weakening effect upon the leaves, is obviated.

Syn.: Dented spring leaf, fishbacked spring leaf.

Spring Leaf Retainer—A small clip clamped around a leaf spring to prevent its leaves from unduly separating or moving out of alignment. Several such retainers are used, distributed along the length of the spring.



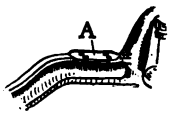
A, Spring Leaf Retainer.

Spring Oiler—See oil retainer.

Spring Perch—See spring seat.

Spring Saddle—See spring clip.

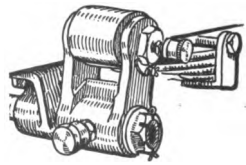
Spring Seat—A flat surface, formed upon an axle or axle casing or on a spring hanger, upon which a spring fits and to which it is secured by spring clips (q. v.) and containing the holes to receive the clip ends. The spring seat on an axle is usually formed integrally therewith, but may be formed upon a special fitting secured around the axle, but free to rotate thereon.



A, Spring Seat.

Syn.: Spring perch, spring pad.

Spring Shackle—A link employed to flexibly attach one or occasionally both ends of a leaf spring to a frame member, or to attach one or both ends of one member of a compound spring to the end or ends of another member. It is used to compensate for the variation in distance between the ends of a spring as it is deflected more or less. A



Spring Shackle

shackle is ordinarily a simple link with a hole through each end to take the eye-bolts (shackle bolts) of two spring members or to receive an eye-bolt and the pivot bolt of a spring hanger. A compound, universal or double shackle is used to join spring members which deflect in planes at right angles one to the other (platform spring), and may consist of two links pivoted together at their ends so as to act in perpendicular planes, or a ball and socket link device may be used.

Spring Stop—A rigid extension of a spring hanger, so located in proximity to a spring as to limit the deflection thereof.

Spring Washer—A lock washer (q. v.).

Sprocket—See chain and sprocket gear.

Squared Shaft—A shaft the end of which, instead of being of circular section, is formed into a square section, the squared end portion fitting into a square hole in the member which drives it or is driven by it. This construction obviates the use of keys (q. v.). Sometimes the corners of the shaft are somewhat rounded off at its end, and its end is fitted into the squared hole in such a manner that, while a positive driving connection is secured, slight angular deviations are permitted in the alignment of the two parts.

A shaft which, for a portion of its length, is of square cross section, and upon which are carried members, such as gears, which are to drive or be driven by it, but which require to be slid along it. See sliding gears. Sliding shaft.

Stall (v.)—To accidentally stop a vehicle motor, usually by overloading it (see overload), as by a too sudden clutch engagement.

Standpipe—See carburetor standpipe and lubrication, constant level.

Starting Button—In a dual or battery system of ignition a button which, when pressed and suddenly released, makes and breaks a battery current through the primary of the transformer coil and produces a high tension current in the secondary winding which is delivered by the distributor to the spark plug of the cylinder that is ready to fire. It is used in starting on the spark. In some systems the pressing of the starting button or the throwing of a switch to the starting position closes the battery circuit and introduces thereinto a magnetic vibrator the make-and-break action of which produces a succession of sparks.

Starting Crank—See crank, starting; crank, safety starting.

Starting Crank Bracket—A bracket attached to the front of a vehicle frame or to the forward end of the motor base, which forms the bearing of the starting crankshaft.

Starting Crank Latch—A latch which holds a starting crank in position when it is not in use, and prevents it from swinging. A leather strap, attached to the vehicle frame and looped about the crank handle is sometimes used.

Starting Crank Shaft—The slidable shaft to which the starting crank is secured, the free end of which engages the motor crankshaft.

Starting Gear—The lowest gear of a gasoline motor vehicle, mainly employed in starting it from rest.

Starting Ratchet—See crank, starting.

Starting Shutter—See air damper.

Starting on the Spark—A method of starting a multi-cylinder gas motor without cranking it. A battery generated spark is produced in the cylinder, which happens to have stopped on its power stroke (q. v.), by throwing on the switch and manipulating the spark lever, and if the motor has not stopped on dead centre (q. v.), and if the fuel charge, which was left in the cylinder at stopping, has not escaped or condensed, it will be ignited, an explosion will occur, and the motor will commence to rotate. It will continue to rotate if the force of the initial explosion brings the next cylinder in firing order (q. v.) to the firing point, and if its cylinder and successive cylinders contain sufficient ignitible charge. See self-starter, ignition type.

Syn.: Switch starting, spark starting.

Steam Boiler—See boiler.

Steam Chest—The closed space adjoining the cylinder of a steam engine, and communicating with the boiler through the steam pipe, and with the cylinder through the steam ports. Within it and controlling the port openings are the valves.

Steam Engine, Compound—An engine with two cylinders—one, the high pressure cylinder, of relatively small bore, and the other, the low pressure cylinder, of considerably larger bore, the moving parts of the two cylinders acting upon the same crankshaft. Steam from the boiler is admitted to the high pressure cylinder, partially expanded therein and exhausted into the steam chest of the low pressure cylinder,

where it is further expanded, and from which it is finally exhausted into a condenser (q. v.) or into the air. The compound engine is capable of utilizing the energy in steam more efficiently than the simple engine.

Steam Engine, Condensing—An engine which exhausts into a condenser (q. v.) instead of directly into the air, as does a non-condensing engine.

Steam Engine, Double Acting—An engine in which the steam performs useful work both upon the inward and the outward strokes of its piston, steam being admitted to the head end of the cylinder near the beginning of the outward piston stroke, and to the crank end of the cylinder on the inward piston stroke. The common type of vehicle engine. See slide valve.

Steam Engine, Horizontal—An engine, the axis of the cylinder or cylinders of which is horizontal. Such an engine is usually arranged under the car body, with its crankshaft crosswise of the vehicle and directly geared to the driving axle.

Steam Engine, Piston Valve—See piston valve.

Steam Engine, Simple—An engine in which the steam entering one of its cylinders receives its full expansion therein. The opposite of compound steam engine.

Steam Engine, Single Acting—An engine in which the steam performs useful work on the outward stroke only, steam being admitted at the head end of the cylinder. Its valves are usually of the cam operated, poppet type, and its design is similar to that of a gas engine. Occasionally used in multicylinder forms, for vehicle propulsion.

Steam Engine, Slide Valve Type—See slide valve.

Steam Engine Vertical—An engine, the axis of the cylinder or cylinders of which is vertical. Such an engine is usually arranged with the crankshaft lengthwise of the car, and power is transmitted to the rear axle through a shaft drive (q. v.).

Steam Gauge—See gauge, steam.

Steam Pipe—A pipe leading from the steam space of a boiler to the steam chest or chests of an engine, through which steam is supplied thereto. The throttle valve (q. v.) is located therein.

Steam Pocket—Any portion of the space within a water jacket (q. v.) which accidentally becomes filled with steam instead of water. Its effect is to prevent the proper cooling of

that portion of the cylinder or valve pocket wall which it includes, and overheating thereof may result. Faulty design of the water spaces, leading to a sluggish circulation at certain parts thereof, is usually the cause.

Steam Separator—See separator.

Steam Siphon—A device used to fill the water tank of a steam vehicle, consisting of an ejector and length of flexible hose connected thereto, carried upon the car. The free end of the hose is placed in a roadside supply of water, steam from the boiler is turned into the ejector and water is lifted through the hose and forced into the tank. The ejector consists of a small chamber, furnished with an inlet and outlet, and with a steam jet located in a contraction therein. When in action, a part of the energy in the steam is converted into energy of motion of the water, which is drawn into the chamber to fill the vacuum formed therein, the water being delivered through the outlet.

Steel—Purified pig iron containing less than 2.2 per cent. of carbon, which is malleable between certain temperatures, and which, furthermore, is either capable of being cast into an initially malleable mass, capable of being hardened by sudden cooling or possesses both these properties. The material principally used for structural and moving parts of automobiles because of its high strength for a given weight and its ability to be formed into the most diversified shapes.

Steel, Acid Open Hearth—Pig iron which has been converted into steel by the burning out of its excess of carbon and impurities by the excess of oxygen contained in a flame of intensely preheated gas and air which plays over it while it lies upon a hearth lined with siliceous material, the action usually being hastened by adding iron ore and scrap steel to the charge. It is sometimes preferred to basic open hearth steel as being more uniform and less likely to contain oxygen, and on account of its usually being made from higher grade materials; but it is less used in the automobile industry than basic open hearth steel.

Steel, Basic Open Hearth—Steel produced similarly to acid open hearth steel except that lime is added to the pig iron of the charge, the hearth is not lined with siliceous but with basic material, such as iron oxide and less pure pig iron

and scrap steel are generally used for the charge. Steel so produced is very largely used in the automobile industry.

Steel, Bessemer—Pig iron which is practically freed of carbon, manganese and silicon by forcing cold air through it. while melted, in a Bessemer converter and to which, while still molten, the proper amount of carbon, manganese and silicon are added to give it the required composition. It is much less used than open hearth steel for automobile parts on account of its inferior quality, due to lack of homogeneity, liability to brittleness from too high phosphorous content and its high content of gases.

Steel, Carbon—Steel which depends mainly upon the presence of a closely regulated proportion of carbon to give it its strength, malleability, ductility and ability to be hardened. Automobile carbon steels usually contain from 0.08 per cent. to 1.05 per cent. of carbon, from 0.25 per cent. to 0.80 per cent. of manganese and not over 0.04 per cent. of phosphorus nor over 0.04 per cent. of sulphur. Low carbon steels may be considered as those containing from 0.08 per cent. to 0.40 per cent. of carbon, and high carbon steels as those containing from 0.40 per cent. to 1.05 per cent. of carbon, but there is no definite line of demarcation between them. In a very general way, an increase of carbon renders steel stronger and harder but less malleable and ductile and more brittle. Carbon steel is the steel most largely used in the automobile industry, but alloy steels (q. v.) are taking its place for many parts of high grade cars.

Steel, Cast—A trade name for crucible steel (see steel, crucible).

Steel, Casting—Steel which can be formed into the desired shape, like cast iron, by pouring it, while molten, into molds. A specification for such steel is as follows: Carbon, 0.30 to 0.40 per cent.; manganese, 0.60 to 0.80 per cent.; silicon, 0.10 to 0.30 per cent.; phosphorus and sulphur not over 0.06 each.

Steel, Chrome—An alloy steel, usually containing 0.80 to 2.00 per cent. of carbon and 1.00 to 2.00 per cent. of chromium, which is extremely hard, without brittleness and possesses a very high elastic limit. Occasionally used for automobile gears, but the use of chrome-nickel steel for this purpose is much more usual.

Steel, Chrome Nickel—An alloy steel, usually containing from 0.10 to 0.50 per cent. of carbon, 1.50 to 3.75 per cent. of nickel, 0.50 to 1.75 per cent. of chromium, 0.30 to 0.60 per cent. of manganese, 0.10 to 0.30 per cent. of silicon and not over 0.04 per cent. each of phosphorus and sulphur, possessing great hardness and strength and thus used for automobile gears, shafts, engine parts, frames, etc. Nickel chrome steels, low in carbon, are chiefly used for structural and case-hardened parts and those higher in carbon for moving parts, such as shafts, that highest in carbon being mainly used for gears.

Syn.: Nickel chrome steel.

Steel, Chrome-Vanadium—An alloy steel of high strength and superior resistance to repeated and reversed stresses and thus largely used for the vital parts of cars where extreme reliability and light weight are required, such as crankshafts, connecting rods, gears and gear shafts, drive shafts, axles and springs. Specifications for various grades call for from 0.10 to 0.18 per cent. of vanadium, 0.80 to 1.30 per cent. of chromium, 0.15 to 0.45 per cent. of carbon, 0.40 to 0.90 per cent. of manganese, 0.10 to 0.30 per cent. of silicon and not over 0.04 per cent. each of phosphorus and sulphur. Such steel, low in carbon, is used for case-hardened gears, that moderate in carbon for shafts and other moving parts, and that higher in carbon for important structural parts and hardened gears.

Steel, Crucible—Steel made by melting pieces of wrought iron in an hermetically sealed crucible, the required amount of carbon being placed on top of the iron before closing the crucible. The finest quality of steel is the result, all gases being excluded and the process being under good control. Crucible steels are usually rather high in carbon and are used for springs. Alloy steels are often made by the crucible process, the alloying materials being added with the carbon.

Syn.: Cast steel.

Steel, Electric—Pig iron refined to the condition of steel in some form of electric furnace, and of a grade comparable with crucible steel.

Steel, High Carbon—See steel, carbon.

Steel, Low Carbon—See steel, carbon.

Steel, Manganese—A steel containing 12.00 to 13.00 per cent. of manganese and 1.50 to 2.00 per cent. of carbon, which is extremely hard and wear-resisting and which possesses

about three times the tensile strength of ordinary steel. It is difficult to machine or otherwise work, but improvements in its manufacture and treatment may render it important in the automobile industry.

Steel, Molybdenum—An alloy steel containing from 2.00 to 2.50 per cent. of molybdenum and similar in its properties to steel, tungsten (q. v.).

Steel, Open Hearth—See steel, acid open hearth, and steel, basic open hearth.

Steel, Nickel—An alloy steel usually containing from 3.25 to 3.75 per cent. of nickel, 0.15 to 0.35 per cent. of carbon, 0.50 to 0.80 per cent. of manganese and not over 0.20 per cent. of silicon nor over 0.04 per cent. of phosphorus. The addition of nickel raises the elastic limit of the material about 50 per cent. and decreases its ductility only slightly, increases its ultimate strength, renders it harder and tougher and better able to resist blows, and, moreover, confers upon it about six times the resistance to repeated and reversed stresses. It is one of the most useful of all alloy steels, as parts may be made of it considerably lighter than of carbon steel and still show superior life. Nickel steel, low in carbon, is mainly used for structural and case-hardened parts and that higher in carbon for moving parts, such as crank, gear and driving shafts.

Steel, Nickel (valve metal)—A metal used for the heads of poppet valves and possessing great resistance to corrosion by hot gases. It contains from 28.00 to 35.00 per cent. of nickel, not over 0.50 per cent. of carbon, not over 1.50 per cent. of manganese, not over 0.04 per cent. of sulphur and not over 0.06 per cent. of phosphorus, the remainder being iron.

Steel, Pressed—See pressed steel.

Steel, Silicon—An alloy steel, capable of higher temporary magnetization than pure iron and in which the magnetic losses are low. It is therefore used for the cores of ignition and lighting apparatus where high efficiency and light weight are important. It contains about 2.75 per cent. of silicon and the percentages of carbon, manganese, sulphur and phosphorus are kept as low as possible.

Steel, Silico-Manganese—An alloy steel specially adapted for vehicle springs, frames and gears, containing from 1.90 to 2.20 per cent. of silicon, 0.60 to 0.70 per cent. of manganese,

0.45 to 0.55 per cent. of carbon and not over 0.04 per cent. of either sulphur or phosphorus.

Steel, Titanium—A steel which, in the process of manufacture, is treated with titanium, which nearly frees it of oxygen and other gases. A trace of titanium is usually found in the finished product. It is coming into use for vehicle springs, etc.

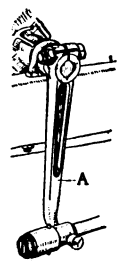
Steel, Tool—Steel, usually that produced by the crucible process (see steel, crucible), of a quality suitable for cutting tools, containing approximately one per cent. of carbon and thus capable of a high degree of hardening. Used for parts which are called upon to resist extensive wear but are not heavily stressed, such as piston pins and steel bushings. Also used for springs.

Steel, Tungsten—An alloy steel of very high magnetic retentivity, used for the permanent magnets of magnetos, ampere hour meters and other electrical measuring instruments. It contains from 4.00 to 5.00 per cent. of tungsten, 0.50 to 0.70 per cent. of carbon and occasionally 0.50 per cent. of chromium.

Steel, Vanadium—See steel, chrome vanadium.

Steering—The act of guiding a motor car, performed by the hands of the operator applied to a wheel or lever and connected mechanism which simultaneously deflects one or more of the road wheels of the car into the direction which it is desired it should take.

Steering Arm—The crank or arm, pivoted at one end within the steering device on the steering arm shaft (q. v.), the other end of which moves through an arc, and thus transmits the steering effort from the steering device to the drag rod. See drag link.



A, Steering Arm.

Steering Arm Shaft—The horizontal shaft, secured in bearings within the housing of a steering device, which carries the steering arm upon its external end, and receives the steering effort upon its inside end.

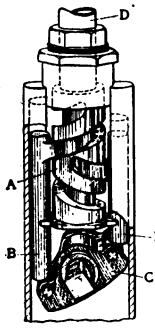
Steering Column—The column or post which carries at its upper end the steering wheel, and usually the spark and throttle levers and quadrants, and at its

lower end the steering device. It is usually inclined upward and to the rear, and its lower and forward end is secured to the vehicle frame at a point under the bonnet, the column itself passing through the dash or the front floor boards. In right hand drive cars it is located directly in front of the right hand front passenger, and in left hand drive cars (q. v.) on the opposite side. The column comprises the steering shaft (q. v.), and the shafts which operate the spark and throttle linkages, and it is usually enclosed in a tubular ornamented casing. In lever steered cars the column is usually vertical, and carries the steering lever at its top.

Syn.: Steering post, steering mast.

Steering Column Jacket—The ornamental casing which surrounds the steering column.

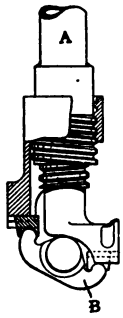
Steering Device—The mechanism by which the movement imparted by the operator's hand to the steering wheel and shaft is altered in direction and rate before being transmitted by the steering arm (q. v.) to the drag rod (q. v.). It consists of some form of reduction gearing which gives the end of the steering arm a movement relatively small as compared with that of the operator's hands, and in a plane nearly at right angles to the plane of movement of the hand wheel. It is usually located at the lower end of the steering column, and encased in an oil and dust tight housing.



CAM AND PUSHROD STEERING DEVICE.
A, Cam; BB, Pushrods; C, Rocking Arm; D, Steering Shaft.

Steering Device, Cam and Pushrod Type—A steering device in which the steering shaft carries cam surfaces which act upon the upper ends of two vertically guided pushrods, the lower ends of which bear upon the respective ends of a rocking lever, fast upon the steering arm shaft. When the wheel is turned in one direction one pushrod is actuated and moves the rocking lever and the steering arm in one direction, and when the wheel is turned in the other direction the other pushrod is actuated and the direction of motion of the rocking lever and steering arm is reversed. It may be made perfectly irreversible.

Steering Device, Differential Screw and Nut—A form of steering device in which the steering shaft carries a left-handed and a right-handed screw, each of which is in mesh with a separate nut, which can slide along the column, but cannot rotate. Turning the hand wheel in one direction moves one nut up and the other nut down, and reversing the direction of motion of the wheel reverses the directions of motion of the nuts. Downward projections of each nut bear respectively upon the ends of a rocking lever fixed to the housed end of the steering arm shaft (q. v.) and the nut, which at any particular instant is being turned down, rocks the lever and gives the steering movement. An irreversible type.

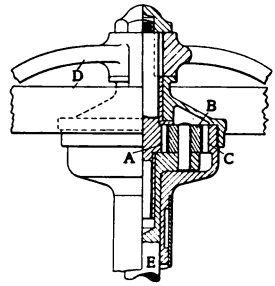


DIFFERENTIAL SCREW AND NUT DEVICE.
A, Steering Shaft; B, Rocking Lever.

Steering Device, Irreversible—Any steering device which is so constructed that road shocks communicated to it from the road wheels by the steering linkage are not transmitted through it at all to the hand wheel, or not to an extent sufficient to turn the wheel, against the will of the operator.

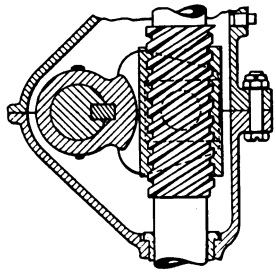
Steering Device, Pinion and Rack—A form of steering device in which a spur pinion mounted upon and rotated by the lower end of the steering shaft, meshes with and gives a straight line motion to a guided rack, to which one end of the drag link (q. v.) is connected. The rack may be replaced by a spur sector pivoted upon a shaft on which the steering arm is secured (pinion and sector steering device). These forms are reversible, and are used mainly upon light cars.

Steering Device, Planetary—A form of steering device in which the gearing down between the hand wheel and the steering arm is effected by means of a planetary gear (q. v.) mechanism, the central pinion of which is turned by the



PLANETARY TYPE STEERING DEVICE.
A, Pinion on Steering Wheel Spindle; B, Planetary Pinion; C, Internal Gear; D, Hand Wheel; E, Steering Shaft.

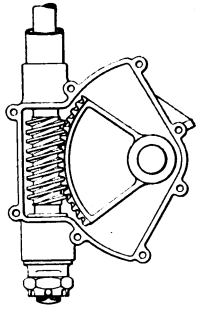
hand wheel, the internal gear being held from rotation by the stationary portion of the column, and the pinion frame (q. v.) communicating its rotation to the steering shaft, and thence to the steering arm. The planetary mechanism is enclosed in a housing located just under the hand wheel. A reversible type, and mainly used upon light cars.



Screw and Nut Type Steering Device.

Steering Device, Screw and Nut—A type of steering device in which the gear reduction between the hand wheel and the steering arm is effected, and irreversibility is secured by means of a screw (usually multiple threaded), formed upon and rotated by the steering shaft, and working in a nut which it moves upward and downward, but which is prevented from rotating. The motion of the nut is usually communicated to the steering arm shaft and steering arm through a rack, cut upon one side of the nut, which meshes with a spur gear on the steering arm shaft.

Steering Device, Worm and Sector—A form of steering device in which a worm (usually multiple threaded) (see worm gear), carried upon and rotated by the lower end of the steering shaft, is in mesh with and rotates a worm wheel or a sector thereof, secured upon the horizontal steering arm shaft.



Worm and Sector Steering Device.

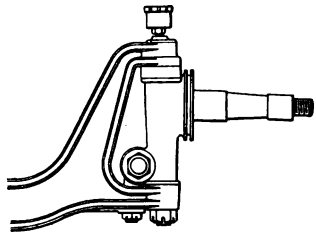
Steering Drag Rod—See drag link.

Steering Gear—A term applied to the entire mechanism concerned in the steering operation.

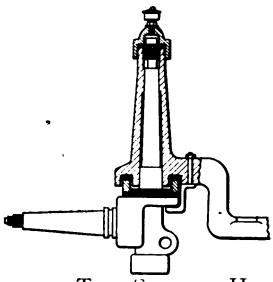
Steering Head—The specially formed portion of each end of the front axle, to which the front road wheels are pivoted. The steering heads may be formed integrally with the axle or they may be sep-

arate forgings, one of which is secured to each end of a tubular axle by pinning and brazing (q. v.), by welding or in some similar manner.

Steering Head, Elliott Type—A steering head of a forked or yoke shape, with the arms of the fork in a nearly vertical plane and their ends nearly in vertical alignment. The steering knuckle (q. v.) and steering knuckle spindle (q. v.) used with this type are a single forging, the hollow vertical member of which is held in the head by the steering knuckle pin (q. v.), which is passed through it and through holes drilled in the ends of the two arms of the head.



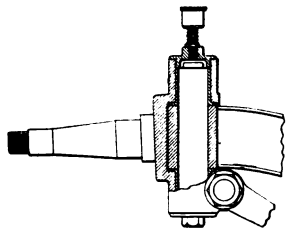
ELLIOTT TYPE STEERING HEAD.



LEMOINE TYPE STEERING HEAD.

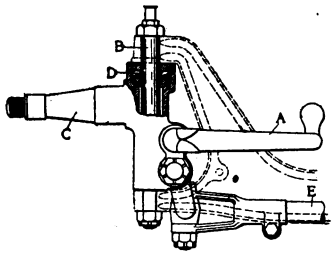
Steering Head, Lemoine Type—A steering head formed by enlarging or spreading the axle end in a vertical plane. A nearly vertical hole is drilled in this portion to receive, from below, the vertical member of the L-shaped steering knuckle, upon the horizontal member of which the road wheel is journaled.

Steering Head, Reversed Elliott Type—A steering head used with a forked knuckle, the ends of the arms of which are secured to the head by the vertical knuckle pin, which is passed through holes in the ends of the knuckle arms and through the hollow, vertical member of the steering head.



REVERSED ELLIOTT TYPE STEERING HEAD.

Steering Knuckle—That part of the steering gear which pivots on a nearly vertical axis fixed in the steering head and carries a front road wheel journaled upon a nearly horizontal projection thereof (the steering knuckle spindle, q. v.), the swinging of which, in a horizontal plane, permits the deflection of the road wheel, in steering.



STEERING KNUCKLE.

A, Steering Knuckle Arm; B, Steering Knuckle Pin; C, Steering Knuckle Spindle; D, Steering Knuckle Thrust; E, Tie Rod.

Steering Knuckle Arm—A nearly horizontal arm, by means of which the knuckle and the road wheel which it carries are deflected, in the act of steering. One end of it is secured in the vertical portion of the knuckle, and to its other end is pivotally secured one end of the steering tie rod (q. v.), and also, in some instances, one end of the drag rod. The knuckle arm may be an integral part of the knuckle forging or a separate forging secured in the knuckle. In some instances one knuckle of a pair is provided with two knuckle arms for the attachment of the tie rod and the drag rod respectively.

Steering Knuckle Pin—The nearly vertical pin or bolt upon which the steering knuckle pivots in or upon the steering head. It is usually drilled with greaseways, carries a grease cup upon its upper end and turns in a bushing secured in the knuckle.

Syn.: Steering yoke bolt.

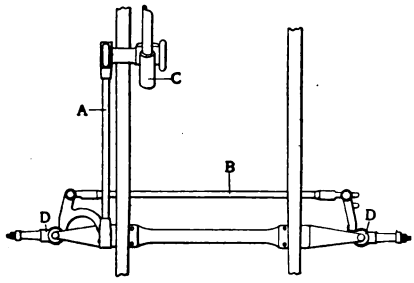
Steering Knuckle Spindle—The nearly horizontal portion of a steering knuckle, which is swung in a horizontal plane in the act of steering, and upon which is carried the bearings of one of the front road wheels.

Syn.: Steering stub; stub axle.

Steering Knuckle Thrust—A thrust bearing (see bearing, ball thrust), interposed between the steering knuckle and the steering head at the point where the pressure due to the vehicle weight acts. By reducing friction between the knuckle and the head, the force required in the act of steering is reduced.

Steering Lever—A lever, used instead of a wheel, in steering light cars. Its free end is grasped by the operator and the other end is attached to and imparts rotation to the upper end of a nearly vertical steering shaft, in a column located in front of or to one side of the operator. The lower end of the shaft usually carries a steering arm that moves the drag rod.

Steering Linkage—The general term applied to the rods and levers of a steering gear, not including the steering device or the mechanism in and upon the column.



STEERING LINKAGE.

A, Drag Link; B, Tie Rod; C, Steering Gear; D, Steering Knuckles.

Steering Lock—See lock, angle of, and turning radius.

Steering Shaft—The shaft, in the steering column, which transmits the rotation imparted to the steering wheel by the operator to the steering device. It is usually hollow, with the steering wheel keyed to its upper end and with the screw, worm, pinion or other driving member of the steering device secured near its lower end. The shafts which operate the spark and throttle linkages are usually within the hollow steering shaft.

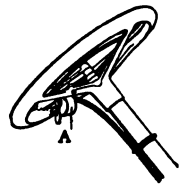
Steering Shaft Thrust—A ball thrust bearing, usually of the double type, located within the steering device housing and adapted to resist the end pressure of the steering shaft which is created by the action of the screw, worm or cam which it carries.

Steering Stop—A projection formed upon a steering knuckle, or upon some other part of a steering linkage, which strikes a stationary part of the running gear when the front wheels have been deflected as far as advisable from the straight ahead position, in either direction, thus limiting the extent of their deflection and preventing the tires from rubbing upon any part of the car.

Steering Tie Rod—See tie rod.

Steering Wheel—The hand wheel which is fast to the upper end of the steering shaft and is turned by the operator in steering. It consists of a metal hub, keyed to the shaft and carrying a number of radial arms (the spider), and a rim, usually of laminated wood or molded composition.

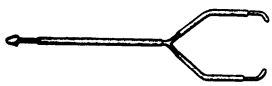
Steering Wheel Switch—An ignition switch (q. v.) mounted upon the steering column so that the driver may operate it without removing either hand from the vicinity of the steering wheel.



A, Steering Wheel Switch.

Step Up Coil—An induction coil. (See coil, induction.)

Stethoscope—An instrument similar in principle to that used by physicians, but known by various trade names, used to locate the source of abnormal operative sounds emitted by a motor, consisting of a sound transmitting rod or tube, one end of which may be placed successively in contact with different parts of the motor and a sound receiving apparatus attached to its other end which is applied to the operator's ears. Only those sounds that are produced in the immediate vicinity of the point at which the instrument is applied are heard in the instrument.



Stethoscope.

Stock Car—A term used in automobile racing, signifying a racing car, the chassis of which is identical with those of standard pleasure cars sold in commercial numbers, in contradistinction to a specially designed racing car.

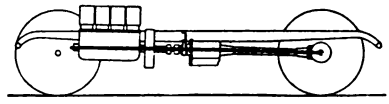
Stonebruise—A contusion sustained by a tire casing, due to forcible contact of the same with a stone or other blunt road obstruction, which results in the complete or partial breakage of the tread, and of the canvas and rubber of the tire carcass (q. v.), so weakening the same as to predispose to a blowout (q. v.) at the point of injury.

Storage Battery, Storage Cell—See accumulator.

Storm Front—See top, Cape.

Straight Line Body—A motor car body, the contour of which is defined by straight rather than by curved lines, the horizontal line of the top of the hood being continued by the upper edges of the doors and side panels. Fore door, flush sided, gunboat and torpedo bodies are generally of the straight line type. See body.

Straight Line Drive—A shaft drive (q. v.) in which the drive shaft (q. v.) is nearly in a straight line with the crank shaft of the motor and the final drive shaft of the change speed gear, at least when the vehicle is normally loaded, and thus but slight relative motion of the parts of the universal joints (q. v.) in the drive shaft is required in the operation of the vehicle.



STRAIGHT LINE DRIVE.

Strip (v.)—To break off the teeth of meshed gears. Stripping of permanently meshed gears is usually caused by the too sudden application to them of an abnormally heavy load and the stripping of sliding gears by attempting to mesh them when their tooth velocities are widely different.

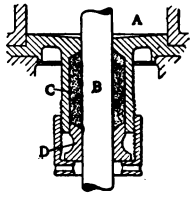
See chassis, stripped.

Stroke—See piston stroke and long stroke motor.

Strut Rod—In general, a structural rod, the function of which is to resist compressive stresses. Specifically, a distance rod (q. v.) or radius rod.

Stud—A bolt-like rod of metal threaded at both ends, one or more of which are employed to hold together two related parts. One end of the stud is permanently screwed into a hole in one of the members and the free end is passed through a correctly positioned unthreaded hole in the other member. A nut is then screwed down upon the free end of the stud, and against the surface of the second member, drawing the two members tightly together. E. g., studs, fixed in the crank case, are used to position and secure thereto the cylinders of a motor.

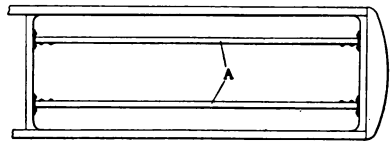
Stuffing Box—A device to prevent the escape of fluid from a chamber around the bearing surface of a rod or shaft which enters and moves therein, consisting of a recess, formed in the wall of the chamber, surrounding the rod or shaft, and adapted to confine a compressible packing (often of asbestos-rubber fabric), usually arranged spirally around the shaft or rod, within the recess. A stuffing nut or gland (q. v.) is arranged to be screwed into the outside end of the stuffing box, around the rod or shaft and to compress the packing so that it bears tightly against the walls of the stuffing box and the shaft or rod, thus preventing leakage. Used in connection with steam engines, around the piston rod and valve stem; in housings which contain oil, around the shafts entering them and around the drive shafts of water pumps.



STUFFING BOX.

A, Cylinder; B, Piston Rod; C, Packing; D, Gland.

Subframe—A subsidiary supporting frame attached to the main frame of a motor car and designed to hold the motor, change speed gear or other part which cannot conveniently be supported directly upon the main frame. A subframe is generally constructed of channel (q. v.) or angle steel (q. v.) riveted to the main frame and is often dropped below the general level of the main frame.



A, SUBFRAME.

Suction Pipe—See intake pipe.

Suction Stroke—See aspirating stroke.

Sulphatation—The conversion of a portion of the active material (q. v.) of an accumulator (q. v.) of the lead type into lead sulphate, by the action of the sulphuric acid of the electrolyte. If this action becomes excessive, the sulphate prevents the proper entrance of the electrolyte into the active material, and loss of capacity, buckling (q. v.) and reduced efficiency result, the internal resistance of the cell is increased and the plates tend to shed (q. v.) excessively. Excessive sulphatation is generally caused by overdischarging a cell, by allowing it to

stand discharged for a considerable time, by a too high discharge rate (q. v.), by too high temperature of the electrolyte or by its too high density or by local action among plates or parts of plates.

If not too far advanced, oversulphatation may be corrected by overcharging a cell at a low rate, with the electrolyte at a low temperature, but, if the plates are completely sulphated, they are generally irreclaimable.

Sump—A reservoir located at the lowest point in a circulating lubrication system (see lubrication, circulating system, pump type), into which the oil supplied to the moving parts, by the pump, returns by gravity, and from which the pump draws it to be recirculated. It is usually a specially formed depression in the bottom of the engine crank case.

Superheated Steam—Steam to which has been imparted more heat than that required to maintain it in the condition of dry or saturated vapor at its existing pressure. A given weight of water in the condition of superheated steam thus possesses a greater capacity for doing work than does the same weight of water in the form of saturated steam and its temperature is higher. It is employed in the engines of steam vehicles because of the water economy thus effected and the less dense exhaust created.

Superheater—A device used in connection with steam vehicle boilers, for superheating steam by subjecting it, as produced, to a temperature higher than its normal saturated temperature at its existing pressure. It consists of passages, often a coil of piping, through which the steam is passed, the outside walls of which are exposed to the hot gases from the burner, by being located in the uptake or chimney. In some boilers, steam is superheated by passing through the upper portions thereof which are maintained at a sufficiently high temperature.

Syn.: Superheating coil.

Supplementary Air Valve—See auxiliary air valve and carburetor, automatic.

Supplementary Spring—See spring, supplementary.

Surrey—A body similar to the tonneau form, except that the side entrances to the rear seat are open and not provided with doors and that the rear seat does not overhang the side lines of the vehicle, and usually seats two instead of three passengers

Switch, Ignition—See ignition switch, kick switch, lock switch, steering wheel switch.

Switch, Lighting—A switch, usually of the multiple push button type, used to separately control the electric current flowing to the headlights, sidelights and tail lamp in an electric vehicle lighting system. It is usually placed upon the dash or upon the heelboard of the front seat.

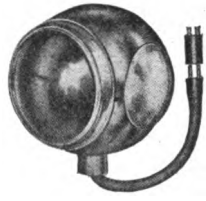
Switch Plug—A removable circuit controlling plug which, when in position in the socket provided for it in an ignition switch, closes the circuit from the switch to the rest of the ignition apparatus and when removed opens the circuit and prevents the operation of the ignition system. In many switches the handle is removable when in the "off" position, and when so removed performs the function of the switch plug.

Switch Starting—See starting on the spark.

Synchronized Ignition—See ignition, synchronized.

Tachometer—A device for continuously indicating speeds of rotation. Its principle is identical with that of the speedometer (see speedometer, centrifugal type, and speedometer, magnetic type). It reads, however in revolutions per minute instead of in miles per hour, and its drive shaft is usually directly connected to the shaft the speed of which is to be measured.

Tail Lamp—A small oil or electric lamp, carried upon the left hand side of the rear of an automobile, to warn following traffic of the presence of the vehicle and to illuminate the rear number plate. It displays a red light to the rear, a green light to the left, and a white light to the right, which is directed upon the number plate.



ELECTRIC TAIL LAMP.

Tail Shaft—The rearward extension of a gas engine crankshaft, beyond the flywheel flange or other mounting, upon which the driven member of the clutch is supported, and upon which it rotates when the clutch is disengaged.

Talc—Finely pulverized soapstone (French chalk), which is of a slippery nature and is thus used to prevent rubber surfaces from sticking together. It is rubbed upon the surface of inner tubes and upon the insides of tire casings for this purpose and to reduce the friction between them.

Taper—A somewhat conical portion of a mechanical part, such as a shaft, usually upon an end of the same. E. g., one end of a shaft may be tapered and intended to receive a gear or similar part, the hub of which is bored out correspondingly conical and fitted upon the tapered end of the shaft. A nut is then screwed down upon the projecting, threaded end of the shaft against the surface of the hub, forcing the tapered surfaces into tight contact. A key (q. v.) may be employed to prevent rotation of the gear upon the shaft.

See pin, taper.

Tappet—A rocker arm (q. v.).

Tappet Rod—A push rod (q. v.),

Taxicab—A public motor vehicle, with a closed or convertible body, operated for hire and fitted with a taximeter (q. v.), by which the charges for its use are automatically computed.

Taximeter—An instrument installed upon a public passenger automobile, that is operated for hire, which automatically indicates the fare which the passenger is expected to pay, at any instant. while the vehicle is in his service. It is a combination of a trip odometer mechanism (see odometer, trip) and a clock, which, respectively, measure the distance traveled and the time consumed, these factors being combined in such a manner by the mechanism that a continuous indication is given in dollars and cents of what the service has cost the passenger at any instant after the vehicle is hired.

TAXIMETER.

Telescope Joint—See slip joint.

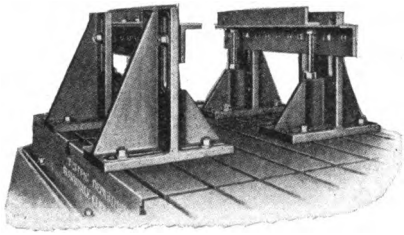
Telltale—A sight feed (q. v.).

Terminal—One of the points of attachment through which an electric current is led into or out of a piece of electrical apparatus. It is generally a binding post (q. v.).

A specially formed piece of metal soldered or otherwise electrically connected to the end of a wire or cable and adapted to be conveniently and securely attached to a binding post or terminal of a piece of electrical apparatus. It may be in the form of a spring clip arranged to be snapped over or upon a binding post.

Terminal Pressure—The fluid pressure existing in an engine cylinder at the instant of the opening of the exhaust valve.

Testing Block—A stand or framework, suitably equipped with apparatus, upon which a motor, change speed gear or other power transmitting part of an automobile, or indeed, a complete chassis, may be quickly and conveniently mounted to enable a dynamometer test (q. v.) or other form of shop test (q. v.) to be made upon it.



TESTING BLOCK.

Syn.: Testing stand.

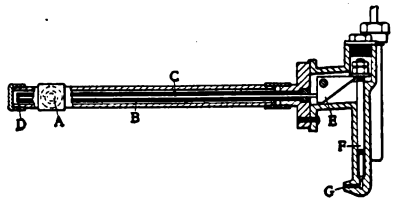
Testing Body—A rude, skeleton body which is mounted upon a completed chassis while it is being given its road test (q. v.), wear and tear upon the highly finished body, which is to be delivered upon the chassis, thus being obviated. Special testing wheels are generally used upon the chassis, during the road test, instead of the highly finished wheels which belong with it.

Testing Track—A course, laid out upon privately owned land, upon which motor cars can be tested under road conditions without interference from other traffic or legal restrictions.

Thermal Efficiency—See efficiency, thermal.

Thermo-siphon—See water cooling, gravity system.

Thermostat—A device which is sensitive to temperature changes, and which when the temperature to which it is exposed changes materially from a predetermined value, is capable of setting into action mechanism which tends to readjust the temperature to its normal value. Its action is usually dependent upon the differential expansion and contraction, by temperature changes, of two substances (usually dissimi-



THERMOSTAT.

A, Steam Inlet; B, Copper Tube; C, Iron Rod Jointed to B at D; E, Bell Crank Operating Valve F; G, Fuel Feed.

lar metals.) Used in flash boilers to regulate the fire (see automatic fire regulator) and in electric vulcanizers (see vulcanizer, electric).

Third Gear—The highest gear ratio obtainable from a three speed change speed device (its high gear), and the next to the highest gear ratio obtainable from a four speed change speed device.

Syn.: Third speed.

Three Point Suspension—A method of supporting a motor crankcase, gearcase, unit power plant (q. v.) or the like upon a vehicle frame, by the employment of which the part so mounted is substantially insured against being stressed by the accidental warping of the frame. The part thus mounted is secured to the frame at three points, usually as follows: By an arm extending from each side of the front or the rear thereof to the adjacent frame side member, and by a third arm extending backward or forward from the middle of the rear or front end thereof to the middle portion of a frame cross member, this last mentioned support often being of trunnion (q. v.) construction. The principle involved in this method of suspension is that three points, no matter how located, are always in the same plane, and that no matter how the vehicle frame distorts in service, and although the plane of the mounted part may be altered as a whole, there is practically no tendency to change the position of one supporting arm relatively to another and thus no tendency to stress the material of the part. Since four points may be so located as not to lie in the same plane, a part secured to a frame by four or more arms must necessarily be subjected to a warping tendency whenever the frame so distorts as to tend to move the parts of it which act as supports out of the same plane.

Throttle Valve—In connection with a gas engine, the valve which controls the passage of the gaseous charge from the carburetor to the cylinders, in response to the suction existing therein, by contracting or enlarging, at the will of the operator, the effective area of the gas passage. Its degree of opening determines the weight of fuel vapor drawn into each cylinder, and thus the explosion pressure therein and the amount of work done by the motor, per cycle. It is generally a part of the carburetor (see diagram carburetor, automatic) and generally located close to its point of attachment to the intake pipe (q. v.), and is most

commonly a butterfly valve (q. v.), but may be a piston valve (see valve piston), a sliding valve or the like.

In connection with a steam engine, the valve in the steam pipe which controls the flow of steam from the boiler to the engine. It may be a slide valve with self-adjusting seat, a form of globe valve moved by a multiple threaded screw or the like.

Throttle (v.)—To restrict the rate at which steam or gas is received by a steam or gas engine and thus to reduce its output. To throttle down.

Throttle, Auxiliary—A valve in the steam pipe of a steam car, additional to the regular throttle valve, arranged so as completely to close the same and thus to prevent the starting of the car upon the unintentional or malicious opening of the regular throttle and to prevent its accidental starting in case the regular throttle leaks. It may be provided with a removable handle or a locking device, as a precautionary measure.

Syn.: Safety throttle.

Throttle, Clutch Operated—In connection with a gas vehicle motor, a mechanism which automatically nearly closes the throttle valve, when the operator disengages the clutch and the load is consequently removed from the motor, the throttle valve being permitted to return to its set degree of opening upon the re-engagement of the clutch. It acts to reduce the speed of the motor to a safe idling rate and thus to prevent racing when the clutch is thrown out.

Throttle, Foot—See accelerator.

Throttle, Governor Controlled—A throttle valve which, in some commercial vehicle gas motors, is entirely distinct from the hand or foot controlled throttle valve, and which is automatically opened and closed by a governor (q. v.), its function being to limit the speed of the motor to a predetermined maximum value. (See Governor, Maximum Speed.)

Throttle Lever—The hand operated lever, by means of which the throttle valve is opened and closed. On gasoline and many steam cars, it is located upon the steering column and moves over a stationary sector (the throttle quadrant or segment) so designed as to retain it in whatever position thereon it is set by the operator.

Syn.: Hand throttle.

Throttle Linkage—The mechanism which transmits the opening and closing movement of a throttle control device (lever, pedal or otherwise) to the throttle valve itself.

Throttle Shaft—The shaft, within or attached to the steering column, which transmits the movement of the throttle lever to the rest of the throttle linkage.

Throttle Spindle—The spindle or shaft, in a carburetor, upon which the throttle valve rotates.

Throttle Wheel—The wheel, located upon the steering column, under the steering wheel on some steam cars, which acts as the throttle valve control device.

Through Bolt—In a gas motor, one of a number of long bolts passed through the cylinder flanges (q. v.), the upper wall of the crank case, and the main bearing hangers and caps, so as to themselves assume the stresses acting between the cylinders and the bearings, and thus relieve the material of the crank case from these stresses.

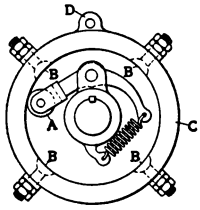
Thrust Bearing—See bearing, ball thrust. Not necessarily a ball bearing, however, roller bearings being sometimes used and plain stepped bearings with washers between the shoulder of the shaft and the end of the bearing being sometimes employed.

Tickler—The device employed to prime (q. v.) a carburetor. See carburetor float depressor.

Tie Rod—The rod forming a part of the steering gear, located transversely of and at the front of a motor car, the ends of which each bears a clevis (q. v.) by which they are pivotally connected respectively to the ends of the right and the left hand steering knuckle arms (q, v.). Its function is to interconnect the two front road wheels so that they are at all times maintained in the straight ahead or in correspondingly deflected positions. Its length is usually slightly variable so that the front wheels can be adjusted to parallelism.

Time (v.)—To adjust the period of occurrence of the ignition spark with relation to the cycle of an internal combustion motor. (See ignition, point of; advance; retard). (See also valve timing).

Timer—In an ignition system, the device which automatically closes and opens the primary circuits at such periods as to produce sparks at the instants when they are



TIMER.

A., Contact Roller; B. Metallic Segment; C, Insulated Housing; D, Connection to Spark Lever.

required by the gas motor with which it is used. It usually consists of a grounded (q. v.) contact-carrying arm, rotated by one of the motor shafts (at one-half the speed of the crankshaft for a four stroke cycle (q. v.) motor and at crankshaft speed for a two stroke cycle (q. v.) motor, and a number of equally spaced, metallic contact segments (one for each engine cylinder) fastened upon the internal surface of a stationary, cylindrical, insulating shell which is carried (usually on a ball bearing) upon and concentric with the contact arm shaft in such a manner that the contact arm, when rotated, successively makes and breaks connection with the segments. The timer shell with its contact segments is capable of being rotated through an arc, by means of the spark lever (q. v.) and linkage so that the period in the engine's cycle at which the contacts are made and broken may be varied and the desired angle of advance (q. v.) can be secured. A primary wire from one of the spark coils (q. v.) is connected to each segment, and, as the contact arm rotates, it touches each contact segment in succession and energizes each ignition circuit successively, the connection being such that sparks are produced in the cylinders in the proper firing order (q. v.). A timer of this type is used with multiple vibrator coils (see ignition, multiple coil), and in the master vibrator system (see ignition, master vibrator). A timer is employed in connection with a distributor (q. v.), usually being built integrally therewith in battery systems, all the contact segments of such a timer being electrically connected together, so that the primary circuit of the single spark coil (see ignition, single coil) is closed at the instant each cylinder requires a spark. In timers used in single spark systems (see ignition, single spark), the contact arm of the timer is usually replaced by a cam (see cam, ignition) with as many projecting faces as there are cylinders to be ignited. The cam projections, as they pass them, successively close a pair of spring opened, platinum tipped contact points which are in circuit with the primary of the single coil used in the system. A magneto make and break (q. v.) is essentially a timer.

Syn.: Commutator.

Timer, Automatically Advanced—A timer so devised as automatically to advance (q. v.) the spark with increasing motor speed, and to retard it with decreasing motor speed, so that ignition always takes place at the most advantageous point (see ignition, point of) in the cycle of each cylinder and manual adjustment of the spark is obviated. A centrifugal device, similar to that used in an engine governor (see governor, centrifugal), rotated by the timer shaft, is mechanically so connected with the timer as to alter the angular relation of the timer arm or cam to the timer shaft, or to alter the angular position of the timer shell and contact segments as to secure the spark position demanded by each change in engine speed. Automatic timing is applied to magnetos, usually automatically varying the angular relation to the magneto driving shaft of the cam which operates the make and break device.

Timer, Ball Contact—A timer the contact arm of which carries a spring pressed steel ball, which makes successive electrical connection with the contact segments, which are usually of hardened steel, a rolling action between the contact parts thus being secured.

Timer, Brush Contact—A timer the rotating arm of which bears a spring pressed brush (q. v.), which makes a sliding contact with the segments or one in which each segment is replaced by a pair of spring contacts between and in rubbing contact with which the timer arm passes, or any timer in which a sliding rather than a rolling electrical contact is employed.

Timer, Roller Contact—A timer, the rotating arm of which terminates in a spring pressed, hardened steel roller, which successively runs over the hardened steel contact segments with a minimum of wearing action.

Timer Shaft—The shaft which operates a timer. Such a shaft runs at one-half engine speed in the case of a four stroke cycle (q. v.) motor, and thus may be identical with a cam shaft (q. v.). In the case of a two stroke cycle (q. v.) motor it runs at crankshaft speed and may be identical therewith. Very often the timer is driven by a special shaft arranged vertically or slightly inclined on one side of the motor and driven by spiral or bevel gears from a camshaft or otherwise.

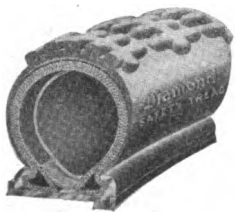
Syn.: Commutator shaft.

Timing Gears—See half-time gears.

Timing Marks—See flywheel markings.

Timing Range—The total angle through which the occurrence of the spark can be varied by moving the spark timing mechanism from its most advanced to its most retarded position. It may be measured as the total angular movement produced in the adjustable member of the timer or as the total angular movement of the motor flywheel between its position when the spark occurs under full advance and that at which it occurs when fully retarded; the angle as measured upon the flywheel being twice that measured at the timer, in the case of a four cycle motor.

Tire—A coninuous circular band, fastened around the periphery of a road wheel outside the felloe, the external surface of which forms the actual surface of contact between the wheel and the roadbed. Its function is to resist the wearing effect of the road surface, and, in automobile practice, to protect the structure of the wheel, the car mechanism and the passengers or load against road shocks and to reduce the noise of the vehicle's operation, to attain which results the material of the tire is usually of a somewhat yielding and resilient nature, such as rubber.



ANTI-SKID TIRE.

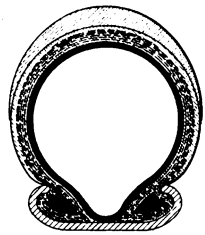
Tire, Anti-Skid—A tire, the tread of which is so constructed as to grip the road surface more securely than does a smooth tread. The treads of pneumatic tires of this class may be provided with a multiplicity of molded knobs of rubber arranged in various patterns; the tread may consist of a leather band, studded externally with a multiplicity of steel rivets, or it may be othewise roughened so as to tend to indent the road surface and thus to offer extra resistance to the tractive effort and to side slip.

BLOCK TIRE.

Tire, Block—A form of solid rubber tire, mainly used upon commercial vehicles, built up of closely spaced blocks of rubber, usually of somewhat rectangular section and thus possessing a tread which is not continuous, but scalloped. The specially constructed bases of the rubber blocks may be held in rectangular sockets in a retaining band (either continuous

or sectional) which is bolted to the wheel felloe, or they may be secured in a channel rim by means of side wires. Two parallel series of such blocks are frequently used upon the same wheel, the blocks of the two series being "staggered." Such tires possess excellent tractive and anti-skid properties, on account of the tendency of the separate blocks to cling to or to indent the roadway. Individual blocks of such tires which have become damaged can be separately replaced.

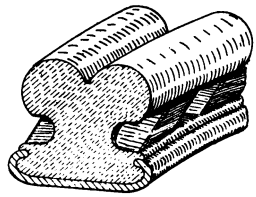
Tire, Clincher—A tire of the pneumatic or solid rubber type, adapted to be held in a clincher rim (see rim, clincher) mainly by the tendency of its base forcibly to expand transversely under inflation or by its own elasticity. Such a tire is made with a continuous bead (see tire bead) upon each side of its base, which is forced under the respective incurved edge of the rim. In pneumatic tires of this type a number of retaining bolts (staybolts) are employed, which pass through the felloe and rim and the appropriately shaped beads of which (on the outside of the rim) bear against the inside edges of the base of the tire casing, when the bolts are tightened, drawing it against the rim and forcing the edges of the beads into the clinchers, thus resisting any tendency to creep (q. v.) and to leave the rim.



CLINCHER TIRE.

Tire, Cushion—A tire depending for its resiliency upon the elasticity of rubber, and differing from a solid rubber tire (see tire, solid rubber) in that the rubber is so distributed as to impart to the tire peculiar yielding qualities.

Such a tire may be constructed with a continuous hollow centre or core, or with a hollow centre divided into cells by rubber bridges; holes or cells may be provided in its tread or sides; the sides may be hollowed or notched; the tread may be provided with several continuous ridges which yield under pressure, or any expedient may be adopted to secure a greater freedom of bending of the tire under load than is obtainable in a rubber tire of solid



CUSHION TIRE.

shaped section. In resiliency, the cushion tire is intermediate between an ordinary solid tire and a pneumatic, and is used upon some commercial vehicles and upon some pleasure vehicles, chiefly electrics and high wheel cars.

Tire, Dual—The combination of two like tires, either of the solid or pneumatic type, side by side, in suitable rims, upon the same wheel. Dual solid tires are more successful than a single tire of equal width upon heavily loaded wheels, for the reason that there is secured a more uniform distribution of driving and braking stresses over the tire base. Dual pneumatic tires are used upon the wheels of heavy vehicles which cannot be economically operated upon single tires of the largest sizes commercially obtainable.

Syn.: Twin tires.

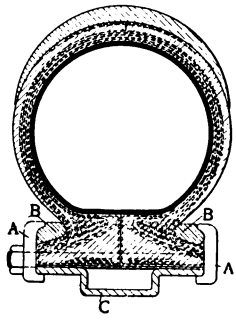
Three tires are sometimes applied in a similar manner to exceedingly heavily loaded wheels of commercial vehicles. (Triple tires.)

Tire, Flat Tread—A pneumatic tire the cross-section of the central portion of the tread of which is a straight line instead of the arc of a circle and which thus presents to the road a flat surface of considerable width, even though no flattening of the tire takes place. Such treads are sometimes employed with the idea of obtaining superior road adhesion, greater security from puncture, greater immunity from skidding and superior wearing qualities.

Tire, Mechanically Fastened—A pneumatic tire the inflation of which plays no part in holding it to its rim, as it does in the case with clincher and most quick detachable tires.

Positive mechanical holding devices are provided which secure it in place whether it is in an inflated or deflated condition.

Syn.: Bolted-on tire.



MECHANICALLY FASTENED TIRE.

AA, Clamp; BB, Ring Retainers; C, Rim.

Tire, Pneumatic—A tire which owes its resiliency to air, confined under pressure, between the rim of the wheel and the tire tread. In its usual form it consists of a continuous circular, tubular casing (see tire casing), fastened

by the edges of its base, upon the wheel rim, within which is fitted an endless circular, air-tight tube, the inner tube (q. v.), which, when inflated with air to a considerable pressure distends, presses against the rim and the inside walls of the casing, thus giving the tire a rotund shape under load, and confining a highly elastic body of air between the roadway and the rim of the wheel. The casing and inner tube are capable of bending, without large waste of energy, to conform to irregularities of the road surface, partly or wholly "absorbing" them and thus preventing jolts which would otherwise be communicated to the wheel and the vehicle.

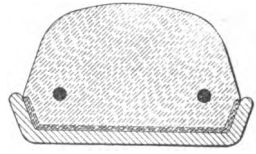
Tire, Puncture Proof—A pneumatic tire in or on the casing of which is provided an armor of steel or other impervious plates which deflect puncturing objects before they reach the inner tube, or any pneumatic tire in which the inner tube is protected against external damage.

Tire, Quick Detachable—A pneumatic tire adapted to be mounted upon a quick detachable rim (see rim, quick detachable) so that it can readily be put on and taken off.

Tire, Single Tube—A pneumatic tire, in which the casing and inner tube are intergral, the latter being merely the air-tight inner layer of nearly pure, lightly vulcanized rubber, the whole forming an endless closed tube of circular section. Equally spaced metal lugs, vulcanized into the inner face of the tire, receive screws driven through the felloe and rim and hold the tire in place, cement also sometimes being used. Occasionally employed upon electric vehicles, a special light-walled and highly resilient form being usually chosen. (High duty tire.)

Syn.: Hosepipe tire.

Tire, Solid Rubber—A tire the resiliency of which is due to the yielding quality of compounded rubber in the form of a band of somewhat Ω shaped section, applied to the periphery of a wheel in a rim of somewhat channel shape. Such tires are generally used upon commercial vehicles and occasionally upon high wheel pleasure cars and others, as they deaden the noise of the wheel contact with the roadway, absorb vibration to quite an extent and possess good road adhesion.

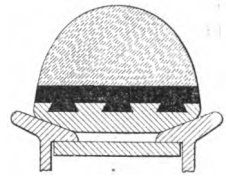


INTERNALLY WIRED SOLID RUBBER TIRE.

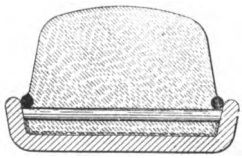
Tire, Solid Rubber, Internally Wired—A solid rubber tire, which is held in its rim by the constrictive ac-

tion of one or more continuous wires which are embedded in the base portion of the tire throughout its entire length. The wires are stretched, by a special machine, after the tire is on the rim and the two ends of each are united by welding or otherwise so that each wire forms a complete band, under heavy tension.

Tire, Solid Rubber, Metal and Hard Rubber Base—A solid rubber tire with a base made up of a steel band externally provided with circumferential dovetail projections, upon which is molded a layer of hard rubber, the external surface of which is vulcanized to the rubber body of the tire. Such tires are especially intended for use upon demountable rims, the inside surface of the steel band being held upon the rim by wedge like rings, one of which is usually clamped to the wheel by bolts.



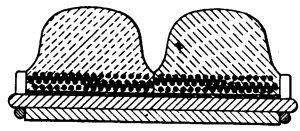
SOLID RUBBER TIRE, METAL AND HARD RUBBER BASE.



SOLID RUBBER TIRE, SIDE WIRED.

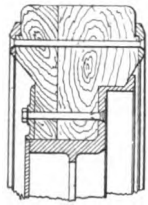
Tire, Solid Rubber, Side Wired—A solid rubber or similar tire which is secured in a somewhat channel-shaped rim by two steel wire bands drawn tightly around between each edge of the rim and the neighboring edge of the tire base. The base of the tire is given rigidity by numerous cross wires vulcanized into it upon the ends of which the two side wires bear.

Tire, Solid Rubber, Wire Mesh Base—A solid rubber tire, in the base of which is embedded a meshwork of wires which prevents it from stretching and forms an unyielding base. It is secured in a channel shaped rim, one flange of which is removable, and which when bolted on, compresses the base transversely and holds the tire from creeping.



SOLID RUBBER TIRE, WIRE MESH BASE.

Tire, Wood Block—A tire, built up of blocks of hard wood secured in and filling a channel rim with the grain of the wood perpendicular thereto, the faces of the blocks being turned down to a true circle. Such a tire is much less noisy, somewhat more resilient and less likely to slip than a steel tire, and is occasionally used upon heavy commercial vehicles.



Wood Block Tire.

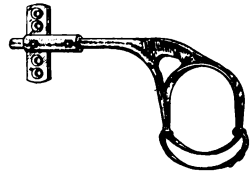
Tire Base—That portion of a tire which is immediately in contact with the rim and by which it is held in position thereon. The term is especially applied to solid rubber and cushion tires, the bases of which are usually of special rigid construction, in order that they may be securely held, while the tire proper is of a yielding nature.

Tire Bead—The two edge portions of the base of a tire which are grasped by the sides of the rim (see tire, clincher). The bead of pneumatic tire casings is formed of a strip of hard rubber around which the rubberized fabric of the tire carcass (q. v.) is built up to give the required shape. In clincher pneumatic tires the bead is hooklike, and adapted to fit under the incurved edges of the rim. In some pneumatic tires for use on quick detachable rims the bead is not hooklike but straight-sided (straight or Dunlop bead) and in the bead is enclosed a continuous elastic wire cable (cable base tire) which prevents the base from stretching and, by contracting under inflation, holds the casing tightly upon the rim.

Tire Breaker Strip—In a pneumatic tire casing a strip of heavy fabric applied between the cushion (q. v.) and the rubber of the tread.

Tire Carcass—The structural or stress resisting portion of a pneumatic tire casing to which the tread and other parts are applied. It is built up of rubberized cotton fabric, wound diagonally around a core of the required shape and size and compacted into a solid mass by pressure and vulcanization.

Tire Carrier—A support attached to a car in which extra tires or demountable rims are carried. The tires are frequently strapped at three points to forked irons, two of which extend



Tire Carrier.

out from the car body and one from the running board, or they may be held in suitable supports attached to the rear of the body.

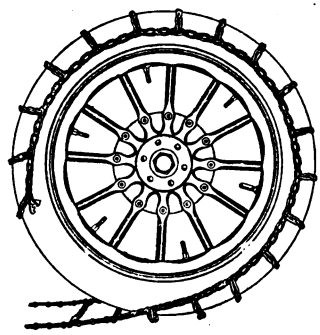
Syn.: Tire holder. Tire irons.

Tire Case—A waterproof and dustproof envelope of the shape and size of a pneumatic tire, designed to be fitted around a spare tire to protect it from deterioration while it is carried on a car. It is usually made of enamel cloth and is held tightly about the tire by a contracting wire spring sewed ino the fabric.

Syn.: Tire cover.

Tire Casing—A pneumatic tire exclusive of its inner tube. The wear and stress resisting external portion or envelope, which is secured to the wheel rim. Syn.: Tire shoe. For parts thereof see tire bead, tire carcass, tire tread, tire cushion, tire flap, tire breaker strip.

Tire Chain—A traction increasing and anti-skid device (q. v.), consisting of two steel chains which fit entirely around a tire on each side thereof near its base. These two side chains are united by a series of short, uniformly spaced cross chains of hardened steel, the ends of which are hooked into links of the side chains so that they lie across the tread of the tire. The two ends of each side chain are held together by a snap hook which is released when the tire chain is put on or taken off. In use, the cross chains indent a yielding roadway and increase the adhesion of the wheel thereto and, on hard road surfaces, wedge between it and the tire and reduce the slipping tendency.



TIRE CHAIN.

Tire Cushion—A layer of nearly pure rubber applied, in the manufacture of a pneumatic tire casing, between the tire carcass (q. v.) and the breaker strip (q. v.) or strips, to act as a buffer between the tread and the body of the tire.

Tire Filling—A composition sometimes used to completely fill the air space within a pneumatic tire, thus rendering it immune to puncture without entirely destroying its resilient

qualities. Such compositions consist of mixtures of somewhat resilient, spongy or jelly-like materials, such as glucose, glue, glycerine, etc., which are introduced into the air tube, when in a melted condition, by means of air pressure, and assume, upon cooling, a resilient solid condition.

Tire Flap—A fabric lip or band, so attached, by one edge, as to lie around the inner circumference of a quick detachable pneumatic tire casing, and which, after the inner tube is placed in position, is so adjusted that it intervenes between it and the rim, thus protecting it from pinching and rusting.

Syn.: Tire chafing strip.

Tire Gauge—See gauge, tire.

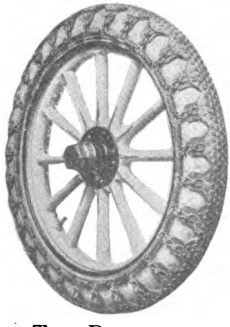
Tire Inflater—See air bottle.

Tire Inner Shoe—A circular band of leather, strong fabric or other material of such shape as to fit between the inside of a pneumatic tire casing and the inner tube and thus to reinforce the former against the outward pressure of the latter, thus assisting in preventing blowouts and in resisting punctures. Principally used with casings which have become weakened in use. See blowout patch. Syn.: Inside tire protector.

Tire Inner Tube—See inner tube.

Tire Patch—A prepared piece of rubber of such quality, size and shape as to be conveniently cemented or vulcanized over a puncture in an inner tube to close the same. The edges of the patch are usually beveled off and one side of it is often prepared with a rubber cement.

Tire Protector—A band of highly resistent and impenetrable material applied to the tread of a pneumatic tire to relieve the tread from road abrasion, to resist the attacks of puncture producing objects and to strengthen the casing against blowouts. It may be a band of leather cemented or otherwise permanently affixed to the tread and studded with steel rivets or a detachable endless band consisting of layers of leather externally bearing steel rivets or containing overlapping steel plates, which is held upon the tire by the outward pressure of its inflation and by a series of contractile springs acting to hold its edges

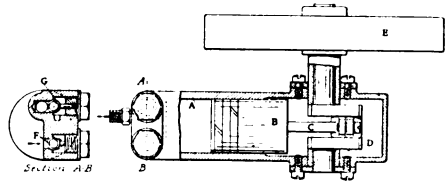


TIRE PROTECTOR.

in tension and closely against the tire. Such protectors are generally designed to act as anti-skid devices (q. v.).

Tire Pump—An air pump or compressor used to inflate pneumatic tires by forcing air into their inner tubes. See illustration under air pump.

Tire Pump, Power—A tire pump operated by mechanical power. Portable pumps for use upon automobiles may consist of a combination of one or more pump cylinders, the pistons of which are driven from a crankshaft which is, in turn, rotated by being thrown into gear with a shaft of the vehicle motor, or by means of a friction pulley forced into contact with the motor flywheel or by suitable mechanical connection to a jacked-up road wheel. Another type (impulse pump) is operated by motor cylinder pressure and consists of a double diameter piston (see piston, double diameter) and cylinder arrangement which is screwed into a spark plug hole of the motor. The alternating compression pressure and suction, within the motor cylinder, acting upon the larger of the pump pistons reciprocates it and causes the smaller piston and its cylinder to reciprocate as well and it and its cylinder to act as an air pump.



ENGINE DRIVEN TIRE PUMP.
A—Cylinder; B—Piston; C—Connecting Rod; D—Crank Shaft; E—Driving Pulley; F—Intake Valve; G—Delivery Valve.

A stationary power tire pump, such as used in garages, usually consists of a multicylinder air pump, operated by an electric motor or from shafting, which maintains a predetermined air pressure in a tank from which air can be drawn for tire inflation.

Tire Shoe—A tire casing (q. v.).

Tire Sleeve—See blowout patch.

Tire Staybolt—See tire, clincher.
Syn.: Tire lug.

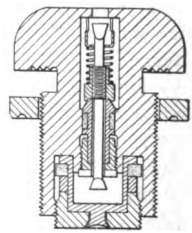
Tire Tape—See friction tape.

Tire Tool—A hand tool employed to facilitate the removal from and replacement upon their rims of pneumatic tire casings. Such tools are stiff steel levers, of a variety of shapes, adapted to act, to the utmost advantage, between the beads of the tire and the rim.

TIRE TOOL.

Tire Tread—The part of a tire which is in actual contact with the road surface and thus has to resist the abrasion and cutting action thereof. In pneumatic tire casings, it is the outside layer of specially compounded rubber adapted to resist wear and cutting by sharp objects and, at the same time, to prevent water from entering the fabric portion of the tire. It is of considerable thickness along the line of contact of the tire with the road and thinner along the sides of the casing, and a portion of it is often deeply embossed into various shapes for anti-skid (q. v.) purposes.

Tire Valve—An inwardly opening, spring closed valve, through which air is forced into the inner tube of a pneumatic tire and by which it is confined therein. The valve is placed in position by screwing it into its seat in the valve stem (q. v.).



TIRE VALVE.

Tire Valve Stem—The externally threaded metal tube, one end of which enters, airtight, through the wall of an inner tube and through which air passes into and out thereof. It contains the seat for the tire valve (q. v.), and its free end is provided with an internal thread to receive a pump connection and an external thread upon which an airtight cap is normally screwed. The stem is of such length that, when the inner tube is in place, its free end protrudes accessibly through a hole in the rim and felloe, a ring nut being screwed down upon the stem so as to bear against the felloe and draw the inner tube tightly against the inside of the rim, and a dust cap (q. v.) is usually screwed down upon this nut.

Tonneau—An unenclosed body used especially in touring, with a front seat for two passengers about midway of the chassis and a seat for three nearly over the rear axle, somewhat overhanging the general side lines of the vehicle. Entrance to the rear seats

is by a door on each side, which when shut entirely encloses the tonneau space. Chair seats for two passengers are sometimes added between the two main seats.

Syn.: Touring body.

Tonneau, Baby—A small tonneau accommodating two instead of three passengers upon the rear seat, and with no space for extra seats between the front and rear seats.

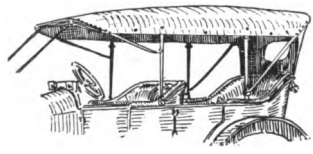
Syn.: Toy tonneau, miniature tonneau, pony tonneau, demi-tonneau.

Tonneau, Detachable—A tonneau body of which that portion to the rear of the front seat-backs and comprising the rear seating accommodations (the tonneau proper) is removable, as a unit, from the vehicle frame upon the loosening of bolts. When so removed the rear portion of the car becomes a flat deck or trunk platform, upon which a truck box or similar attachment may be mounted, thus permitting the same car to be used as a two passenger car, a four passenger car or for light commercial purposes.

Tool Box—A box in which automobile tools are carried, usually constructed of pressed steel and generally mounted upon one of the running boards of a car.

Tool Steel—See steel, tool.

Top, Cape—A folding top of waterproof fabric attached to inverted ∩ shaped bows which, when extended, forms a rain and sun proof protective covering over a car, extending from the extreme rear to a point slightly forward of the dash, the fabric being brought down for a short distance along its edges, but leaving the sides and ends of the car practically open. The lower ends of the bows are supported upon two top irons on each side of the body, one pair being located close to the rear and the other pair nearly in line with the front seat. Two bows are generally used at the front and either two or three at the rear. The top is kept tightly extended by means of two pairs of adjustable top



Cape Top.

straps attached respectively to the two sides of the front and of the rear thereof, the other ends of the front straps being hooked into eyes fastened to the front of the car frame and the other ends of the rear straps to the rear portion of the body. In putting down the top, the front straps are unhooked, and the front bows are detached from the front irons and attached to the rear irons and the top collapsed rearwardly, the bows being closely strapped together with the top fabric folded among them. Detachable, waterproof curtains, with celluloid windows, which button onto the top and onto the body at the sides and rear of the car (side curtains), may be attached to completely close in the passengers, in inclement weather, and a curtain with celluloid windows, ordinarily carried rolled up on the front bow, may be let down and buttoned to the dash, to close in the front of the car (storm front).

Syn.: Cape cart top.

Top Cover—A waterproof fabric cover, so shaped as to slip over a top when it is folded and to button securely about it, thus hiding it from view and protecting it against soiling.

Syn.: Slip cover, envelope.

Top Circle—With reference to a gear wheel, the imaginary circle drawn through the points of its teeth.

Torpedo Body—See body, gunboat.

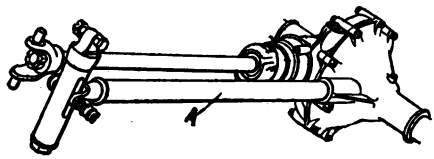
Torque—The turning or twisting effort exerted by or upon a rotating part, such as a shaft, and measured by the moment of the forces acting. It is the product of the turning force and the perpendicular distance of its point of application from the axis of rotation. If the force is expressed in pounds and the distance in feet or in inches, the torque is expressed in pounds-feet or pounds-inches, respectively. Knowing the horse power P being transmitted by a rotating part, the torque T acting in pounds-feet, is

$$T = \frac{33{,}000\,P}{2\,\pi\,N} = 5{,}025.2\,\frac{P}{N}$$

where N = the revolutions per minute of the rotating part. See horse power and dynamometer.

Syn.: Turning moment.

Torque Rod—A rod, generally tubular or of I-section, employed to resist the tendency of an automobile driving axle housing to rotate under the reaction of the driving and braking forces. It is located lengthwise of the vehicle, its rear end being secured rigidly into some part of the axle structure, usually the driving gear housing, and its front end secured to a frame cross member, this end usually being confined between two spiral springs, held in a suitable fitting, with the intention of permitting slight deflections of the rod to cushion starting and braking shocks. Sometimes two tubes are used, their rear ends being bolted, respectively, to the upper and lower edges of the drive gear housing, and their front ends united at the spring support on the frame, a triangular structure thus being formed. A torque rod is used upon most shaft driven cars having drive shafts of the double jointed type (see drive shaft, double jointed), although in some small cars, the rear springs which are tightly clipped to the axle housing, act to resist its rotation. In cars with drive shafts of the single jointed type, the drive shaft housing (q. v.) is often arranged to act as a torque rod, its front end being secured to a frame supported part so that it can pivot thereon at a point concentric with the universal joint and its rear end being rigidly secured to the drive gear housing. Under such conditions the housing also acts as a distance rod (q. v.).



TORQUE ROD (*A*).

Touring Car—A motor car, usually of the five or seven passenger tonneau type, especially intended for use in making long, continuous runs over all kinds of roads at speed, and with comfort to its passengers, in contradistinction to a runabout intended for use in making short, local trips. It is usually rather highly powered, with large capacity for supplies and luggage, a long wheelbase, specially easy riding springs and luxurious seats, and specially fitted with conveniences tending to make its occupancy comfortable during long periods.

Town Car—A motor car with a closed or convertible body, usually hung rather low to afford easy access and egress, pri-

marily intended for city use, such as shopping and calling. Such a car is usually not especially high powered, but is designed with a small turning radius (q. v.) and a capacity for rapid acceleration to facilitiate its being manœuvred handily in crowded traffic. Limousine, landaulet, coupé and other similar bodies are employed.

Track—The gauge of a vehicle (q. v.).

Traction—The adhesion of the wheels of a vehicle to the roadway; that is, the frictional force acting between them and the road, which furnishes the reaction against which the tractive effort acts in moving the vehicle and against which the braking effort acts in stopping it. It is the product of the coefficient of friction of the tires on the roadway and the weight supported upon the driving wheels. When the tractive effort or braking effort exceeds the traction, the driving wheels slip and the vehicle fails to move or fails to stop promptly. Imperfect or diminished traction results from icy, muddy or otherwise slippery roads, unsuitable tires or too lightly loaded driving wheels.

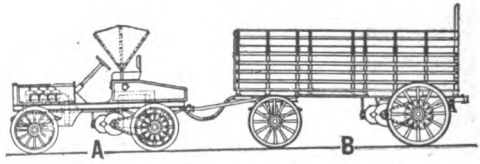
Traction Increasing Device—See mud hook, tire chain and tire, anti-skid.

Tractive Effort—The force applied, tangentially, at the point of contact of a driving wheel with the roadway which tends to move a self-propelled vehicle. Knowing the horse power P being applied to a pair of driving wheels, the tractive effort in pounds is $F = 5025.2 \frac{P}{RN}$, where R is the wheel radius in feet and N is the speed thereof in revolutions per minute.

Tractive Resistance—The resistances acting at the points of contact of the wheels of a vehicle with the surface of a level roadway, which opposes the rolling of the wheels over it and thus the movement of the vehicle. Such resistance varies with the load carried, the kind and width of tires used and their condition, the character and condition of the road surface, the wheel diameter and vehicle speed and other factors. It is usually expressed in pounds per ton of weight moved.

Syn.: Road resistance.

Tractor—A motor car designed to draw trailers



Tractor (A) and Trailer (B).

(commercial vehicles without motive power) or to drag agricultural or other similar machinery. Syn.: Traction engine.

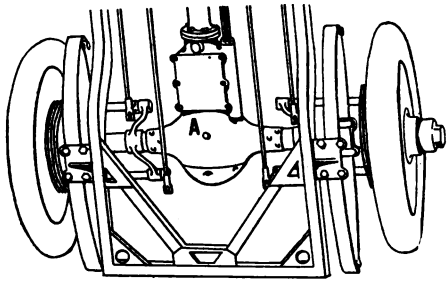
Also a motor-car mechanism adapted to be attached to the forward end of a horse drawn vehicle and thus to convert the latter into a self-propelled vehicle. Syn.: Forecarriage. One type of tractor consists of a power chassis with a single front wheel for steering purposes, the rear of this chassis being made fast to the fifth wheel of the horse-drawn vehicle, the front wheels of the latter receiving the power from the tractor and supporting its rear portion, the whole constituting a five wheel vehicle. Deflection of the front wheel deflects the tractor portion and turns the fifth wheel and the two driving wheels, thus permitting the whole vehicle to be steered and manœuvred in a small space.

Transfer Passage—In a two (stroke) cycle motor, the passage through which the fuel charge, which has been compressed in a separate chamber, is allowed to expand and flow into the working cylinder. Its point of entrance into the crank case or other chamber in which the charge is compressed is called the transfer port and its point of entrance into the working cylinder is called the inlet port. The transfer passage is usually cast in the cylinder wall from the crank case to the working cylinder space, but, in multiple cylinder engines, it may be a passage extending from the pumping space of one engine to the working cylinder of the adjacent engine. See diagram under two cycle engine, three port type.

Transformer—See coil, induction.

Transmission—A change speed gear (q. v.).

Transmission Axle—A driving axle to the front side of the gear housing of which is bolted the rear end of the case (gear case) containing the change speed gear (q. v.) of a gasoline automobile, the front end of the drive shaft (q. v.) (either single or double jointed) being connected directly to the clutch shaft, and



TRANSMISSION AXLE (*A*).

its rear end to the primary shaft of the change speed gear, upon the final drive shaft of which is directly mounted the driving pinion of the bevel gear drive (q. v.). In this construction there are but two units to be mounted upon the frame: the engine-clutch unit at front and the change speed gear-axle unit at the rear.

Transmission Brake—See brake, transmission.

Transmission Efficiency—See efficiency, transmission.

Transmission Line—A term applied to all the elements concerned in the transmission of power from the motor to the driving wheels of an automobile, including the clutch and its shafts, the change speed gears and their shafts, the universal joints, differential gear, axle shafts and drive shaft or chains and sprockets of the final drive.

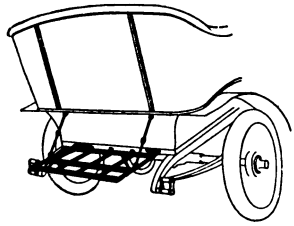
Tread—The gauge (q. v.) of a vehicle.

Tread—See tire tread and tire, anti-skid.

Trembler—See magnetic vibrator.

Truck Box—A box adapted to be mounted upon the rear of an automobile for commercial purposes. The term is usually applied to a box which can be attached and detached at will, in place of a tonneau or rear deck, to enable a car to be used for several classes of service.

Trunk Rack—A folding rack, usually of steel construction, attached to the rear of an automobile body and adapted to hold a trunk or other luggage and to be folded into small compass when not in use.



TRUNK RACK.

Trunnion—A projection attached to a movable structure, which fits into a suitable socket in a stationary part and forms a pivot upon which the supported structure may rotate slightly (usually in a vertical plane). The end support of a motor or other mechanism which is on a three point suspension (q. v.) is often a trunnion, and a trunnion is sometimes used upon each side of a radiator to give it a slight freedom of motion in the radiator brackets.

Truss—A construction designed to give transverse stiffness to a structural member. See axle, trussed, and frame, trussed.

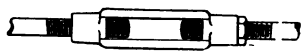
Try Cock—A gauge cock (q. v.) or a cock set horizontally into a housing containing oil, the opening of which indicates by the outflow of oil therethrough, or its failure so to outflow, whether the oil level is or is not above the point of insertion of the cock.

Tungsten Lamp—A form of electric incandescent lamp the filament of which is of tungsten wire and which is highly efficient as compared with the carbon filament lamp, consuming from 1.0 to 1.25 watts. per mean horizontal candle power. It is generally used in all automobile electric lighting systems.

Tune Up (v.)—To make such adjustments upon a motor car mechanism as to cause all parts to work together with the utmost harmony and efficiency.

Tungsten Steel—See steel, tungsten.

Turnbuckle—A device for adjusting the length of a structural or control rod. In one common form, the rod is divided at some convenient point in its length and the adjacent ends are threaded respectively right and left handedly. A long nut, with its two ends threaded correspondingly right and left handedly, is screwed onto the two threaded ends of the rod. Turning the nut in one direction draws both ends of the rod into it, thus reducing the rod's length, and turning the nut in the opposite direction screws both ends of the rod out of the nut, thus increasing the rod's length. A check nut is sometimes applied to one end of the nut to retain the adjustment. It is used to adjust the lengths of spark, throttle and brake linkages, the tension rods of trusses, distance rods, etc.

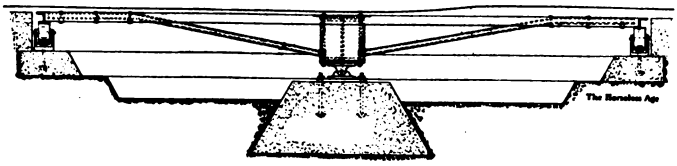


TURNBUCKLE.

Turning Moment—Torque (q. v.).

Turning Radius—The radius of the circle which the outside wheels of a car describe when it is turned completely around with the front wheels deflected, by the steering gear, into one or the other of their extreme positions. The greater the angle of lock (see lock, angle of) and the shorter the wheelbase (q. v.) the smaller the turning radius and the less space required in which to manœuvre a car.

Turntable—A device for turning cars around in a garage, consisting of a circular platform, flush with the floor, which is supported beneath upon anti-friction bearings, generally several series of balls, so that it and a car which has been run onto it can readily be rotated by hand, and the car be left pointing in any desired direction.



TURNTABLE.

Two Cycle Engine—A gas engine operated upon the two stroke cycle (q. v.). Most such engines are without valves in the common acceptation of the term, gases leaving and entering the working cylinder and pump chamber through ports in the cylinder wall, which are closed and opened by being covered and uncovered by the working surface of the piston in its travel. In some late designs, however, mechanically operated and automatic valves are adopted. The charge to be admitted to the working cylinder, through the transfer passage (q. v.), is usually precompressed in the gas-tight crank case by the lower face of the piston or in a special pump chamber acted upon by an extension of the working piston. The displacement of remanent burnt gases from the cylinder and the distribution of the fresh charge therein are facilitated by a deflector plate (q. v.). Mechanically and as to their ignition (see timer), carburetion, cooling and lubrication (see lubrication, mixture method), they are similar to four cycle engines. They are built in multicylinder types and in the four cylinder type the cranks are usually set at angular intervals of 90 degrees, thus providing for an overlapping of power impulses and a constant torque. The details of the manner in which the cycle is carried out is susceptible of considerable variation, and much diversity of design exists. The most common types in commercial use are defined under the following heads:

Two Cycle Engine, Differential Piston Type—A type of two cycle engine equipped with differential pistons and cylinders (see piston, double diameter, and cylinder, double diameter).

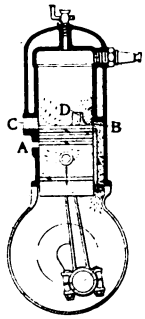
The larger bore and piston of each cylinder acts as a pump, precompressing the charge for transfer to the combustion space of another cylinder, the crank of which is set at 180 degrees with that of the pumping cylinder.

Two Cycle Engine, Distributor Valve Type—A type of two cycle engine, built with two cylinders or a multiple thereof, in which the transfer of the precompressed charges to the working cylinders is effected through transfer passages which, as well as the suction passages to the pumping chambers, are controlled by a rotary distributor valve (q. v.), rotated at crankshaft speed by the engine. In a typical form of four cylinder engine of this type, in which the cranks of each pair of cylinders are set in opposition, double diameter pistons are employed (see two cycle engine, differential piston type). The distributor valve alternately establishes communication between the carburetor and the precompression space of a particular cylinder, during the entire downward stroke of its piston and between the said precompression space and the tranfer passage to the adjacent working cylinder when the piston of the same is near its downward dead centre. The angular relation of the distributor valve to the crankshaft can be varied at the will of the operator so as to delay the instants of transfer of the charges to the working cylinders, when high fuel economy but not maximum power is required.

Two Cycle Engine, Fuel Injected—A form of two cycle engine in which pure air is supplied the working cylinder from the crank case or other source of transfer pressure, and fuel is injected into the combustion space at the correct instant to form the combustible mixture (see fuel injection). Not in commercial use.

Two Cycle Engine, Rotary Valve Crank Case Admission Type—A type of two cycle engine in which the third port (see two cycle engine, three port type) is dispensed with and in which the charge is admitted from the carburetor to the crank case, previous to its compression therein, and transfer to the working cylinder, through a rotary valve carried by the crankshaft, which opens the passage during nearly the whole upward stroke of the piston and closes it during the down stroke. A disc, with a sector shaped port, is carried by the crankshaft, which registers during the appropriate part of its revolution with a port in the end of the crank case, which gives communication with the carburetor.

Two Cycle Engine, Three Port Type—A two cycle engine, the cylinder wall of which is pierced with three ports, extending around it through considerable arcs, viz.: The inlet port *B* on one side thereof, forming one termination of the transfer passage (q. v.) and, upon the other side, the exhaust port *C*, the outward edges of these ports registering with the inward edge of the piston when at its outward dead centre. The exhaust port is wider than the inlet port. On one side of the cylinder is the third, or crank case admission port *A*, the inward edge of which registers with the outward edge of the piston when it is at its inward dead centre. This port is piped to the carburetor. The cycle is as follows: Considering first the outward face of the piston acting upon the gases in the tight crank case, in moving inwardly, nearly to its inward dead centre, the piston has rarified the gases in the crank case by increasing its volume, and, as its outward edge passes the outward edge of port *A*, gas rushes in therethrough from the carburetor, filling the crank case. As the piston reverses and begins to move outward, port *A* is closed and the charge, trapped in the crank case, is slightly compressed, which action continues until, late in the outstroke, the inward edge of the piston uncovers inlet port *B* and the somewhat compressed charge rushes into the working cylinder through the transfer passage being diverted into a proper direction by deflector plate (q. v.) *D*, the exhaust gases meanwhile escaping through exhaust port *C*, partly under the scavenging (see scavenge) action of the incoming charge. As the piston commences its inward movement, its inward edge closes inlet port *B*, and, somewhat later, exhaust port *C*, and the charge trapped in the working cylinder is compressed therein, back of the piston, until the inward dead centre is reached, when the spark is passed, ignition and expansion occur and the piston is forced outward on the working stroke. When its inward edge registers with the inward edge of exhaust port *C*, the burned gases commence to escape, and a little later, when its inward edge registers with the inward edge of inlet port *B*, the new charge, previously compressed in the crank case, begins to enter the cylinder.



THREE PORT TYPE, TWO CYCLE MOTOR

The most generally used type of two cycle engine.

Two Cycle Engine, Two Port Type—A type of two cycle engine in which the crank case admission port (see two cycle engine, three port type) is dispensed with, gas being drawn into the crank case from the carburetor, through an inwardly opening, suction operated, spring closed poppet valve (see valve, automatic), which opens when the instroke of the piston has sufficiently rarefied the gases in the crank case and closes when the rarefaction ceases, at or near the beginning of the outstroke. This type is not well fitted for automobile use, but is common in marine practice.

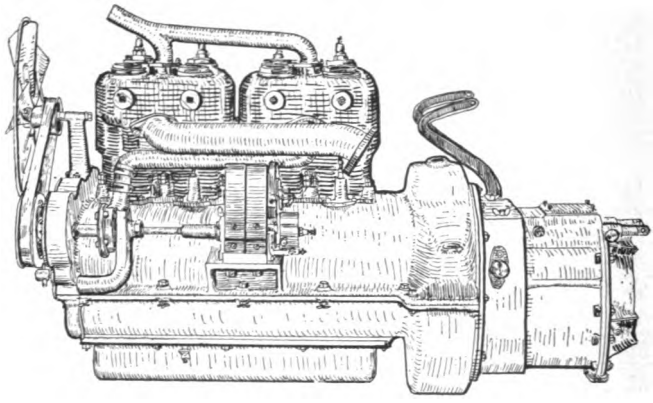
Two Stroke Cycle—The cycle upon which a two (stroke) cycle internal combustion motor is operated, comprising one inward and one outward piston stroke. At the beginning of the outward stroke, the fuel charge, previously compressed behind the piston in the working cylinder, is ignited, expands and does useful work upon the piston, forcing it outward, the products of combustion escaping during the later portion of this stroke and the earlier portion of the inward stroke. During the last part of the outward stroke and the first part of the inward stroke, the next fuel charge, which has meanwhile been somewhat compressed in a communicating pump cylinder, is allowed to expand into the working cylinder, its entrance thereinto assisting in displacing the remanent exhaust gases therefrom and charging the working cylinder for the next combustion. During all but the earlier portion of the inward stroke the charge thus admitted is trapped behind the working piston and is compressed preparatory to being ignited at the end of this stroke. An engine operating upon this cycle does useful work on each outward stroke instead of on each alternate outward stroke, as does a four cycle engine. The outward stroke is primarily a power stroke and the inward stroke a compression stroke, exhaust and admission occurring practically simultaneously during the period when the piston is near its outward dead centre. The charge is always forced into the working cylinder by external energy and not by the suction of the working piston as in a four cycle engine.

Underpan—See sod pan.

Unit Coil—See coil, unit.

Unit Power Plant—The combination as a single rigid structure of a vehicle motor and all transmission parts other than the final drive mechanism. To the rear end of the motor crank case is bolted the front end of a yoke or housing sup-

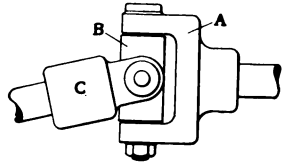
porting the clutch and the change speed gear case, so that the three elements constitute a unit which is readily mounted upon



UNIT POWER PLANT.

and dismounted from the frame and in which the liability of any failure of alignment of parts is minimized. The control levers and pedals and all engine auxiliaries are usually attached to this structure.

Universal Joint—A form of joint adapted to transmit rotary motion from one shaft to another located at an angle therewith. Principally used to connect the ends of the driving shaft of shaft-driven cars respectively to the clutch or gearshaft and to the driving pinion shaft which rotates the rear axle, and required because the angular relation of the drive shaft to the other shafts is constantly varying as the vehicle springs act. A common form is constructed as follows: The ends of the connected shafts terminate in U-shaped yokes *A C*, yoke *A*, on one shaft, lying in a plane perpendicular to yoke *C* of the other shaft. The two yokes are held in driving relation by a cross-shaped piece *B*, the ends of the two pair of arms of which are journaled respectively in



UNIVERSAL JOINT.

the ends of the two yokes. A dust and lubricant tight housing is usually fitted over the whole joint.

Syn.: Cardan joint, Hooke's joint.

Universal Rim—See rim, universal.

Upset (v.)—To expand or rivet over the end of a part which protrudes through a hole in another part, so as to prevent its loosening therefrom.

V-Belt—A leather or fabric belt of blunt V-section, adapted to run upon pulleys with V-shaped grooves. The belt is either notched upon its working face or built up of overlapped layers of leather to give it flexibility. Such a belt may be run quite loose without serious slipping and is sometimes used to drive radiator fans. Syn.: Trapezoidal belt.

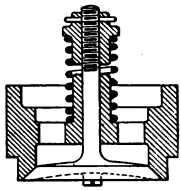
V-Type Motor—See motor, V-type.

Valve—Any device for controlling the flow of a fluid through a passage, such as a pipe, or through an opening from one chamber to another, consisting of means for opening or closing such passage or for enlarging or contracting its cross section at will, as, for instance, by the insertion into or withdrawal from it of a movable member, such, for instance, as a slide or damper or by the seating or unseating of a tightly fitting part in the entrance or exit space of the passage.

The entrance and exit of the working fluid from the cylinders of gas and steam engines is effected through valves, automatically opened and closed by the engine mechanism and most of the definitions here given refer to engine valves, although valves are also used in fuel systems, lubrication systems, etc.

Valve, Admission—See inlet valve.

Valve, Automatic—Specifically, a valve, usually of the poppet type (see valve, poppet), which is opened automatically by the difference in pressure of the fluid acting upon the two sides of its disc and which is closed by a spring. Such valves were formerly used as gas engine inlet valves opening inwardly by atmospheric pressure, and admitting the fuel charge to the cylinder when the rarefaction therein, caused by piston movement, became sufficient to overcome the closing spring pressure. Such valves are used as the crank case inlet valves of two cycle engines (two port type)

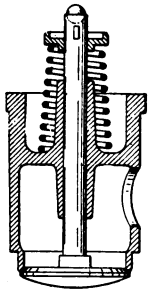


AUTOMATIC VALVE.

(q. v.) and as the auxiliary air valves (q. v.) of carburetors and similar ones, as suction valves of air, oil and gasoline pumps and water feed pumps.

The term is used in contradistinction to mechanically operated valve. Syn.: Suction operated valve, clack valve.

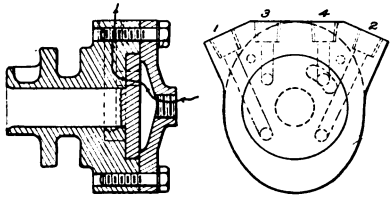
Valve, Caged—In gas engine practice, a valve usually of the poppet type, which, together with its seat, its spring and the valve stem guide, can be removed from the cylinder in which it is used. Such valves are used in overhead valve gas motors (see valve, overhead), the cage usually being cylindrical, provided with a gas passage by which it connects with the manifold, and arranged to be screwed into a threaded hole or clamped in an unthreaded hole in the cylinder head, seating gas-tight upon an annular gasket (q. v.).



CAGED VALVE.

Valve, Concentric—A combination of two valves arranged concentrically, so that intake and exhaust can take place through the same cylinder port and space thus be economized so that valve openings of large area as compared to the cylinder bore can be secured. In one form, which has been used in an air-cooled motor, the intake valve is hollow and annular and its external edge closes upon a seat formed in the cylinder head, and the exhaust valve is an ordinary poppet valve, coaxial with the inlet valve and within it, seating upon the internal periphery of the head of the latter. Both valves are lifted as a unit during intake and the exhaust valve only during exhaust.

Valve, Distributor—A valve, usually rotary in its action, the function of which is to control the flow of fluid from a common source of supply to several points of delivery in regular succession. Such valves are used to distribute the fuel charge from the carburetor to the pump chambers and working cylinders of two cycle motors (see two



DISTRIBUTOR VALVE.

cycle motor, distributor valve type); to deliver oil to a series of leads; in self-starters (q. v.) of the spark type to distribute acetylene gas to the motor cylinders, and in self-starters (q. v.) of the gas pressure type to furnish gas pressure to the motor cylinders in their firing order. In the latter application the distributor valve consists of a rotating disc, provided with an arc shaped port, operated at one-half crankshaft speed (for a four cycle motor), which disc contacts with and moves over a flat surface in which equally spaced holes deliver the gas from the gas-tight valve housing through tubes to the several cylinders.

Valve, Exhaust—See exhaust valve.

Valve, Inclined—A gas engine valve of the poppet type, the axis of which makes an acute angle with the cylinder axis. Overhead valves are often so placed, as very large valve diameters and a domed form of cylinder head may be employed when the valves are so placed.

Valve, Inlet—See inlet valve.

Valve, Interchangeable—A gas engine poppet valve which can be used either as an exhaust or inlet valve in any particular engine. The valves of the two sets being identical, one spare valve serves to replace any one of the valves of the engine which may have broken.

Valve, Mechanically Operated—A valve which is operated by power driven mechanism and not by suction or manually. Specifically, a gas engine valve which is operated by mechanism driven by the motor of which it is a part, in contradistinction to an automatic valve (see valve, automatic). The valves of practically all gas engines are mechanically operated. (See valve gear.)

Valve, Mushroom—See valve, poppet.

Valve, Needle—See needle valve and carburetor needle valve.

Valve, One Piece—A gas engine poppet valve, the head and stem of which are integral, being a single forging, in contradistinction to a valve whose head and stem are separate parts screwed together or united by welding—the more usual practice.

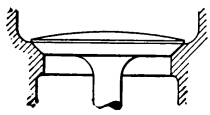
Valve, Overhead—A gas engine valve, generally of the caged type (see valve, caged), which is placed directly in the cylinder head, in contradistinction to one which is located in a pocket or valve chamber communicating with the cylinder (see valve pocket), and which thus permits gases to enter or leave the cylinder directly, avoiding the friction and transfers of heat inci-

dent to their movement through any intervening passages. Such valves are practically universally used upon air cooled motors. For method of operation see camshaft, overhead; push rod and rocker arm. Syn.: Valve in the head.

Valve, Piston—A type of gas engine valve, consisting of a piston, similar to a motor piston, which fits in and is caused to reciprocate (q. v.) in a cylinder (the valve cylinder) in the wall of which is a port communicating with the working cylinder (the exhaust or inlet port, q. v.). When the valve piston is so moved by the valve gear (q. v.) that its end begins to pass off from this port, gases may pass therethrough to or from the valve cylinder and out of or into the working cylinder, and when the end of the valve piston has again covered the port, gas movement is prevented. Instead of employing the end of the valve piston to effect the valve action, a port may be cut in the piston wall, which permits gas flow when it registers with the port in the valve cylinder. Piston valves have lately been applied to four cycle gas motors in order to secure silence of operation and improved filling and evacuation of the cylinders, a separate valve generally being used for exhaust and intake. Such valves are sometimes used in steam vehicle motors.

Valve, Pocketed—A gas engine valve, especially a poppet valve, which is located in a chamber or pocket (see valve pocket) attached to and communicating with the working cylinder, in contradistinction to one which is located directly in the cylinder wall. (See valve, overhead.)

Valve, Poppet—A disc valve, borne upon a guided stem and having a reciprocating motion in the line of its axis. When closed, the edge of its disc or head rests, fluid-tight, upon an annular seat formed in a partition which separates a chamber from which fluid is to be transferred from a chamber into which it is to be transferred. In opening, the valve moves away from its seat and the fluid flows through the passage formed between its head and its seat. This is the type most generally used for gas engine inlet and exhaust valves, being generally mechanically opened by cam action and closed by a spring. See valve, mechanically operated; valve head, valve stem, valve spring; Syn.: Mushroom valve, mitre valve.



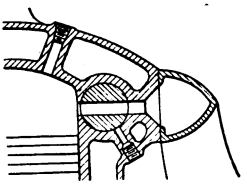
POPPET VALVE.

Valve, Poppet (Flat Seated)—A poppet valve the seating surface of the head of which is flat or in a plane at right angles to its axis and contacts with an annular seat which is also flat or in a plane at right angles to the valve axis.

Valve, Poppet (Taper Seated)—A poppet valve, the seating surface of the head of which is beveled or conical and which contacts with an annular seat which is correspondingly beveled or conical. The angle of the conical surfaces of head and seat is usually about 45 degrees with the plane of the head. The most commonly used type of gas engine poppet valve.

Syn.: Conical seated valve, bevel seated valve.

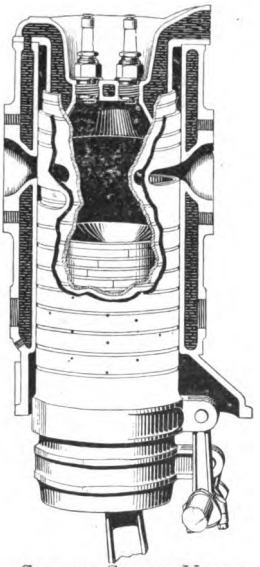
Valve, Rotary—A valve which is rotated upon a shaft and in so rotating alternately permits and cuts off the flow of a fluid, the valve being pierced with a passage which, when it registers with the inlet or exit passages provided for the fluid, allows the flow thereof. Such valves as applied to four cycle gas engines, in order to secure quiet action and complete filling and evacuation of the cylinders, are of various forms, mechanically operated by gearing. In one type the single valve employed is a disc on a vertical shaft operated at one-half engine speed, seated against the inside of the cylinder head and pierced with a sector shaped opening which alternately registers with the exhaust and inlet ports cut in the cylinder head. In another type the single valve is a cylinder rotated at one-quarter engine speed, in a cylindrical housing formed upon the cylinder head. The valve is pierced by a diametral passage, each end of which registers alternately with the inlet and exhaust ports cut from the housing into the cylinder. Instead of a single valve, separate valves may be used for inlet and exhaust, each valve consisting of a hollow cylinder with a port in its wall, fitting in a housing formed in the cylinder head. When the port registers with a port cut in the cylinder wall, gas movement is permitted, the hollow valve acting as a gas passage.



ROTARY VALVE.

Valve, Slide—See slide valve.

Valve, Sliding Sleeve—A type of gas engine valve, consisting of a thin cylindrical sleeve, or a pair of concentrically arranged sleeves, fitted between the cylinder wall and the piston and pierced with ports which control the transfer of gases to and from the cylinder through ports in its wall, the sleeve or sleeves being reciprocated parallel to the cylinder axis or given a combined reciprocatory and rotary motion by suitable valve gear. In the Silent Knight sliding sleeve motor two concentric sleeves are employed, which are independently reciprocated by two crank and connecting rod mechanisms at a frequency one-half that of the piston. The inlet and exhaust ports in the cylinder wall are at opposite sides thereof, above piston travel (q. v.), and each extends about one-third around the cylinder. Each side of each sleeve is pierced toward its inward end with a correspondingly arranged port, and the reciprocatory motions of the two sleeves are so timed that, during intake, the intake ports of both sleeves simultaneously register with the intake port in the cylinder wall and the charge enters, while, during exhaust, the exhaust ports in both sleeves simultaneously register with the exhaust port in the cylinder wall. At all other periods in the cycle the sleeves prevent gas movement. In this construction the rate of valve opening is high, the area of the passages is large, and their resistance is slight; there are no valve pockets to add to the surface exposed to the charge, and the valve action is quiet and capable of permanent adjustment.



Sliding Sleeve Valve Motor.

Valve Cap—A plug which screws into a valve pocket (q. v.) and closes the same, the removal of which permits the withdrawal of the poppet valve which is located therein. The cap usually seats upon a ring-shaped gasket, and a spark plug is commonly located in a hole drilled and tapped in the cap.

Syn.: Valve plug.

Valve Chamber—See valve pocket.

Valve Clearance—See clearance.

Valve Cover Plate—A readily detachable plate used to protect poppet valve gears from dust and to retain lubricant upon the parts. (See valve gear, enclosed.)

Valve Diameter—The diameter of the passage in which a poppet valve is seated. It is usually the same as the smaller diameter of the head of a conical or taper poppet valve.

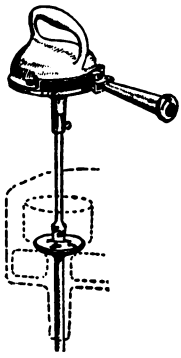
Syn.: Clear valve diameter.

Valve Gear—The term applied to all the mechanism concerned in operating engine valves. In gas engines of the poppet valve type, it includes the cam mechanism, push rods, rocker arms, valve springs, valve guides, etc.; and in rotary valve, piston valve and sliding sleeve gas motors it includes the gears, shafts, cranks, connecting rods, rockers, etc. In steam engines it includes the eccentrics, eccentric rods, valve stems, etc.

Valve Gear, Enclosed—A valve gear in which the parts that operate outside of the engine structure, such as the valve stems, push rods, valve springs, etc., of a poppet valve gas engine, are protected from dust and so housed as to be susceptible of continuous lubrication, by some such device as a tightly fitted plate covering them in and bolted to suitable projections cast upon the outsides of the cylinders. Syn.: Valve gear housing.

Valve Grinding—See grind.

Valve Grinding Tool—A tool similar to a bit stock, provided with a screwdriver-like point adapted to rotate a poppet valve upon its seat in the process of grinding the same, and to facilitate the occasional separation of the valve from its seat to cause the redistribution of the grinding material thereupon. Syn.: Valve grinder.



VALVE GRINDING TOOL.

Valve Head—The disc-like portion of a poppet valve (see valve, poppet) which performs the valve function. It is usually made of nickel steel (see steel, nickel) or of cast iron, and is slightly convex on its outward surface and concaved upon its inner surface to form a fillet (q. v.). The stem (see valve stem) is either electrically welded into an axial hole therein or is

screwed and riveted thereinto. Its outer surface is slotted to receive a screwdriver point.

Valve Housing—Any stationary part which encloses a valve. In gas engines it may be an integral part of the cylinder or a part attached thereto. It usually forms a gas passage to or from the valve, a pipe branch from a manifold being connected to it.

Valve Lap—See lap.

Valve Lead—See lead.

Valve Lift—The distance through which a poppet valve moves in passing from its closed to its full open position.

Valve Lifter—See pushrod.

Valve Location—The positions occupied by the valves of a gas engine with reference to the working cylinder. Poppet valves may be located in pockets at the sides of the head (see valve, pocketed). Both inlet and exhaust valve may be so placed, side by side, or one over the other on the same side of the cylinder (see cylinder, L type), or the inlet valve may be pocketed upon one side of the cylinder and the exhaust valve upon the opposite side (see cylinder, T type). One valve may be pocketed upon one side of the cylinder and the other valve may be in the cylinder head (see valve, overhead). Both valves may be located in the head (see valve, overhead) with their stems parallel to the cylinder axis; inclined thereto (see valve, inclined) or in the side of the head with their stems perpendicular to the cylinder axis.

Syn.: Valve position, valve arrangement.

Valve Plunger—See push rod.

Valve Pocket—A chamber, usually cast integral with the cylinder head of a gas engine upon the side thereof, communicating with the cylinder and with the inlet or exhaust piping, respectively, through ports, with a valve, usually of the poppet type, seated in a dividing partition within the pocket. Access to the pocket is secured by removing a valve cap (q. v.).

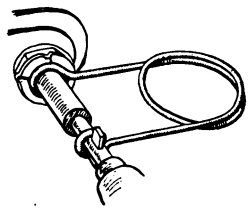
Syn.: Valve chamber, valve housing.

Valve Seat—The surface with which a valve is in contact when closed and upon which it forms a fluid-tight joint. The seat is usually finished by grinding the valve upon it. The seats of gas engine poppet valves are annular, with flat or conical surfaces (see valve, poppet), and are formed in the metal of the valve pocket (q. v.), or of a valve cage (see valve, caged).

Valve Setting—See valve timing.

Valve Spring—The spring which returns a valve to position. The springs used with gas engine poppet valves are usually of the spiral type, wound of high carbon or vanadium steel wire, threaded around the valve stem (q. v.) and compressed between the end of the valve stem guide (q. v.) and the valve spring washer (q. v.) and valve spring key (q. v.). They act to promptly close the valve upon its seat after it has been opened by the push rod (q. v.) or rocker arm (q. v.). A light spiral spring is sometimes used in a poppet valve operating mechanism to keep the push rod in constant contact with its cam, and thus avoid the tapping noise otherwise caused by the hammer like action of these parts.

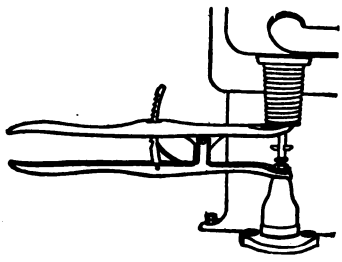
Valve Spring, Shear Type—A type of valve spring (q. v.) consisting of a loop of wire with spiral convolutions at its closed end, the free ends of which act respectively upon a fulcrum and upon a valve to close it. Springs of this type stand further away from the hot parts of the motor than spiral springs, and, being thus less likely to lose their temper by heat, are used upon some air cooled motors.



SHEAR TYPE VALVE SPRING.

Valve Spring Key—A pin which is passed through and secured in a hole drilled in a poppet valve stem, the function of which is to resist the reaction of one end of the valve spring (q. v.) and to hold it in place.

Valve Spring Remover—A tool, consisting of a lever, adapted to be adjustably fulcrumed upon some part of a motor, the short arm of which is engaged under the valve spring washer (q. v.) and the long arm moved by the hand, compressing the valve spring away from the valve spring key (q. v.), thus permitting the removal of the latter and the freeing of the spring and valve.



VALVE SPRING REMOVER.

Syn.: Valve spring tool.

Valve Spring Washer—A cup shaped washer which is threaded upon a poppet valve stem and receives the end of the valve spring, and which is held in place by the valve spring key (q. v.).

Valve Stem—The rod-like part of a gas engine poppet valve (see valve, poppet), to which is axially attached the valve head (q. v.), and which guides the motion of the valve. It is usually made of carbon steel rod and its free end is case hardened (q. v.) to resist the wear of the push rod or rocker arm impact, and near this end is drilled a hole for the reception of the valve spring key (q. v.). In a steam vehicle motor, the rod which operates the slide valve (q. v.) from the eccentric rod (q. v.) and eccentric (q. v.).

Valve Stem Guide—The specially formed part of a valve pocket (q. v.) or of a valve cage (see valve, caged), in which is drilled a hole, coaxial with the valve seat, in which slides the stem of a poppet valve, and by which its motion is guided. The hole is usually provided with a replaceable bushing (q. v., the valve guide bushing). One end of the valve spring acts against the external end of the valve stem guide.

Valve Timing—The adjustment of the valves of an engine so as to open and close at such periods in its cycle as to give the best operative results, such as maximum output or maximum fuel efficiency. See lap; lead; cut-off, point of. For approximate periods of opening and closing of gas engine poppet valves, see exhaust valve and inlet valve. The timing of such valves is primarily dependent upon the form and angular relations of their cams (q. v.) and by the mesh of the camshaft gears (q. v.), but is influenced by the adjustment of the push rods (q. v.).

Syn.: Valve setting.

Valve Tool Fulcrum—A small projection or ledge, cast upon the outside surface of a gas motor cylinder in such a position as to form a convenient fulcrum for the lever of a valve spring remover (q. v.).

Vanadium Steel—See steel, vanadium.

Vaporization—In general, the change of a liquid into an aeriform or vaporous state (vapor), brought about by the application

of heat and facilitated by the reduction of the pressure which acts upon the liquid. This change of state involves the absorption of a large amount of heat (latent heat of vaporization). In automobile practice, that form of vaporization known as evaporation, or the change of a liquid into a vapor at the liquid's surface, at ordinary air temperatures, is of chief interest. All internal combustion vehicle motors make use of gaseous fuel consisting of suitably proportioned mixtures of air and the vapor of some volatile combustible liquid, which are produced by evaporation in a carburetor (q. v.), and all steam vehicle boilers, which are fired with liquid fuel, make use of similar mixtures formed in a vaporizer (q. v.) and mixing tube (q. v.). Gasoline (q. v.), denatured alcohol (q. v.), benzol (q. v.), evaporate at ordinary temperatures, and are thus available for the formation of fuel mixtures, little or no application of artificial heat being required, the evaporation of such fuels in carburetors which are unjacketed being accomplished by the heat in the air and liquid used, and in carburetors, exhaust jacketed (q. v.), and in carburetors, water jacketed (q. v.) partly by heat artificially applied. In all carburetors evaporation is facilitated by the reduced pressure acting therein caused by the engine suction, by the rapid removal of the vapor from the liquid surfaces by the moving air, and by the practice of finely dividing the liquid at the spraying nozzle (see carburetor, atomizing), so that a very large liquid surface is exposed to the passing air.

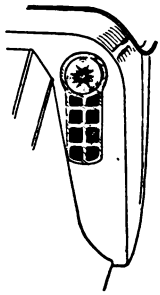
Syn.: Gasification, evaporation.

Vaporizer—In a steam vehicle burner (q. v.), an arrangement of piping through which the liquid fuel is passed, and which is exposed to heat, for instance, by being placed across the face of the burner plate (q. v.), so that the fuel may be warmed and may readily vaporize when it is sprayed into the mixing tube (q. v.) at the burner jet (q. v.). The pilot light (q. v.) is usually so placed as to keep the vaporizer warm when the main burner is shut off. The term vaporizer is sometimes applied to the carburetor (q. v.).

Vaporizing Chamber—See mixing chamber.

Vaporizing Tube Carburetor—See carburetor, vaporizing tube.

Ventilator—An arrangement for admitting air for purposes of ventilation into the body of a closed car or of a car of the fore-door type (see body, fore-door), consisting of an adjustable slide or register closing or uncovering perforations in the body, doors or dash or a deflector plate and orifices answering the same purpose, by the adjustment of which more or less air can be admitted to the body or to the front seat compartment.



VENTILATOR.

Venturi Tube—A tube for the flow of fluids, of somewhat hour-glass shape, which may be considered as formed by the junction at their smaller ends, of two tubes, each of which is the frustum of a circular cone, the junction where the cross section is the least being known as the throat or waist. The mixing chambers (q. v.) of carburetors are quite often Venturi tubes, as this design secures a very decided increase of suction at the spraying nozzle (see carburetor spraying nozzle), which is located at the throat, and hence a very energetic action thereof and a tendency toward homogeneity of mixture, without excessive contraction of the air flow through the mixing chamber, the effect of the flared outlet of the Venturi, being to facilitate the delivery of air. A large gas output, together with low frictional resistance, is thus secured.

VENTURI TUBE.

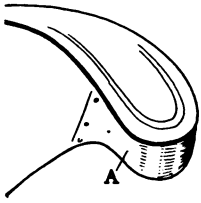
Vibrator—See magnetic vibrator.

Vibrator Coil—See coil, vibrator.

Viscosity—That property of a liquid dependent upon the degree of cohesion among its particles, in virture of which it is sluggish in its flow. The term is chiefly used in reference to lubricating oils, oils of considerable viscosity being better suited to the maintenance of continuous lubricating films between surfaces acting under heavy pressures than those of slight viscosity, but giving rise to increased liquid friction. Viscosity is increased by reduction of temperature (see cold test). It is measured by the viscometer, the indications of which depend upon the weight of liquid which is discharged in a given period of time at a given

temperature and constant known head through a small tube of standard area. The opposite of fluidity.

Syn.: Body (q. v.).



VISOR.

Visor—A forwardly and downwardly sloping extension formed upon the forward ends of a front fender (q. v.), shaped like a cap visor and designed to catch the road splash from the front wheel.

Volt—The practical unit of electromotive force (q. v.). That electromotive force which, steadily applied in a closed electric circuit of a total resistance of one ohm (q. v.), causes a current of one ampere to flow therein is one volt.

Voltage—Electromotive force expressed in volts.

Voltammeter—An electrical measuring instrument, consisting of a voltmeter (q. v.) and ammeter (q. v.) combined, for convenience, in the same case.

Voltmeter—An instrument, similar in most respects to an ammeter (q. v.), but used for the measurement of electromotive force and giving indications expressed in volts. The wire coil of a voltmeter is of extremely high resistance (q. v.), and thus the current which flows through it is practically proportional to the electromotive force applied to it. The electromagnetic effect which moves the pointer, being proportional to the current flowing in the coil, the indications of the instrument are proportional to the electromotive force being measured.

VOLTMETER.

Volumetric Efficiency—See charge ratio.

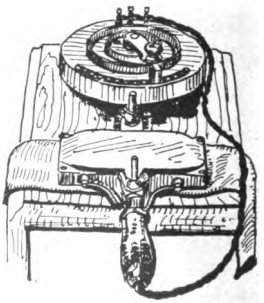
Vulcanization—A process for rendering rubber more highly elastic, stronger, more durable and less liable to the attacks of solvents, by adding to it a carefully proportioned amount of sulphur and "curing" it, usually under pressure, for a short time, at a temperature of about 300° Fahr. The rubber of vehicle tires is all vulcanized more or less highly, dependent upon the character

of the service required of it. Vulcanization is employed to effect the permanent adhesion of the fabric and rubber layers of pneumatic tire casings, and in joining to the tire structure the rubber or rubberized fabric used in making repairs.

(v.): To vulcanize.

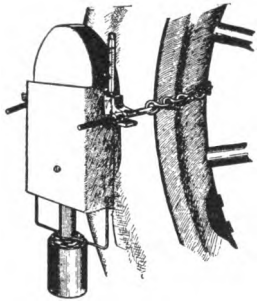
Vulcanizer—The apparatus in which vulcanization is effected. In this connection, the apparatus employed to perform the vulcanization required in the repair of pneumatic tire casings and inner tubes, consisting of an iron mold or plate fitting around or upon the portion of the tire to be repaired, and means for clamping the mold or plate thereon and for applying heat from the mold to the rubber to be vulcanized. Such vulcanizers may be stationary and capable of making extensive repairs quickly, or portable and intended for smaller repairs, which may be performed, if desired, without removing the tire from the wheel.

Vulcanizer, Electric—A type of vulcanizer in which the heat required is developed electrically in conductors embedded in the metal of the iron or aluminum plate or mold. The temperature of the vulcanizing surfaces is indicated by a thermometer, and is automatically maintained at the correct point by means of a thermostat (q. v.) within the apparatus, which interrupts the heating current when the proper temperature is exceeded and re-establishes it when the temperature is too low. In some vulcanizers a rheostat (q. v.) is adjusted by hand to maintain the required current strength and temperature. Portable vulcanizers of this type, which may be operated in connection with any commercial electric circuit, are provided with means for clamping the vulcanizing surfaces to the tire, even though it is still upon its wheel, and the surfaces are so formed as to enable repairs upon both casings and inner tubes to be accomplished.



ELECTRIC VULCANIZER.

Vulcanizer, Steam—A vulcanizer, the molds or plates of which are set into the external surface of a closed chamber containing water, to which the heat from a gas, gasoline or alcohol flame is applied to raise steam, which brings the vulcanizing surfaces to the required temperature, a steam gauge or thermometer being used to measure the same. Such vulcanizers may be stationary or portable, the latter type usually burning alcohol and being adapted to the repairing of tires on or off their wheels.



STEAM VULCANIZER.

Vulcanizing Cement—A rubber cement used in making tire repairs which are to be vulcanized.

Vulcanizing Rubber—Rubber compounded with sulphur and capable of vulcanization.

Walking Beam—See rocker arm.

Warp (v.)—With reference to the heads of gas engine poppet valves (see valve, poppet), to distort under the expansive influence of the heat to which they are subjected, so that they no longer fit gastight upon their seats.

Wash (v.)—With reference to the elements (q. v.) and separators (q. v.) of accumulator cells, to clean them of all shed (q. v.) active material (q. v.) which may cause internal short-circuits (q. v.).

Water Column—A vertical chamber, the upper end of which is connected into the steam space and the lower end into the water space of a steam boiler. Water rises in the column to the same height at which it stands in the boiler and this height is approximately indicated by opening the gauge cocks (q. v.).

Water Cooling—A method of maintaining the internal walls of a gas motor cylinder at a sufficiently low temperature to permit of their lubrication by oil and to obviate the overheating of the fuel charges, by the continuous circulation about the external walls of the cylinder of water contained in a water jacket (q. v.) enveloping these parts. The moving water abstracts heat from the cylinder walls, maintaining their temperature below the boiling point, and in its circulation, carries away the heat thus ab-

stracted and dissipates it to the air in a radiator (q. v.) from which the water is returned, in a cooled condition, to the jackets, to be heated again, this action going on continuously.

The ordinary method of cooling gasoline vehicle motors.

Water Cooling, Gravity System—A system of water cooling in which no pump is employed, the circulation of the water being effected, as in a domestic hot water heating system, by taking advantage of the head produced by the difference of specific gravity of the water in the hot and cool portions of the system. The bottom of the radiator is connected, through very large area piping, to the bottoms of the water jackets and the tops of the jackets to the top of the radiator. The water which is heated in the jackets rises and flows to the top of the radiator, where it is cooled in flowing down therethrough and returns to the bottoms of the jackets to be heated again, this action going on continuously during the operation of the motor.

Syn.: Natural circulation, thermo-siphon system.

Water Cooling, Pump System—A system of water cooling in which the circulation of water is maintained by a pump (see water pump), driven by the motor to be cooled. The pump usually delivers water through suitable piping (see water manifold) to the water jackets (q. v.) at points near the exhaust valves, which leaves them at points in their cylinder head portions, and is conducted through piping to the top of the radiator (q. v.), downward through which it passes and out of the bottom of which it flows, through piping, to the intake connection of the pump. A closed path of flow is thus formed, through which the same water is forced so long as the motor is in operation.

Syn.: Forced water cooling.

Water Glass—See gauge, water.

Water Hammer—The shock and noise occasioned by the piston of a steam engine when, in approaching the end of its stroke, water, which has condensed in the cylinder, more than fills the clearance space and thus impedes further piston movement. Under these conditions there is danger of the breakage of the cylinder head or other parts. See drain cock.

Water Jacket—A water tight casing or envelope provided around those portions of the outside cylinder walls of an internal combustion motor which are most exposed to the heat de-

veloped therein; between which and the walls of the cylinder itself is a closed space, in which is circulated water which is delivered to and conducted away from the space through pipes. The water space usually includes not only that around the cylinder barrel or the head portion of the same, but that around the cylinder head itself, the valve chambers or cages (especially the exhaust valves) and the valve stem guides. The water intake to the jacket is usually at a point near the exhaust valve and the outlet in the head portion and baffle plates are sometimes used within the water space to insure an active flow in all parts thereof. See water cooling.

Water Jacket, Applied—A water jacket, the barrel portion or the whole of the walls of which are not formed integrally with the cylinder itself, but are of sheet metal (usually copper), so formed and applied as to envelop the parts of the cylinder requiring cooling, water tight joints being formed at the junctions of the sheet metal and the cylinder.

Syn.: Sheet metal water jacket.

Water Jacket, Integral—A water jacket, the walls of which are cast of the same metal and as an integral part of the cylinder itself, the water spaces being cored out in the operation of founding. The most common type. (See diagram under cylinder, L type.)

Water Jacket Cover Plate—A detachable plate which, when fastened into place with screws, forms a part of the wall of a water jacket which is not cast complete as a part of its cylinder or block of cylinders. This method of casting jackets incomplete and using cover plates enables the water spaces to be inspected for defects and gives access to the water spaces at any time. The cover plates being of thin, somewhat yielding material, the bursting of the jacket casting by freezing is rendered less likely.

Water Jacket Plug—A plug screwed into a threaded hole in a cast water jacket—for instance, in the centre of the cylinder head to give access to the cylinder plug (q. v.), or at other points in a water jacket to close holes left in the process of founding.

Water Level—With reference to a steam boiler of other than the flash type, the height at which the water stands within it. (See gauge, water and gauge cock.)

Water Level Indicator—A device other than the water gauge, which gives a continuous (usually visual) indication of the height of the water in a steam vehicle boiler.

Water Manifold—The main pipe into or out of which water flows, through branches, to or from the jackets of multi-cylinder gas motor. Two such manifolds are used, one, the water outlet manifold, which receives the heated water from the jackets and conveys it to the radiator, and the other, the water inlet manifold which delivers cooled water from the pump or bottom of the radiator to the jackets. These manifolds are usually of branched copper or brass tubing, of cross section, varying with the flow of water therethrough, the junctions of their branches with the jacket ports being by flanged couplings or tapered nipples. In motors with pair cast cylinders (see cylinder, pair cast) there is usually but one inlet and outlet from each double jacket to the manifolds, and in block motors (see cylinder, block cast) there may be but one water inlet and one water outlet and no manifold required.

Syn.: Water header.

Water Pump—With reference to a gas motor, the pump which circulates the water in a forced water cooling system (see water cooling, pump system). Such a pump may be of the centrifugal type (see pump, centrifugal), the gear type (see pump, gear) or sliding vane type (see pump, sliding vane) and is usually direct driven from a gear driven auxiliary shaft (q. v.) by the motor which it serves, through a somewhat flexible coupling, often including a member designed to break in case the pump is frozen or otherwise obstructed and thus to prevent any injury to the pump itself. The pump inlet is usually piped to the bottom of the radiator and its outlet to the water intake manifold.

With reference to a steam vehicle, the feed pump (q. v.).

Water Tank—The reservoir in which is carried the water which is to be fed to the boiler of a steam vehicle.

Watt—The unit by which is measured the rate at which electrical energy is delivered to an electric circuit. If a current of one ampere (q. v.) is delivered to a circuit or an electrical device at an electromotive force of one volt, electrical energy is being expended therein at the rate of one watt, and the rate of expenditure of electrical energy in any circuit or electrical device, in watts, is equal to the product of the current flowing

therein, in amperes, by the electromotive force acting thereupon in volts. E. g., a tungsten lamp requires 1.25 amperes at 6 volts. It therefore absorbs $6 \times 1.25 = 7.5$ watts. The rate of expenditure of electrical energy in electrical horse power (see horse power, electrical) is obtained by dividing the rate of expenditure in watts by 746.

The above statements apply to direct currents only.

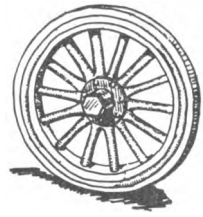
Weak Mixture—See lean mixture.

Weave (v.)—In reference to a vehicle frame, to distort from its normal form under the stresses imposed by rough roads, tending to throw the mechanical parts mounted upon it out of correct relationship.

Web—A comparatively thin portion of a mechanical or structural part, formed integrally therewith and serving to connect portions thereof of greater cross section or extending out from a part of larger cross section. In castings and forgings, those portions where the stresses acting are slight are often made in the form of thin webs, for purposes of weight reduction, such webs connecting portions of greater cross section where the stresses acting are severe; e. g., in an I-section axle (see axle, I-beam) such a web joins the two flanges.

Weight Efficiency—See efficiency, weight.

Wheel, Artillery—A wheel with wooden spokes and felloe, which differs in the following respects from the ordinary horse-drawn vehicle wheel, in which the inside ends of the spokes are mortised into a wooden hub: The inner ends of the spokes are wedge or sector shaped and so proportioned and formed that when the spokes are assembled in the felloe and on the metal hub or box, their sloping sided ends fit tightly together, filling the entire angular space and forming a compact wooden disc with a hole in its centre filled by the metal hub. The compactly arranged inner ends of the spokes are clamped between two steel flanges, one integral with the hub and the other separable, by means of bolts passing through both flanges, and through each of the spokes. A wheel of very great strength and that most commonly used upon motor vehicles.

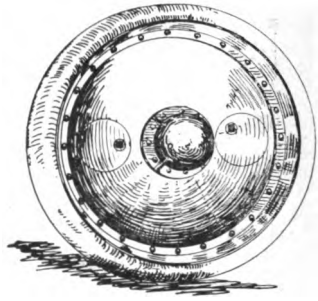


Artillery Wheel.

Wheel, Cast—A type of wheel which is cast as a unit—hub

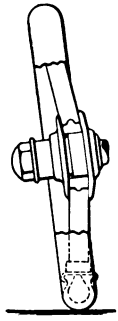
spokes and felloe—out of steel or iron. It is used upon very heavy commercial vehicles and tractors.

Wheel, Disc—A form of metal wheel, without spokes, the hub and felloe being connected by two shallow saucer shaped or very flatly conical discs, usually of heavy pressed steel, placed with their concave faces together, and with their external edges bolted to the felloe and their centres secured to flanges at the respective ends of the rather long metal hub. Such wheels are sometimes used upon heavy commercial vehicles, especially those of the electric type, the space within the wheel, between the two concave discs, being utilized to house the electric motor which drives the wheel and which is geared to a large internal gear fixed to the inside periphery of the felloe.



Disc Wheel.

Wheel, Dished—A wheel the axes of the spokes of which are not exactly in the plane of the felloe, but are the elements of a very flat cone, the complete wheel being of a very shallow saucer form. Such wheels are generally used upon axles the spindles of which are cambered (see axle, cambered), and the camber and degree of dish are so chosen that the spokes which support the vehicle weight are vertical and thus are subjected to compression only.



Dished Wheel.

Dished construction gives a wheel great resistance to transverse stresses, especially those acting against the felloe inward toward the vehicle, such as met with in running against a curb.

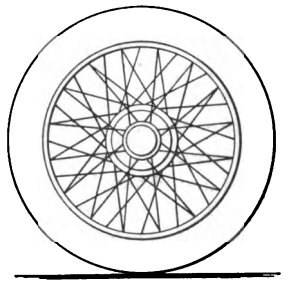
Wheel, Elastic—A wheel between the hub and felloe of which is provided a resilient elastic medium of some kind so that road shocks sustained by the rim are partially absorbed before reaching the axle. The elastic medium may be a series of metallic springs acting radially along the spokes or in an equivalent man-

ner, or may be cushions of rubber performing a similar function. The spring wheel is designed to obviate the necessity of using rubber tires, but has thus far met with very limited commercial application.

Wheel, Spare—See spare wheel.

Wheel, Tubular Steel—A wheel, the rim, spokes and hub of which are made of steel tubing. A type formerly quite largely used upon automobiles.

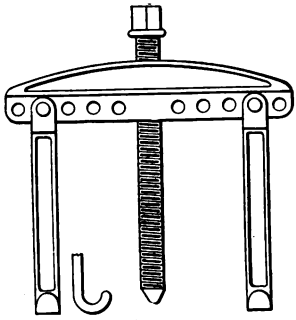
Wheel, Wire—A wheel in essential respects like the familiar tangent spoked bicycle wheel, but made larger and stronger for automobile purposes. It is considered to be lighter for a given strength than an artillery wood wheel, and is therefore extensively used upon racing cars. It is also used upon ordinary motor cars in countries where wood suitable for artillery wheels is difficult to obtain.



WIRE WHEEL.

Wheel Base—The straight line distance from the point of road contact of a rear wheel of a vehicle to the point of road contact of the front wheel upon the same side of the vehicle, the front wheels being in their straight ahead position.

Wheel Puller—A sort of screw press used to remove a wheel from the end of a shaft upon which it is a tight fit, consisting of means for holding the puller to the wheel hub or spokes and a screw capable of being turned in the body of the puller and of exerting pressure upon the end of the shaft to force the shaft out of the wheel hub. Used for removing road wheels from axle shafts, fly wheels from crank shafts, etc.



WHEEL PULLER.

White Bronze—A kind of bearing metal of qualities somewhat similar to babbitt (q. v.) for

which the following is a specification: Copper, 3.00 to 6.00 per cent.; tin, not less than 65.00 per cent., and zinc, 28.00 to 30.00 per cent. Extensively used in gas engine bearings.

Wick Oiler—A means of supplying oil to a bearing, consisting of a reservoir containing oil which is supplied to the shaft by the capillary action of a wick, or of cotton waste placed in the reservoir and in contact with the shaft. A common means of oiling the armature shafts of electric vehicle motors.

Wind Resistance—See air resistance.

Wind Shield—See glass front.

Windage—The energy expended by a rotating part in beating the surrounding air.

Winding, Primary and Secondary—See coil induction and magneto.

Wing Nut—See butterfly nut.

Wirebar—A bar of insulating material in which is embedded or through channels in which are threaded the ignition wires required by a vehicle motor, the wirebar being so supported and placed as to enclose the wiring as far as possible and to protect it against mechanical injury and the action of oil and water. Ignition wiring is quite commonly enclosed in copper or fibre tubing suitably supported from the motor.

Wiredrawing—The reduction in pressure sustained by a fluid, such as steam or the vaporous fuel mixture of an internal combustion motor, as a result of friction incident to its movement through restricted passages or ports or through piping with rough inside walls. Wiredrawing results in the reduction of the effective pressure acting in steam engines and limits the charge which enters the cylinder of an internal combustion motor, and hence reduces the output of both types of engine.

Wireless Battery Box—See battery box.

Wiring, Primary—The ignition wiring used in connection with a gas motor, in which flows a low tension current (q. v.).

Wiring, Secondary—The ignition wiring, used in connection with a gas motor, in which flows a high tension current (q. v.).

Wood Alcohol—Methyl alcohol (CH_3OH) produced by the destructive distillation of wood, which is used in the preparation of denatured alcohol (q. v.) and, in mixture with water, as an anti-freeze solution (q. v.). Such an aqueous solution containing 20 per cent. of wood alcohol freezes at about 5 degrees

Fahr. above zero, and one containing 40 per cent. at about 22 degrees Fahr. below zero.

Syn.: Methyl alcohol.

Working Fluid—The gas or vapor which, by acting expansively, at a relatively high temperature, upon the piston of an engine, causes the conversion of heat energy into mechanical energy and operates the engine. Steam and air are the working fluids of steam and gas engines, respectively.

Working Stroke—See power stroke.

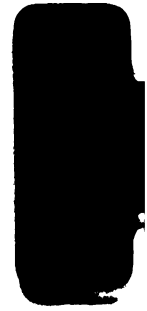
Worm Drive—See gear, worm.

Wrist Pin—See piston pin.

Yoke—A forked or U-shaped operative or structural part, e. g., that part of a clutch operating device (q. v.) which acts against the clutch collar and clutch spring to effect disengagement.

Yoke End—See clevis.

[The End.]



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