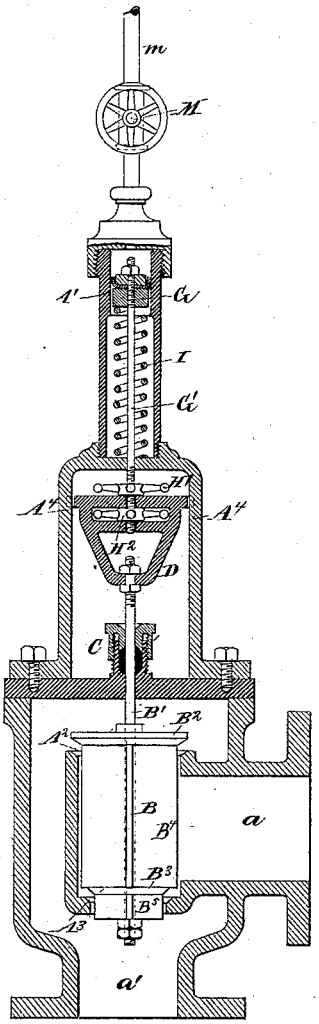
(No Model.)

W. FISHER & G. H. BEEBE.

GOVERNOR FOR PUMPING ENGINES.

No. 305,167. Patented Sept. 16, 1884.



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UNITED STATES PATENT OFFICE.

WILLIAM FISHER AND GEORGE H. BEEBE, OF MARSHALLTOWN, IOWA.

GOVERNOR FOR PUMPING-ENGINES.

SPECIFICATION forming part of Letters Patent No. 305,167, dated September 16, 1884.

Application filed April 18, 1884. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM FISHER and GEORGE H. BEEBE, both of Marshalltown, Marshall county, in the State of Iowa, have invented certain new and useful Improvements in Governors for Pumping-Engines, of which the following is a specification.

Our improved governor controls the flow of steam from the boiler to the engine according to the pressure in the water-mains. As the pressure of the water increases the flow of steam is restricted. This regulator may be used either alone or in combination with a speed-governor of any ordinary or suitable character. There may thus be a reasonable limit to the speed when the water-pressure is so low as to call for the fullest action of the engine. We will describe the invention as used alone, it being understood that where other governors are also employed a separate valve connected with such other governor may be introduced in the steam-passage, either before or behind our governor. We employ a partially-balanced valve to control the flow of the steam, but it is arranged to exert some force. This may be exerted in the direction either to open or to close. We have shown it as exerted in the direction to open the valve. The effect is to control the valve mainly by the pressure of the water, but partially by the pressure of the steam. When the steam-pressure is high, the pumping will proceed more rapidly than when the steam-pressure is low, with the same pressure of the water.

The accompanying drawing forms a part of this specification. It is a central vertical section.

Referring to the drawing, and to the letters of reference marked thereon, we will use the letter A, with additional marks A′ A^2, &c., to designate the fixed portions of the apparatus. The lower portion is adapted to resist the pressure of the steam and to constitute suitable seats for a partially-balanced valve. The seat for the upper and larger portion of the valve is marked A^2. The seat for the lower and smaller portion is marked A^3.

B is the partially-balanced valve, certain portions being designated, when necessary, by additional marks, as B′ B^2, &c. An axial stem, B′, extends out through a stuffing-box, C, and connects to a yoke, D, which is guided in stationary vertical ways A^4.

G′ is a rod, screw-threaded at its lower end and adapted to be adjusted loosely up and down in holes made sufficiently large in the yoke D. It is equipped with two thumb-nuts, H′ H^2, which engage it strongly but adjustably with the said yoke. The upper end of the rod G′ carries a piston, G, equipped with a cup-leather arranged to be distended by pressure from above. This piston is arranged to play up and down in a smooth-fitting hollow cylinder, A′, which is fixed at a proper elevation. A spiral spring, I, lifts forcibly on the piston G. A pipe, *m*, controlled by a valve, M, connects the upper end of the hollow cylinder A′ with the water-mains. (Not represented.) A pressure in the water-main is felt on the upper face of the piston G, tending to press it, and consequently the valve B, downward. The spring I resists this pressure downward. The force of the spring may be adjusted by turning the thumb-nuts H′ H^2 upward or downward.

Operation: Supposing the nuts H′ H^2 to be properly adjusted, the valve M is opened, allowing water from the main to flow through the pipe *m* into the cylinder above the piston G. Now, a steam-valve (not represented) is opened, and the steam flows from the boiler (not represented) through the passage *a* and past the valve B down through the passage *a′* to work the pumping-engine. (Not represented.) The starting of the engine and the commencement of the pumping will raise the pressure in the main and cause the water therefrom to act with more and more force on the upper surface of the piston G, correspondingly compressing the spring I and urging the valve B down toward its seats. The contraction of the steam-passage by the partial closing of this valve limits the supply of steam to the pumping-engine, and consequently controls the speed of the pumping. Supposing the engine to be working quietly and regularly at a rate sufficient to maintain the full desired pressure in the street mains, the opening of one or more hydrants, in consequence of a fire or other cause, by increasing the ave-

nues of escape for the water from the street-mains lowers its pressure. This reduces the force on the upper face of the piston G. The spring I, being subject to less force, expands and raises the piston G, with its connections. This opens the valve B and allows more steam to flow to the pumping-engine. When this has been done to a sufficient extent, the pumping will proceed at a sufficiently increased rate to maintain the pressure at a proper working height. The pressure in the street-mains under these conditions will not be as high as before, the steam-pressure in the boilers being equal, but it will be a practical working pressure. Thenceforward each fluctuation in the pressure in the street-mains will result in a movement of the piston G upward or downward, and a consequent expansion or contraction of the area through which the steam may flow past the valve B. Giving more area and more steam will pump faster and increase the supply of water to the mains. Contracting the area will have the opposite result. The effect is to regulate the pressure in the mains and keep it nearly uniform. The force of the steam acting on the unbalanced areas of the valve tends to open the valve. So long as the boilers are of sufficient capacity and are promptly attended to, so that they are able to supply the steam at a uniform pressure for all rates of working of the pumping apparatus, the tendency of the steam-pressure to open the valve will have little useful effect. It will enable a less forcible spring I to serve; but this will be an advantage of little moment. When, however, the boiler capacity is insufficient, or the attendants are not sufficiently prompt in adjusting the fires to the exigencies, or when, for any reason, the boiler-pressure varies, the effect of the varying pressure on the unbalanced areas of the valve gives an important advantage. So long as the boiler-pressure is high a given lowering of pressure in the water-mains will hold the valve in such a position that the pumping-engine will work at a certain high speed; but when the boiler-pressure is reduced the same draft on the water-mains, and the same lowering of pressure therein, although it similarly lowers the pressure forcing downward on the piston G, will not result in the same expansion of the spring I and the same rising of the valve B, because the pressure of the steam on the unbalanced surfaces of the valve B is not as great—that is to say, under all circumstances the pressure of the steam applies on the bottom of the large upper disk, B^2, and on the top of the smaller bottom disk, B^3. The pressure on each will be somewhat modified by the action on the beveled surfaces as they rise and sink, as is well understood in the working of such balanced puppet-valves; but the general tendency is as follows: The pressure on the lower disk, B^3, balances the pressure on an equal area of the upper disk, B^2. An annular area of the upper disk, B^2, which remains unbalanced, is forced upward by the pressure in the boiler, or, rather, by the difference between the pressure in the boiler and that of the steam which has passed the valve. This unbalanced pressure has the effect to open the valve wider when the boiler-pressure is high, and less wide when the boiler-pressure is low.

It will now be seen that the regulation of the engine by our apparatus is dependent partly on the varying water-pressure which is felt on the piston G, and allows the valve to rise higher as the water-pressure is reduced, and partly on the varying pressure in the boiler, which, when it is high, forces the valve open to a greater extent than when it is low. The relative influence of these two elements may be varied by varying the area of the piston G, supplying a spring, I, of corresponding force, and keeping the valve B, with its disks B^2 B^3, the same; or the relations may be varied by keeping the piston G and the spring I as at present and varying the sizes of the two disks B^2 B^3.

It will be understood that the wings B^4, which connect the disks B^2 B^3, and also the wings B^5, which are below the lower disk, B^3, are simply to stiffen and support the disks and to guide the valve as it rises and sinks, and insure that it shall always work in line with the axes of its seats.

Our improved governor requires no motion from the engine or other source to operate it. It needs but one stuffing-box. It is adaptable to all classes of steam-pumping machinery, but more especially for the water-supply of towns and large manufactories. It will work very quickly, and is very simple in construction. If the consumption of the water entirely ceases, the pressure in the mains, and consequently on the upper face of the piston G, will by the action of the spring I close the valve entirely and the pumping machinery will stop until the consumption of water again commences. In case the governor breaks down or is taken apart for repairs or for other purpose, the engine will not be disabled. The steam-valve will open itself as soon as steam is admitted to the valve-chamber, and in case an alarm of fire is given, requiring the engine to work rapidly, or under any other circumstances, the action may be regulated by the ordinary throttle-valve (not represented) until the governor is repaired and again put in operation. A double engine should be employed in cases where difficulty is apprehended from a possibility of the engine stopping in some position where it will not start on receiving the steam-pressure.

We propose in some cases to introduce a stop in such position that the valve shall remain a little open under all conditions sufficiently to keep the pumping machinery in slow motion.

Modifications may be made in the forms and proportions, within wide limits without departing from the principle or sacrificing the advan-

tages of the invention. Parts of the invention may be used without the whole. We can employ a form of valve B which shall be perfectly balanced. In such case the area of opening for the flow of steam will depend entirely on the pressure of the water. We prefer the construction shown.

We have described the invention as applying to water, but it will be obvious that it may apply to pumping any other fluid. We believe the invention can be used with advantage as applied to air-pumps for various purposes—as, for example, air-engines and air-brakes.

We claim as our invention—

1. In a governor, substantially as described, a double puppet-valve, as B, having bearings of unequal area, arranged as described, a piston, G, and spring I, combined with connections between said piston and valve, and with means for subjecting the piston to the pressure of the street-main, and for leading the steam to the valve, as and for the purposes set forth.

2. In a governor, the adjusting means $H' H^2$, in combination with the yoke D, ways A^4, valve B, piston G, spring I, and suitable connecting means arranged to serve as herein specified.

In testimony whereof we have hereunto set our hands, at Marshalltown, Iowa, this 31st day of March, 1884, in the presence of two subscribing witnesses.

WILLIAM FISHER.
GEO. H. BEEBE.

Witnesses:
O. B. PINKHAM,
R. ESTABROOK,