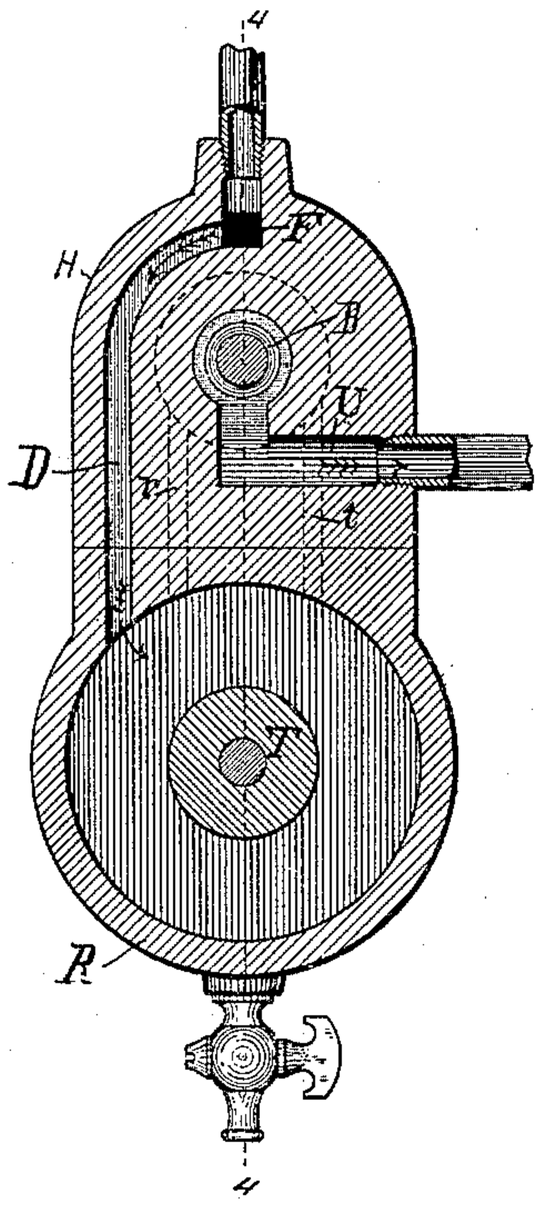
(No Model.)

R. L. FROST.

STEAM ENGINE VALVE.

No. 421,355. Patented Feb. 11, 1890.



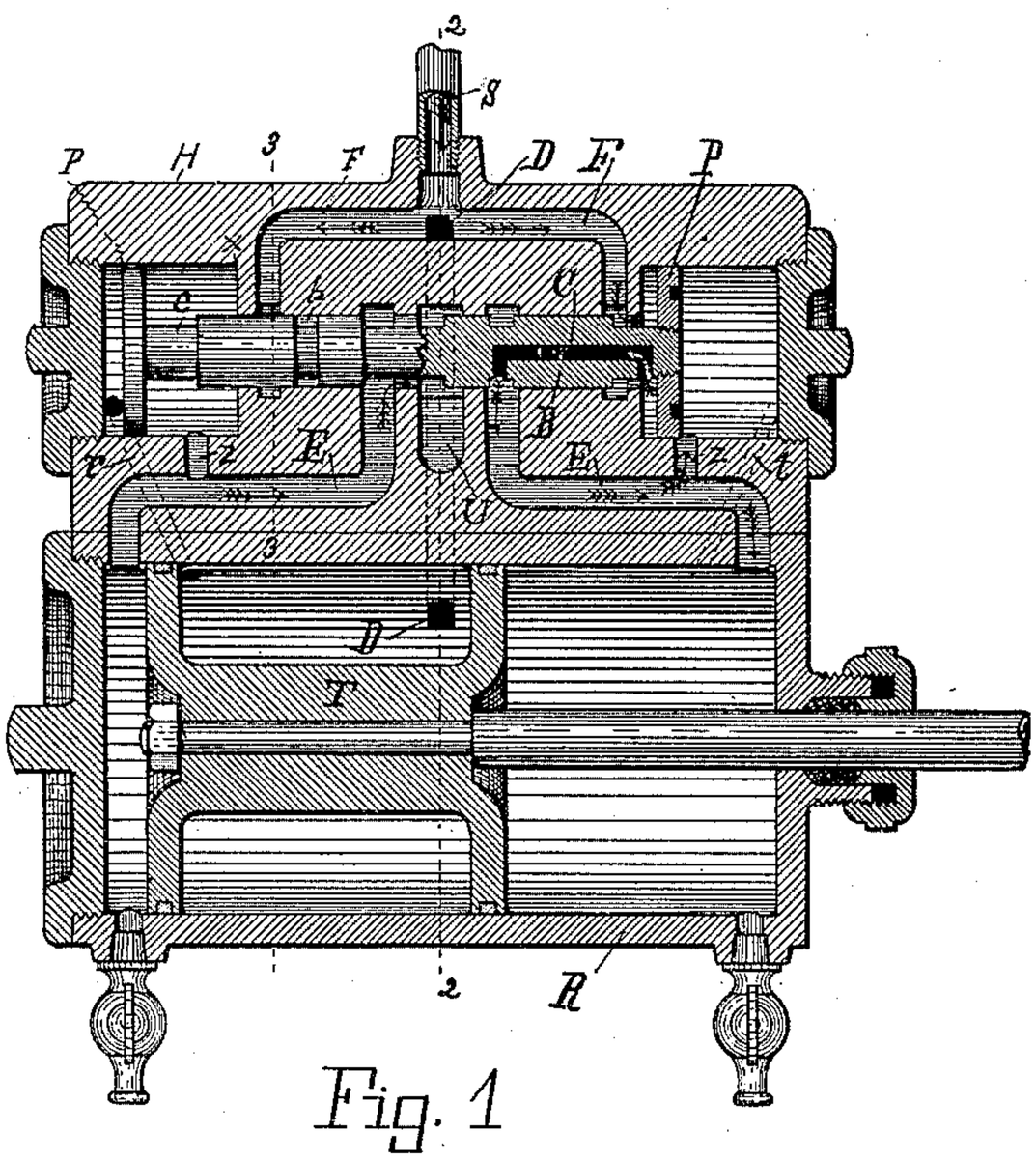


Fig. 1

Fig. 2

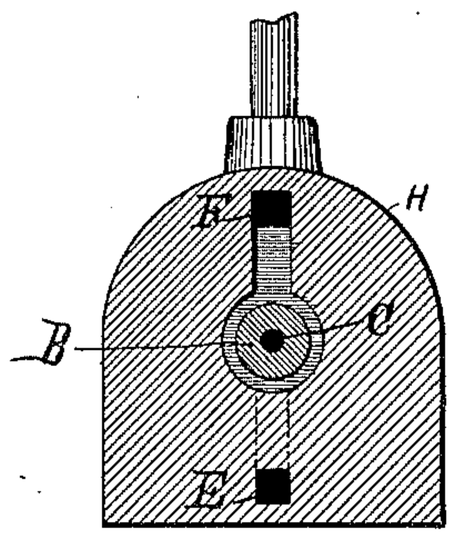


Fig. 3

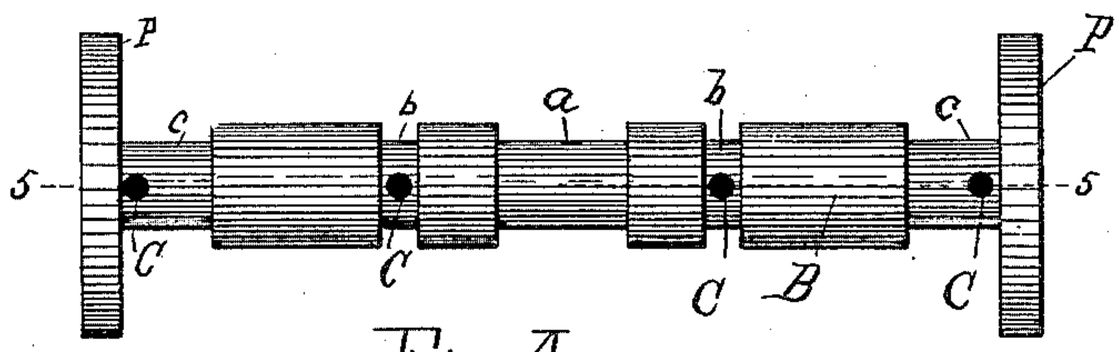


Fig. 4

Witnesses:

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L. L. Benson

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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-ENGINE VALVE.

SPECIFICATION forming part of Letters Patent No. 421,355, dated February 11, 1890.

Application filed August 28, 1889. Serial No. 322,222. (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-Engine 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 the principal object of the invention consists in the 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 cannot so act upon the valve in the steam-chest as to entirely close the live-steam port at any time.

While the steam-engine herein disclosed is especially intended for steam-pumps, it may be used for other purposes where power is needed.

In the drawings forming a part of this specification, Figure 1 is a sectional elevation on line 4 4 in Fig. 2 and a part on line 5 5 in Fig. 4, looking from a point at the right of said Fig. 2. Fig. 2 is a section on line 2 2 in Fig. 1, looking from a point at the left. Fig. 3 is a section on line 3 3 in Fig. 1, looking from a point at the left; and Fig. 4 is an inverted plan view of an enlarged lettered detail in Fig. 1.

Referring to the lettered parts of the drawings, R is the cylinder.

T is the piston having an annular depression between its two ends, thus forming a double-headed piston.

At H is the steam-chest, having therein what is usually termed a "float-valve" B, said valve having enlarged heads P P at each end, which reciprocate in the internal enlargements in the ends of the steam-chest.

Referring to Fig. 4, the valve B is shown having an annular depression *c c* at the ends and centrally at *a*, and at *b b* between said center and end depressions. Each end of the valve B has a live-steam port C, leading from the annular depressions *c c* internally and longitudinally through said valve into the annular depressions *b b*. These several depressions *c c*, *b b*, and *a* may be termed "annular steam-ports." The ports C, through the valve, are as clearly shown at right hand in Fig. 1.

At S is the ordinary steam-supply pipe, and from said pipe the live-steam ports F F lead into the interior of the steam-chest and the steam-passage D, which leads into the cylinder R, Figs. 1 and 2.

E E are ports leading from the steam-chest into each end of the cylinder, and U is the exhaust-port.

Ports *r t* lead from either end of the steam-chest into the cylinder.

In the operation of the engine, referring to Fig. 1, live steam has filled the steam-passages F F and D, and steam from the right-hand passage F has passed through the right-hand annular port *c* of the valve B, and from thence through the steam-passage C, through said valve, and thence through the right-hand induction-port E, and into the right-hand end of the cylinder R, as indicated by arrows. A portion of the live steam has passed through the branch steam-passage Z from the port E 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 Z 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 E forced the piston T over to left-hand end of the cylinder, during which action the exhaust-steam passed through the left-hand steam-port E, through the central annular port *a*, and on through the exhaust-port U. It will be observed that the live steam which passes through the steam-passage D into the cylinder R between the two heads of the piston T always fills the passage made by the annular depression in the piston T, for which reason, when the piston has reached the end of the cylinder just described, live steam enters the left-hand end of the steam-chest H through the steam-passage *r*, for the purpose of throwing the valve

B to the right, which of course would cause the live steam to pass through the left-hand steam-passage F and left-hand annular port *c* and passage C, through the left-hand end of the valve B and annular port *b*, and on through the left-hand steam-port E into the left-hand end of the cylinder R, and this throws the piston T to the right-hand end of cylinder R, and during this action live steam of course passes through the left-hand steam-passage Z into left-hand end of the steam-chest. During the exhaustion of the steam through the ports E, if the pressure of steam against the inner side of the valve-heads P is less than the pressure of the exhaust-steam, of course a portion of said exhaust-steam would enter through passages Z Z into the steam-chest, and vice versa, if the pressure of the exhaust-steam be less.

An important feature of this invention is explained as follows: When the resistance of the work being done by the engine increases the pressure of the steam in the cylinder, said overpressure of steam enters the end of the steam-chest beyond the end of the valve P and pushes said valve toward the shoulder *x* in the steam-chest, and frequently against said shoulder *x*. One great advantage of valve B, constructed as here shown, is that in case the head P of the valve is thus pushed against the shoulder *x* the induction-port leading into the cylinder is not entirely closed, as is the case in construction disclosed in the prior state of the art.

It will be seen that the forces 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 the valve acts in lieu of the ordinary ball-governor and regulates the speed of the engine.

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

The valve having the annular end depressions and the annular center depression, the annular depressions each side of the center depression, and the steam-passages leading from the end depressions longitudinally through the valve and into the annular depressions next to the center depression, in combination with the piston, and the cylinder and steam-chest having suitable ports coacting with said valve and piston, substantially in the manner and for the object set forth.

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

RICHARD L. FROST.

Witnesses:
JOHN C. BARBER,
STEVEN S. HULBERT.