(No Model.)

J. E. SWEET.

RELIEF PISTON FOR HIGH SPEED ENGINES.

No. 551,912. Patented Dec. 24, 1895.

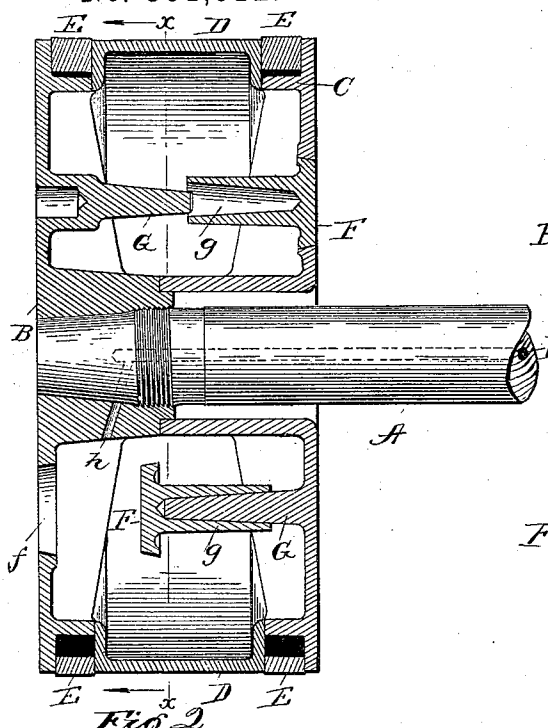

Fig. 2

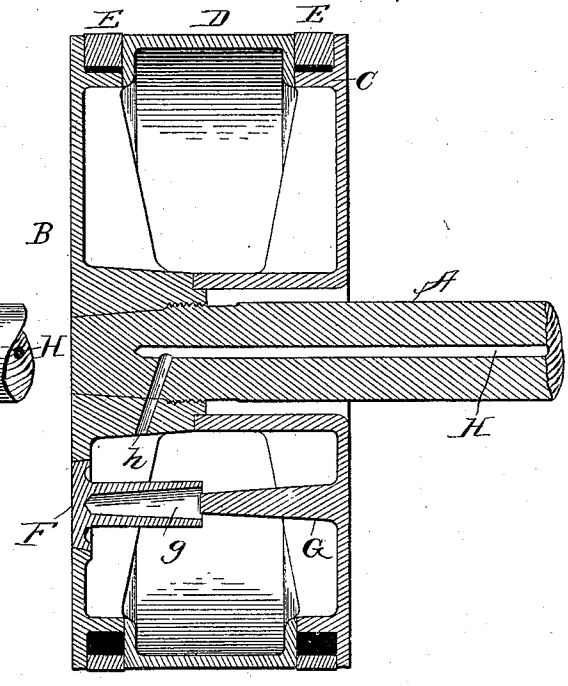

Fig. 1

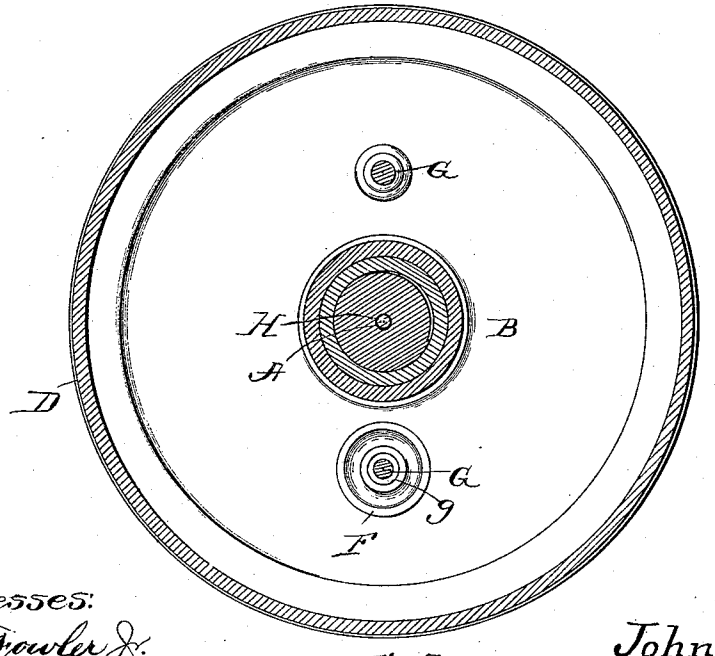

Fig. 3.

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JOHN E. SWEET, OF SYRACUSE, NEW YORK.

RELIEF-PISTON FOR HIGH-SPEED ENGINES.

SPECIFICATION forming part of Letters Patent No. 551,912, dated December 24, 1895.

Application filed August 1, 1895. Serial No. 557,851. (No model.)

To all whom it may concern:

Be it known that I, JOHN E. SWEET, a citizen of the United States, residing at Syracuse, in the county of Onondaga and State of New York, have invented certain new and useful Improvements in Relief-Pistons for High-Speed Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in relief devices for the cylinders of high-speed engines; and it consists primarily in employing the cavity of the piston for that purpose and means therefor.

It is well known that from various causes water finds its way into the cylinders of engines. If in larger quantities than the clearance in the cylinder will admit, a broken engine is the result, unless some means of relief is provided. In the slow-running slide-valve engines the valve itself lifts off its seat and thus permits the water to flow into the steam-chest. In high-speed engines with any form of valve the blow is too sudden for the valve to afford the required relief, and in the piston-valve engines and the like the valve cannot furnish that relief, however slow or however great the pressure. It is customary, nevertheless, to supply spring relief-valves of various designs to furnish the proper relief to high-speed engines. These guard external apertures opening from the cylinder into the engine-room; but all such are defective, for the reason that their action is both too slow and too inefficient for the high speeds now employed, since the valve-opening is necessarily limited in size and no valve can yield instantly under a smashing blow, and like all spring-guarded gateways, the valve is uncertain in its operation, which only occurs at irregular intervals.

My present invention consists primarily in utilizing the cavity of the piston as the relief-chamber, which I accomplish by opening apertures into the same guarded by tapered plugs forced into accurately-fitted seats under a determined pressure greater than the contemplated steam-pressure on the same area; also, in means for taking care of the plugs after they are driven in by receiving them on tapered pins properly located for the purpose, where they stick fast until removed for replacement, and, finally, in a novel means for signaling the engineer that an accident has occurred, which consists in opening a communication from the piston-cavity with the outer air by a hole drilled longitudinally through the axis of the piston-rod meeting a hole drilled laterally from the piston-cavity to said longitudinal aperture, thus forming a "telltale-pathway" for a small jet of steam.

Referring to the drawings forming a part of this specification, Figures 1 and 2 illustrate different aspects of the piston in longitudinal mid-section, in which A is the piston-rod; B, the "spider;" C, the follower; D, the "bull-ring;" E E, piston-rings; F F, the relief-plugs; G G, the taper-pins for receiving the relief-plugs; *g g*, the tapered sockets, and H the hole in the piston-rod meeting the lateral hole *h*, making communication with the cavity of the piston. Fig. 3 represents the piston in horizontal section.

Like letters refer to like parts in the several figures.

The piston, except for the novel relief provisions, is of ordinary construction and requires but a brief passing description. The spider B forms the front steam-face of the piston, into which the piston-rod A is firmly fixed. The follower C forms the rear face of the piston and, in conjunction with the intermediate bull-ring D and the aforesaid spider, forms the cavity used as a relief-cavity. The piston-rings or packing-rings E E are seated in annular channels between the bull-ring and the flanges on the spider and the follower respectively. The tapered apertures *f* are pierced in the front and rear walls of the piston-cavity respectively, either or both, and tapered relief-plugs F are accurately fitted to said tapered apertures with steam-tight joints and so made as to require to be forced into place with a pressure so great that they will not be loosened by any ordinary steam-pressure which will be brought to bear on them, being intended to yield only to the violent impact or blow occasioned by the presence of a mass of water in the clearance-space too great to be disposed of through the ordinary channels. These tapered plugs carry on their rear tapered sockets *g*, which are so

proportioned and fitted as to engage with and stick fast upon tapered pins G located on the opposite wall of the cavity and projecting toward the sockets. It is obvious that the pins may be located on the relief-plugs and the sockets on the opposite wall in reversal of the plan shown in the drawings, this being the full mechanical equivalent of the former construction. It is also obvious that one or more tapered apertures and relief-plugs may be employed, according to the judgment and preference of the designer. In Fig. 1 I have shown the relief-plug F in its place in section, while in Fig. 2 I have shown the same forced from the seat and sticking on the pin G projecting from the opposite wall. In Fig. 2 also I show relief-plugs and apertures in both faces of the piston, one in place and the other removed.

The mode of operation is as follows: The tapered plugs having been forced into place under great pressure are of course expected to remain *in situ* under all ordinary conditions, forming an impervious piston-face in no respect differing in action from the ordinary piston. When, however, water reaches the cylinder in quantities greaterthan provided for by the clearance, the tapered relief-plugs on that side are driven in under the violent impact, thus anticipating breakage by yielding on predetermined artificial breakage-lines thus provided, whereby the clearance is immediately increased by a volume equal to the piston-cavity, and the required relief furnished. The tapered plugs are taken care of by the provision above referred to of tapered pins or their equivalent, situated immediately behind them, which catch and retain the plugs until replaced by means of the tapered sockets located upon the same at the rear.

The foregoing plan of relief does not compel the stopping of the engine when accidental flooding occurs, and the same may be allowed to run until stopping-time with no loss except the loss of steam due to the extra clearance. Should the flood of water continue to come in volumes, so as to force in the plugs on the other side, there is then an opening directly through the piston, and the engine of course stops, as is very desirable. When the engine is stopped, the plug or plugs should be forced back to place and the machinery restored to its normal condition.

By the provision of the alarm-hole drilled longitudinally through the piston-rod to meet another hole extending to the piston-cavity above referred to a signal is instantly conveyed to the engineer by the escape of steam at the outlet as soon as the cavity of the piston is broken into, while of course no steam enters the said cavity so long as the plugs remain in place.

Among the advantages of this plan of relief may be mentioned the following: First, the relief is instantaneous and sure to occur under the sudden violent impact of the unyielding mass of intruding water, saving the parts from breakage under conditions where no spring-controlled valve of limited aperture could afford protection; second, the normal clearance, which is not excessive in the best engines, is increased to an amount sufficient to meet the emergency and take care of the inflow; third, no muss is made in the engine-room, the only indication of accident being the small jet of steam escaping from the piston-rod at the cross-head end, and, fourth, great simplicity and economy of construction, there being no spring or working combination liable to derangement from long inactivity just at the critical times when expected to operate.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A steam engine cylinder containing a hollow piston provided on its steam faces with relief apertures normally closed by plugs forcibly inserted therein under great pressure, but opening under impact to discharge surplus water in the cylinder into the hollow interior of the piston, substantially as specified.

2. In a steam engine a cylinder containing a hollow piston normally closed on all sides but provided on its steam faces with predetermined lines of breakage as described, whereby the said piston faces give way on the said lines when encountering a mass of water in the clearance space under high speed, thus enlarging clearance in the cylinder by admitting the surplus water occupying the clearance space into the hollow interior of the piston under impact, substantially as specified.

3. In a steam engine, a hollow piston having its steam faces perforated and stopped with plugs forcibly inserted in the perforations, whereby the piston remains entire under ordinary steam pressure, but yields at the plugs under the impact of water in the cylinder beyond the clearance capacity, thus admitting the surplus water to the cavity of the piston through the said perforations, which serve the function of relief or escape valves, substantially as specified.

4. In a steam engine, a hollow piston having one or more tapered apertures in its steam faces, said apertures being normally closed by accurately fitted tapered plugs forcibly inserted therein, substantially as specified.

5. In a steam engine, a hollow piston having one or more tapered apertures in its steam faces, said apertures being normally closed by accurately fitted tapered plugs forcibly inserted therein, the said plugs being provided with tapered sockets at the rear, in combination with tapered pins projecting from the opposite wall of the piston toward the sockets, whereby when the plugs are forced in by the impact of surplus water in the cylinder they will be caught and retained on the pins, substantially as specified.

6. In a hollow relief piston such as described, the provision of tapered pins in combination with tapered sockets between the tapered relief plugs and the opposite walls of

the piston cavity, and attached to each respectively, whereby when the said plugs are forced into the cavity of the piston by the impact of the surplus water contained in the cylinder they are caught and retained by the projecting member opposite, substantially as specified.

7. In a steam engine provided with a hollow relief piston having in its steam faces relief apertures normally closed by plugs forcibly inserted therein, but designed to yield under impact, an aperture or outlet extending from the hollow interior of the piston into and along the axis of the piston rod to the outer air, whereby when steam enters the hollow interior of the said piston by the forcing of its wall or face it may escape at the outlet and thus give warning of its entry into the interior of the piston, substantially as specified.

8. In a steam engine, a hollow piston provided with tapered apertures in its steam faces, normally closed by accurately fitted tapered plugs forcibly inserted, having tapered sockets at their rear, stationary tapered pins located opposite the tapered sockets, for receiving the same when the plugs are forced in, and a tell tale outlet for steam from the piston cavity, extending from the said cavity to the extremity of the piston rod near the cross head, substantially as specified.

9. In a hollow relief piston for high speed engines, such as described, a tapered aperture *f*, tapered plug F accurately fitted to and forcibly seated in the said aperture, tapered socket *g*, tapered pin G located opposite the socket, and a tell tale outlet *h*, H, extending from the piston cavity to the extremity of the piston rod along the axis of the latter, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN E. SWEET.

Witnesses:
W. T. POWERS,
WM. F. KACEE.