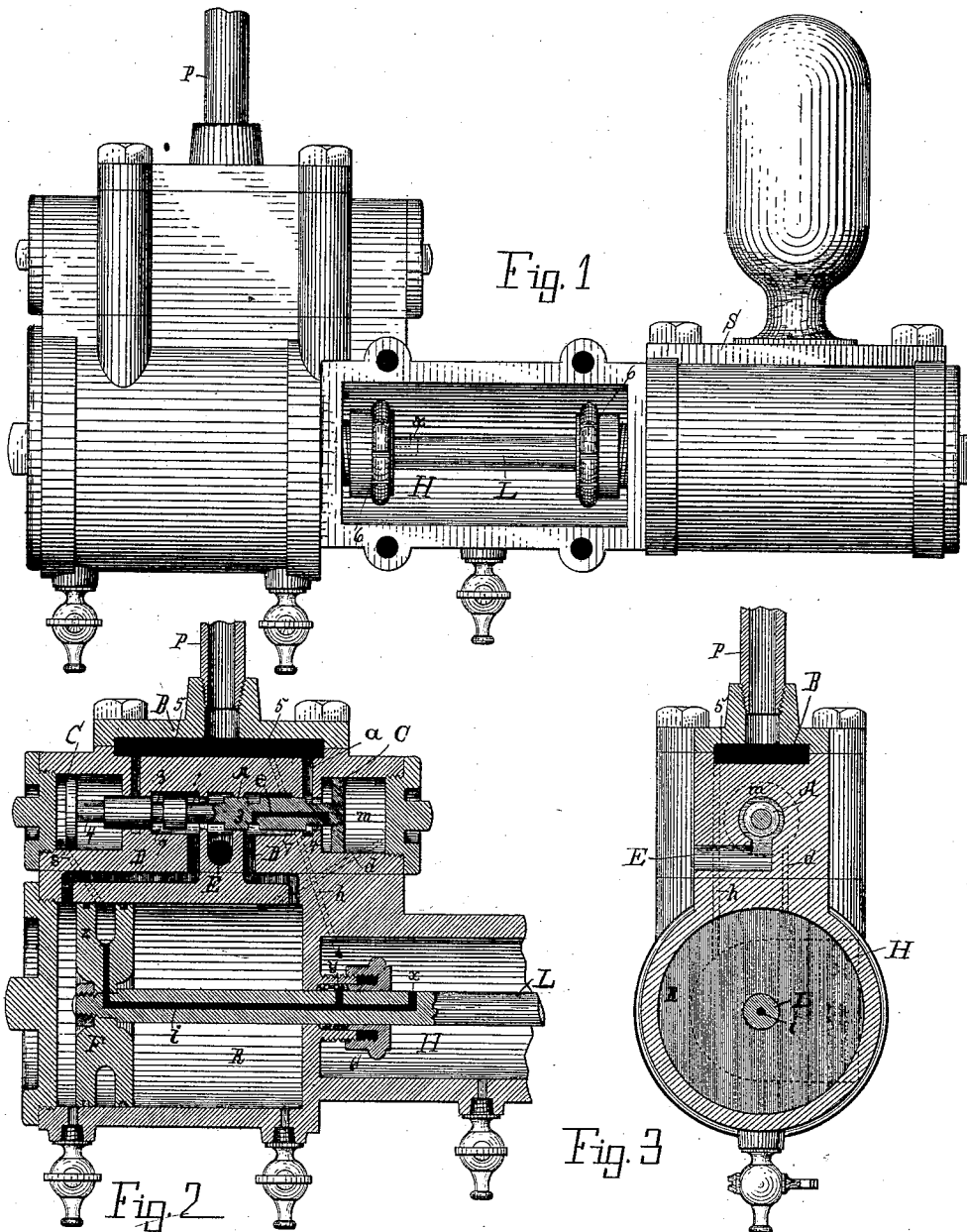


(No Model.)

R. L. FROST.
STEAM ACTUATED VALVE.

No. 428,672.

Patented May 27, 1890.



Witnesses:

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UNITED STATES PATENT OFFICE.

RICHARD L. FROST, OF BATTLE CREEK, MICHIGAN, ASSIGNOR TO THE
UNION MANUFACTURING COMPANY, OF SAME PLACE.

STEAM-ACTUATED VALVE.

SPECIFICATION forming part of Letters Patent No. 428,672, dated May 27, 1890.

Application filed December 2, 1889. Serial No. 332,346. (No model.)

To all whom it may concern:

Be it known that I, RICHARD L. FROST, a citizen of the United States, residing at Battle Creek, county of Calhoun, State of Michigan, have invented a new and useful Steam-Actuated Valve, of which the following is a specification.

This invention relates to that class of steam-engines in which the pressure of steam in the cylinder is so regulated as to obtain isochronal movement of the steam-piston under varying resistances; and it more especially relates to an invention disclosed in my patent, No. 421,355, dated February 11, 1890, in which the object of the invention as set forth consists in a peculiar construction of the steam-engine valve and its relation to the ports in the steam chest and cylinder, whereby when the resistance of the work being done increases the pressure of steam in the cylinder said pressure of steam will not so act upon the valve in the steam-chest as to entirely close the live-steam port at either end of the stroke of said valve when the engine is in operation.

The construction herein disclosed is more especially intended for use in connection with steam-pumps, the same as my prior invention referred to, but of course may be used for other purposes.

The object of the present invention consists in certain changes in the steam-chest, and in providing a secondary steam chest or receiver, and in a peculiar construction of the piston in connection with said steam-chest, all as more particularly described and claimed in the following specification.

In the drawings forming a part of this specification, Figure 1 is a side elevation with a part removed. Fig. 2 is a longitudinal section of lettered parts in Fig. 1, and Fig. 3 is a vertical section of Fig. 2 on a line with the induction-pipe P.

Referring to the lettered parts of the drawings, R is the cylinder, and F is the piston-head, having an annular depression Z in the periphery of said piston-head, as shown in Fig. 2.

At B is shown the steam-chest, having therein what is usually termed a "float-valve" A, said valve having enlarged heads C C at each end, which play back and forth in the inter-

nal enlargements *m* in the ends of the steam-chest.

Referring to Fig. 2 the valve A is shown having an annular depression 4 4 at each end and centrally at 1, and at 3 3 between said center and end depressions. Each end of the valve A has a live-steam port *e* leading from the annular depressions 4 4 internally and longitudinally through said valve into the annular depressions 3 3. These several depressions 4 4, 3 3, and 1 may be termed "annular steam-ports." This valve A is like the one shown in my prior application herein referred to. The ports *e* through the valve are as clearly shown at right hand in Fig. 2.

At P is the ordinary steam-supply pipe, and from said pipe the live-steam ports 5 5 lead into the interior of the steam-chest and into the steam-passage *h*, which leads into the cylinder H, Figs. 1 and 2.

D D are ports leading from the steam-chest into each end of the cylinder, and E is the exhaust-port. Ports *d s* lead from either end of the steam-chest into the cylinder R.

The piston-rod L passes from the cylinder R through the stuffing-boxes 6 6 in the steam-receiver H and on into the pump S, said pump of course being of the ordinary construction. Each end of this rod has a steam-port *i* passing longitudinally through it from the steam-receiver H and into the piston-head F, and leading from thence out into the annular depression *z* in the periphery of said head. This port *i* has two openings *y x* into the steam-receiver H, one of which is closed by passing into the stuffing-box at each end of the stroke. Fig. 2 shows these ports at one end.

In the operation of the engine, referring to Fig. 2, live steam has filled the steam-passages 5 5 and *h*, and steam from the right-hand passage 5 has passed through the right-hand annular port 4 of the valve A, and from thence through the steam-passage *e*, through said valve, and thence through the right-hand induction-port D and into the right-hand end of the cylinder R. A portion of the live steam has passed through the branch steam-passage *d* into the right-hand end of the steam-chest. Since the outer surface of the ends P of the valve exceeds the inner surface of said heads, the steam which enters the end of the steam-

chest through passage *d* counterbalances the pressure of the live steam against the inner surface of said head, and thus prevents abnormal displacement of said valve. The steam which entered the cylinder through the right-hand passage *D* forced the piston over to left-hand end of the cylinder, during which action the exhaust-steam passed through the left-hand steam-port *D*, through the central annular port *1*, and on through the exhaust-port *E*. The live steam which passes through the steam-passage *h* into the steam-receiver *H* fills said receiver, and for which reason, when the piston has reached the end of the cylinder just described, live steam passes through port *i* into the annular depression *z* in the periphery of the piston-head, and from thence through the steam-passage *s* into the left-hand end of the steam-chest *B*, for the purpose of throwing the valve *A* to the right, which of course would reverse the position of said valve and cause the live steam to pass through the left-hand steam-passage *5* and left-hand annular port *4* and passage *e*, through the left-hand end of the valve *A*, annular port *3*, and on through the left-hand steam-port *D* into the left-hand end of the cylinder *R*, and thus throwing the piston to the right-hand end of said cylinder. The annular depression *z* of the piston-head *F* will now register with the right-hand steam-passage *d*, which communicates with the cylinder and the right-hand end of the steam-chest, which would institute a reverse action of the valve.

One advantage of the valve as here constructed, is in case the head of the valve is pushed against the inner shoulder of the enlargements *m* of the steam-chest by the increased pressure of steam from the cylinder, caused by the resistance of the work being done by the engine, the induction-port leading into the cylinder will not be entirely closed. This advantage, however, held good in my prior application herein referred to.

Referring to Fig. 2, a change in the construction of the steam-chest from that disclosed in said prior application is shown by the chambered portions *7 7*, which communicate with the annular ports *3* and *1*, the induction-ports *D*, and the exhaust-port *E*. The object of these chambers *7 7* is explained as follows: The steam which escapes between the periphery of the valve-heads and the annular walls of the chambers in which said heads reciprocate is allowed to pass through the ports *e* of the valve, and is received into said chambers *7 7*, from whence said steam passes out through the exhaust-port *E*, and thus not interfering with the throw of the valve by the pressure of steam against the outer ends of its heads. The normal speed of the engine is fixed by the relative size of the ports *4 4* and the ports *e e* of the valve, the speed being greater when the ports *e e* approach more nearly to the capacity of the ports *4 4*.

It will be seen that in this invention the force of the steam on the two faces of the valve-head equalize and automatically control the position of the valve relative to the resistance and steam-pressure, and thus regulates the speed of the engine the same as in the prior invention herein referred to; but I have made important changes in this invention, as claimed below.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination of the valve having the annular end depressions, the annular central depression, the annular depressions each side of the central depression, and the steam-ports leading from the end depressions longitudinally through the valve and into the annular depressions next to the central depression, a suitable piston and cylinder, the steam-chest having the chambered portions communicating with the central depression, and with the annular depressions each side thereof, and with the exhaust-port, and said cylinder steam-chest having suitable ports coacting with said valve and piston, whereby said valve is operated to regulate the pressure of steam in the cylinder in accordance with the resistance to said piston, thus automatically controlling the speed of the engine, substantially as set forth.

2. The combination of the steam-chest having the end chambers, a steam-actuated valve in said steam-chest, said chest and valve having suitable coacting ports, a cylinder, live-steam passages leading from each end of the steam-chest into said cylinder, induction and exhaust ports, the steam-receiver, a live-steam port leading into said receiver, a piston-rod passing through said receiver and having a piston-head with the annular depression in the periphery thereof, said piston rod and head having the port leading therefrom through the steam-receiver into the annular depression of said head, said steam-port having two openings into the receiver, one of which is always open at each end of the stroke, substantially as set forth.

3. In an engine employing a steam-actuated valve in the steam-chest, a steam-receiver, and a piston-rod extending into and having bearings in said receiver, the piston-head of said rod having the peripheral depression, and a live-steam passage leading through said rod and out through the head into said depression, which depression registers with the live-steam ports leading to the ends of the valve, substantially as set forth.

In testimony of the foregoing I have hereunto subscribed my name in presence of two witnesses.

RICHARD L. FROST.

Witnesses:

F. G. WELLER,
A. W. LOVELL.