

J. G. HEASLET  
MUFFLER.

APPLICATION FILED JULY 7, 1902.

NO MODEL.

3 SHEETS—SHEET 1.

FIG. 1

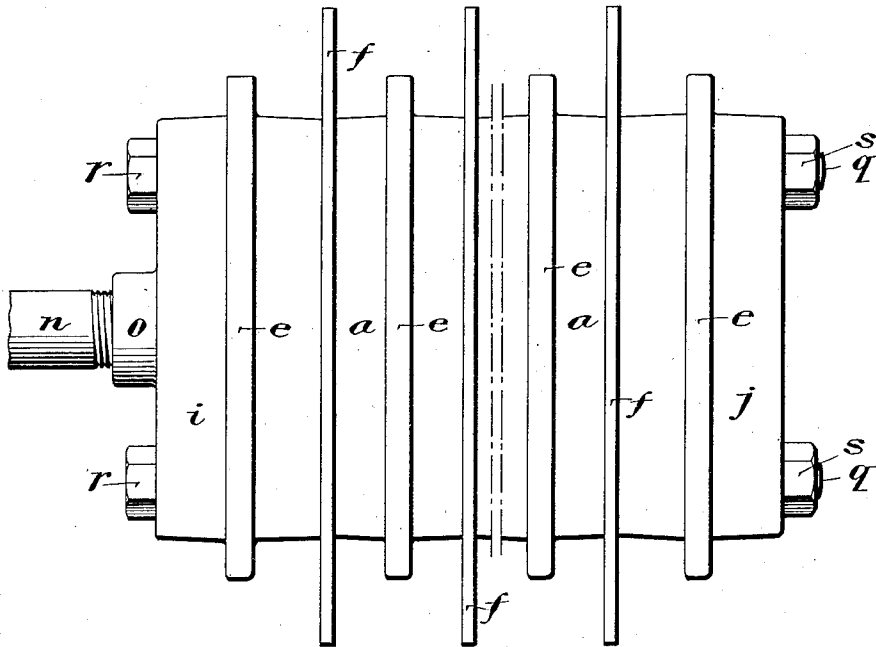
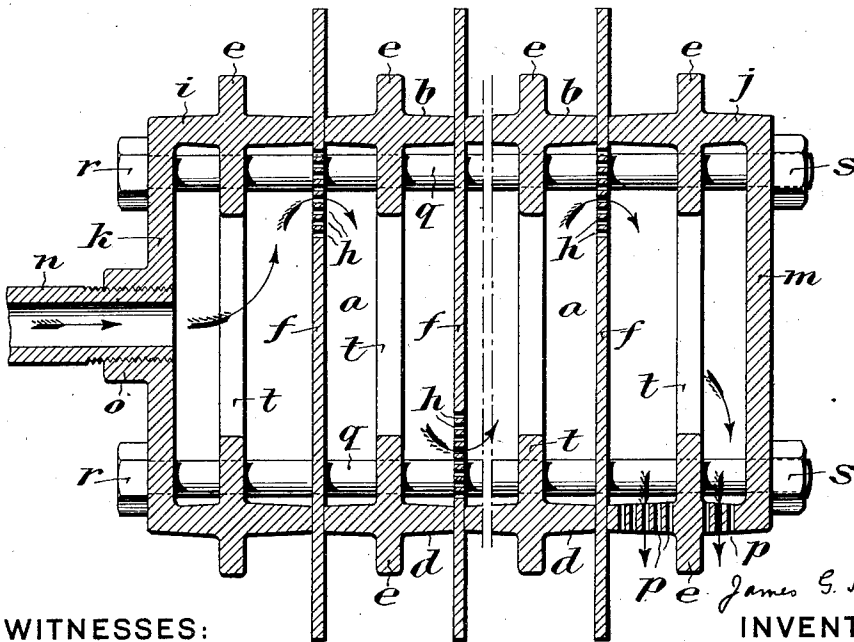


FIG. 2



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3 SHEETS—SHEET 2.

FIG. 3.

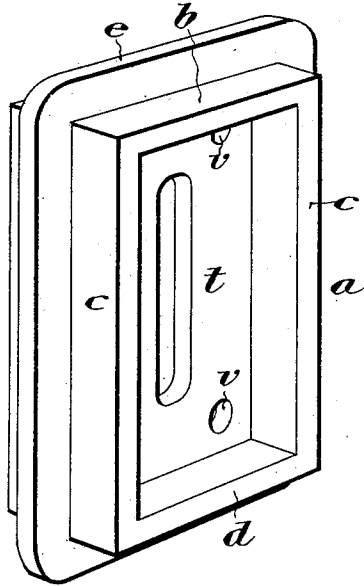
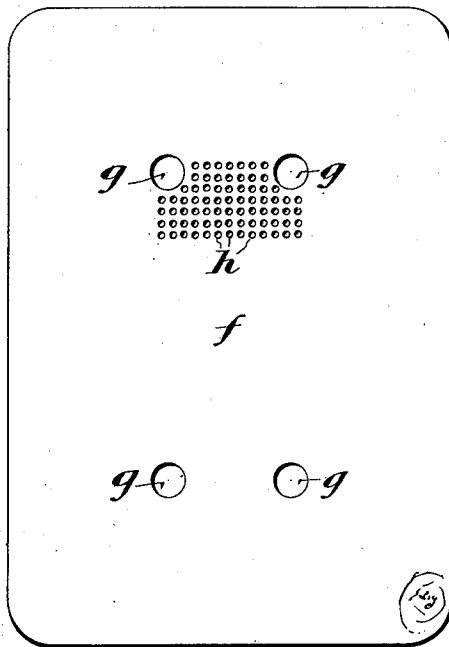


FIG. 4.



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3 SHEETS—SHEET 3.

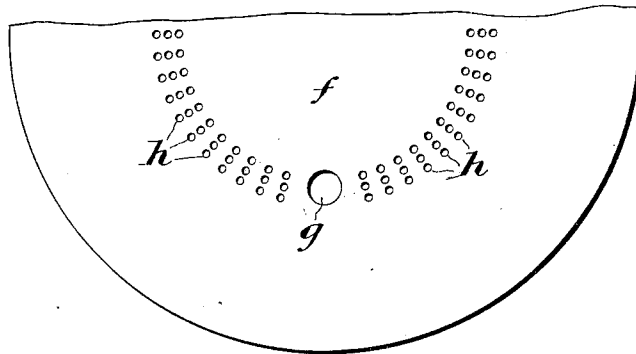
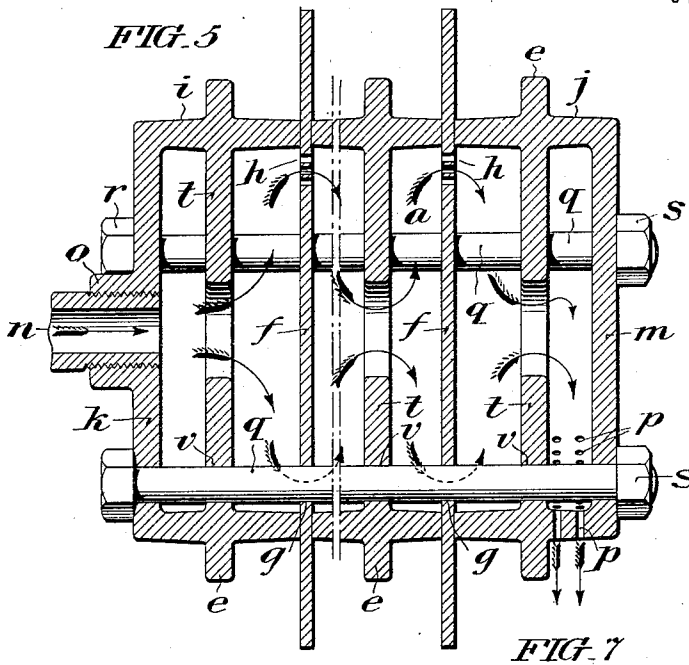
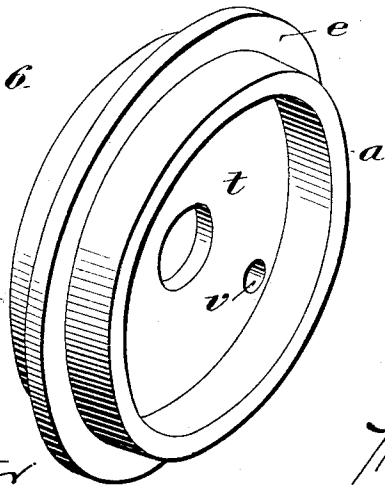


FIG. 6.



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# UNITED STATES PATENT OFFICE.

JAMES G. HEASLET, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE AUTOCAR COMPANY, OF ARDMORE, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

## MUFFLER.

SPECIFICATION forming part of Letters Patent No. 734,864, dated July 28, 1903.

Application filed July 7, 1902. Serial No. 114,548. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES G. HEASLET, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Mufflers, of which the following is a specification.

In the operation of motors, such as explosive gas engines, and particularly those employed to propel road vehicles, it is customary to conduct the exhaust or burned gases discharged from the cylinder or cylinders through a muffler before permitting their escape to the atmosphere.

The object of leading the gases and products of combustion through a muffler instead of discharging them from the cylinder direct to the atmosphere, is to cool them, and allow them to become diminished in tension, so that when discharged from the muffler, their passage through its exit port will be attended by less sound than would be incident to their discharge directly to the atmosphere from the cylinder in the hot and expanded condition in which they leave the latter.

It is desirable in the construction and arrangement of mufflers that the maximum cooling effect be produced, and it is desirable that the mufflers employed upon automobiles should be as simple, light, compact, and strong as possible.

It is the object of my invention to provide a muffler of such construction and arrangement that a much more thorough cooling of the gases proportionate to the size of the structure may be brought about, than has been possible with such devices as heretofore constructed.

A further object is the provision of a muffler which is not only of very simple, inexpensive, and compact construction, but is of such organization that it may be built up to any desired length in accordance with the amount of space available in the vehicle in connection with which it is to be employed.

In the accompanying drawings I show, and herein I describe, a good form of a convenient embodiment of my invention, the particular subject-matter claimed as novel being hereinafter definitely specified. Variations in

form and structure may manifestly be resorted to, without departure from the spirit of my invention.

In the accompanying drawings,

Figure 1 is a view in top plan, and Figure 2 a longitudinal vertical section, of a muffler embodying a good form of my improvements.

Figure 3 is a view in perspective of one of the cell frames, as I term it, employed in the structure shown in Figures 1 and 2.

Figure 4 is a view in face elevation of one of the series of plates employed in the structure shown in Figures 1 and 2.

Figure 5 is a sectional elevation of a muffler arranged in a modified form.

Figure 6 is a view in perspective of one of the cell frames employed in the construction shown in Figure 5.

Figure 7 is a face view of a portion of one of the division plates employed in the construction shown in Figure 5.

Referring first to Figures 1, 2, 3, and 4, *a* are the intermediate cell frames, as I term them, the same being shown as four-sided, and as open as to their front and back faces; *b* are the top, *c* the side, and *d* the bottom, walls of said cell frames.

The cell frames may manifestly be made of any desired general form, height, breadth, and depth. In the form of my invention shown in the figures last referred to, their height is somewhat in excess of their breadth. Preferably, said frames, which may conveniently be formed as castings, are, whatever their form, each provided with a rib, *e*, extending continuously along the outer faces of its four sides, and a rib, *t*, extending continuously along the inner faces of its four sides. Said outer and inner ribs of a cell frame are preferably arranged in line with each other on the opposite sides of the relatively thin walls of said cell frames. Said inner ribs each embody tie rod-openings, *v*, one close to each of the corners formed at the junctions of the end and side walls of the cell frame.

*f* are flat plates of metal, which I term division plates, preferably of height and breadth in excess of the height and breadth of the bodies of the cell frames. Each plate, *f*, is

provided with a series of tie rod openings *g*, and a series of gas passages *h*, and said openings and passages are all formed within central regions of the plates *f*, of size corresponding to the height and breadth of the interiors of the cell frames, *a*,—the tie rod openings *g*, moreover, being preferably so disposed that when the parts are assembled they will be alined with the tie rod openings *v* of the cell frames. The gas passages *h* of each plate are in the form under discussion shown as formed at one end of its said central region.

The end cell frames, designated *i j*, instead of being open as to both faces, as are the intermediate cells *a*, are closed as to their external faces by the plates *k* and *m*, respectively, (see Figure 2), said plates which I term closing plates being conveniently formed integral with the bodies of said end cells, and embodying openings corresponding in position with the tie rod openings of the intermediate members.

*n* is a pipe through which the exploded or exhaust gases or vapors from the cylinder of a motor are discharged within the end cell frame *i*. Said pipe *n* is shown as externally screw-threaded and engaged in a correspondingly threaded opening formed in the plate *k* and in a boss *o* integral therewith.

*p* are a series of discharge openings formed in the bottom wall member of the end cell frame *j*.

*q* are the tie rods, *r* are the heads of said rods, and *s* are nuts upon their threaded extremities.

As will be understood, the muffler is built up from an assemblage of any desired number of the cell frames *a* and plates *f*; at the respective ends of the series of cell frames *a* and division plates *f*, are placed the end cell frames *i* and *j*. The parts are retained in their assembled position by the tie rods *q*, which are inserted through the tie rod openings *v* of the internal ribs *t*, and *g* of the plates *f*. The heads of the tie rods bear against the plate of one of the end cells and the nuts on the other ends of said rods bear against the plate of the other end cell.

The screwing up of the nuts on the tie rods serves to clamp the assembled parts together. In the assemblage of the parts, the plates *f* are preferably so disposed that the gas passages *h* of the successive plates are alternately located at the top and bottom of the muffler so that the gases entering through the pipe *n*, and leaving through the discharge openings *p*, will in passing through the structure be compelled to follow a serpentine path.

The ribs *e* of the cell frames increase the area of the surface exposed to the atmosphere, and consequently increase the radiation of heat from the gases.

The ribs *t* which project within the interiors of the cells formed between the respective pairs of division plates, afford quite an extensive area of heat absorbing surface, and

the arrangement of the external ribs opposite to the internal ribs and, so to speak, radially continuous of said internal ribs, provides for the conduction of the heat absorbed by the internal ribs directly to said external ribs, from which last named ribs it radiates to the atmosphere,—said arrangement of the ribs being manifestly one in which they occupy the least possible face area of the thin walls of the cell frames.

The extension of the margins of the plates *f* beyond the walls of the cell frames, by exposure of said edges to the atmosphere, serves to permit the radiation of heat conducted through their bodies from the central regions of said plates to their marginal portions. By reason of the projection of the edges of the plates, therefore, the central portions of said plates *f* are maintained in a cooler condition than they otherwise would be.

As will be understood from a contemplation of the drawings, the cell frames in which, and between pairs of the plates *f*, the gas chambers or cells are formed, are all externally exposed to the atmosphere. The direct contact of the atmosphere with the exteriors of all of the cell frames permits of the ready and constant radiation of the heat of the gases which is conducted through the walls of the cell frames, from the time the gases enter the muffler until they leave it, and consequently in the passage of the gases through the successive cells, they are caused to lose their heat very rapidly, with the result that they are greatly diminished in tension, and escape through the openings *p* with very little sound.

I emphasize the features of the strength and simplicity of the construction described, the ease with which a muffler of any desired length to fit special conditions may be built up, and the fact that from first to last the gas cells are in direct contact with the atmosphere so that the gases at all points of their travel through the structure lose their heat by radiation to the atmosphere, and consequently finally emerge from the muffler in a comparatively cool condition and without occasioning loud, explosive sound.

In the form of my invention shown in Figures 5, 6, and 7, the general arrangement of cell frames, division plates, inner and outer ribs on the cell frames, inlet to one end cell and outlet from the other end cell, and connecting tie rods,—is the same as that illustrated in Figures 1, 2, 3, and 4, except that the cell frames and division plates are shown as of circular instead of rectangular outline.

In the arrangement shown in Figures 5, 6, and 7, however, the gas passages *h* formed in a division plate are arranged in a continuous series inclosing the central portion of the plate, said passages being arranged in the region of the division plate which faces the internal ribs of the adjacent cell frames.

The gases or vapors passing through the structure shown in Figure 5 will, instead of

passing, as in the construction of Figures 1, 2, 3, and 4, through passages *h* at one end of one division plate and then through passages in the other end of the next division plate, be free to pass through passages arranged on all sides of the centers of said plates.

As a result of this arrangement, the entire side face of each internal rib of an intermediate cell frame is in position to be encountered by gases passing through the adjacent division plate, whereby a very intimate contact of said gases with said rib is brought about and a better result is achieved in this connection (in the absorption of heat by the rib) than in the arrangement shown particularly in Figure 2, in which last named arrangement only part of each internal rib is in direct line with the gas passages of the adjacent division plate.

The ribs *e*, *t*, as is manifest, in addition to assisting in the radiation of the heat, serve to strengthen the cell frames.

Having thus described my invention, I claim—

1. A muffler comprising a series of cell frames arranged to afford a passage for gases or vapors through their interiors in succession, each frame having an external encircling rib, plates arranged at intervals throughout the structure, and having each a series of perforations for the passage of gases or vapors, and means for securing the parts together, substantially as set forth.

2. A muffler comprising a series of cell frames arranged to afford a passage for gases or vapors through their interiors in succession, each frame having an external encircling rib and an internal rib, plates arranged at intervals throughout the structure, and having each a series of perforations for the passage of gases or vapors, and means for securing the parts together, substantially as set forth.

3. In a muffler, in combination, a series of cell frames having external ribs and internal ribs, said external ribs and internal ribs being opposite each other, a series of division plates alternated with said cell frames, and means

for tying said cell frames and plates together.

4. In a muffler, in combination, a pair of end cell frames having each a closing plate, one of said end cell frames having an inlet through which gases or vapors have access to the muffler, and the other having an outlet through which gases or vapors leave the muffler, a series of intermediate cell frames, each of the end and intermediate cell frames having an external rib, perforated division plates, structurally independent of the cells, alternated with said intermediate cell frames, and means for fixedly securing said end cells, intermediate cells and said plates in operative relationship, substantially as set forth.

5. In a muffler, in combination, the end cell frames, a series of intermediate cell frames and division plates, disposed between said end cell frames, the edges of said division plates extending beyond the exteriors of the bodies of the cell frames, tie rods extending through said end cells, intermediate cells, and division plates, ribs on the exteriors of the cell frames, ribs on the interiors of the cell frames, gas passages formed in the successive frame plates, a gas or vapor inlet leading to one end cell and an outlet opening formed in the other end cell.

6. In a muffler, in combination, a series of cell frames, each of which embodies on its inner face a rib projecting toward its central portion, a series of division plates alternated with said cell frames and embodying each a number of gas passages which passages are in each plate arranged in a continuous series inclosing the central portion of the plate and in such position that when the parts are assembled such passages confront the internal ribs of the intermediate cells, and means for tying said cell frames and plates together.

In testimony that I claim the foregoing as my invention I have hereunto signed my name this 15th day of June, A. D. 1902.

JAMES G. HEASLET.

In presence of—

S. SALOME BROOKE,  
THOS. K. LANCASTER.