(No Model.)

W. FISHER & G. H. BEEBE.

REGULATOR FOR PUMPING ENGINES.

No. 423,145. Patented Mar. 11, 1890.

Fig. 1.

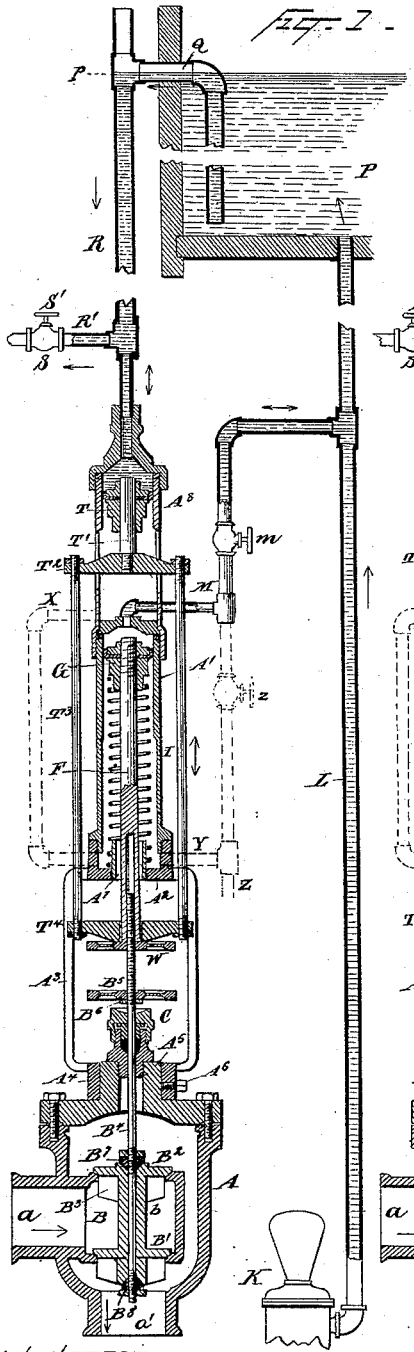


Fig. 2.

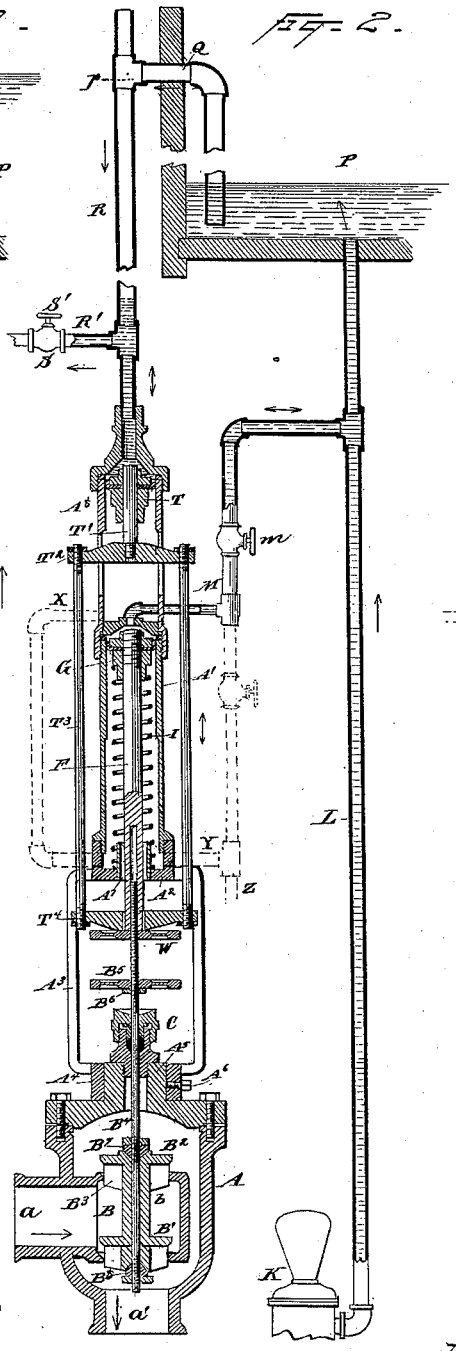
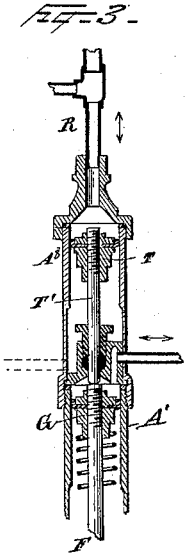


Fig. 3.



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

REGULATOR FOR PUMPING-ENGINES.

SPECIFICATION forming part of Letters Patent No. 423,145, dated March 11, 1890.

Application filed November 23, 1889. Serial No. 331,282. (No model.)

To all whom it may concern:

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

The improvement is intended more especially for supplying tanks in the upper parts of high buildings from which the water is being drawn irregularly, as in manufactories, office-buildings in cities, and the like. It may be applied in any situation where there is a reservoir either directly over the pumping mechanism or at a considerable distance removed laterally with sufficient difference of level to cause the pressure to be rapidly felt at the pumping-engine when the overflowing water fills a pipe connected so as to let its pressure be felt on the mechanism. We provide a pipe arranged to be filled with the water from the tank when it has reached the prescribed limit, with connections allowing the pressure of the water in such pipe when filled to stop the pump. We provide for emptying the pipe immediately or soon after the water has sunk below the prescribed level, leaving the pump again free to work. In what we esteem the most complete form of the invention this provision for promptly stopping and for again starting the pump as it rises to and sinks from the highest level allowable is combined with the automatic regulator set forth in the patent to us, dated September 16, 1884, No. 305,167. We have also devised important improvements in certain details, all of which are fully set forth below. We have devised means for conveniently turning around the upper portions relatively to the lower and confining them so as to allow the pipes to be connected in any position, or to expose the hand-wheels to be seen and operated from any desired point, thus facilitating the use of the device in any required position in the engine-room.

The accompanying drawings form a part of this specification, and represent what we consider the best means of carrying out the invention.

Figures 1 and 2 are vertical sections through the entire apparatus, representing it in two conditions. Fig. 1 shows the conditions which obtain when the tank is full and the pumping is stopped. Fig. 2 shows the conditions when the pump is working and the water is being forced up to supply the tank. Fig. 3 is a vertical section through a portion showing a modification.

Similar letters of reference indicate corresponding parts in all the figures where they appear.

A is the cast-iron casing or body of a steam-regulating valve, certain portions being designated, when necessary, by supernumerals, as A′. When this valve is partially opened, the steam flows through from the receiving pipe or nozzle a to the delivery pipe or nozzle a' in the direction indicated by the arrows.

B is a partially-balanced puppet-valve, certain portions being designated, when necessary, by supernumerals.

B′ is the lower disk, and B^2 the upper and larger disk.

B^3 are wings, which extend longitudinally and serve as guides. Instead of the continuous wings with straight outer edges, (shown in our patent of 1884,) we form these wings with the large portion b cut out from each.

B^4 is the rod or stem extending upward through a stuffing-box C.

A′ is the lower cylinder, inclosing a piston G, having a cup-leather packing arranged to receive the pressure from above. This piston and its connections are urged upward by the tension of a spring I, which encircles the rod F and abutting against the platform A^2 below, which is supported on arms A^3, extending upward from the ring A^4, which latter is fitted upon a boss A^5 on the top of the valve, and is held firmly by a pinching-screw A^6. The rod F traverses loosely through a hole in the platform A^2, which is surrounded by a short tube A^7, serving to retain any leakage which flows down past the piston G. To the top of the cylinder A′ is connected a pipe M, controlled by a valve m, and connecting with the pipe L, through which latter the water is forced upward by the pumping-engine K and delivered into the bottom of an elevated tank P. The action of these parts is substantially that set forth in our patent of 1884 referred to.

A considerable length of the valve-rod B^4

is screw-threaded. Its upper end is inserted in a correspondingly-threaded hole in the axial line of the thicker rod F, connecting to the lower piston G, and also through rigid cross-heads and side bars with an upper piston T, which will presently be described.

B^5 is a hand-wheel having internal threads, by which it is fitted on the screw-threaded portion of the valve-rod B^4 a little above the stuffing-box C. It is firmly held in position by a jam-nut B^6. This hand-wheel aids in the turning of the valve-rod by the attendant as required in adjusting the two pistons G and T and their connections up and down relatively to the valve B. This adjustment allows for variations in the tension of the spring I, or in the pressure of the steam or water.

W is a hand-wheel matched on the screw-threads of the valve-rod B^4 above the wheel B^5, and serving to press against the lower end of the piston-rod F as a jam-nut to hold the rods B^4 and F rigidly together.

The pressure of the water being forced up through the pipe L increases as the water accumulates in the tank P. If through any diminution in the consumption or through any other cause the water-level rises in the tank, the pressure transmitted through the pipe M and exerted on the upper side of the piston G increases and overcomes the tension of the spring I and forces the piston G and its connections downward. This partially closes the valve B and the engine commences to pump more slowly. When from this cause or from any other cause the supply forced into the tank through the pipe L becomes less than the consumption and the water-level in the tank is lowered, the pressure in the pipe M, and consequently on the upper face of the piston G, is reduced and the piston rises by the force of the spring I, causing the valve B to open more widely. This portion of the apparatus tends to regulate the action of the pumping-engine, but it would, except for the additional parts to be described, continue to work slowly after the tank has become nearly or quite filled. This might induce serious mischief, unless a liberal waste-pipe should be provided, and even with that safeguard there would be much waste. We provide for stopping the action peremptorily when the tank is nearly but not quite full.

Q is a pipe leading horizontally outward through the side of the tank P near the top. Its inner end extends downward nearly to the bottom of the tank, so that when water overflows through this pipe it cannot be clogged by any floating object. Its outer end connects with a vertical pipe R, the upper end of which is constantly open to avoid siphoning. This pipe R extends down to the vicinity of the pumping-engine. Ordinarily the pumping-engine is in the cellar or basement, and the pipe R therefore extends downward some fifty or one hundred feet. It terminates in the top of a vertical cylinder A^8, which is fixed on the cylinder A′ and in line therewith. The cylinder A^8 incloses the piston T, having a cup-leather packing adapted to be operated by pressure applied from above. The rod T′ of this piston extends downward a little distance and connects to a cross-head T^2, which extends out through slots in the lower portion of the cylinder A^8 and is adapted to move up and down freely, as required. The ends of this cross-head T^2 connect by vertical rods T^3 with the cross-head T^4 on the stem or rod F.

R′ is a branch pipe extending laterally from a low point in the pipe R and terminating in a tank or other receptacle for waste water. (Not represented.) The pipe R′ is controlled by a regulating cock or valve S. This cock can be adjusted with great nicety to allow a small flow outward through the branch R′ whenever the pipe R is filled.

So long as the action of the pumping-engine K is only sufficient to maintain the water-level at about the mid-height in the tank P, this last-described portion of the apparatus will be of no effect and the parts first described, which correspond to our patent of 1884, will alone regulate the action of the engine, giving a quicker stroke, and consequently pumping more water when the consumption is rapid and the water-level has sunk nearly to the bottom of the tank P, and compelling a slower action and the pumping of less water in a given unit of time when the water-level in the tank has risen again; but when there is risk that the tank may become filled and either flow out wastefully through a higher waste-pipe (not shown) or overflow and induce destruction in the building the last-described portion of the apparatus will assert itself as follows: The water-level rises in the tank until it reaches the horizontal part of the pipe Q, (designated farther on as the point *p*,) and flows out through it into the vertical pipe R. Descending in this pipe its gravity performs the important function of rapidly and peremptorily arresting the action of the pumping-engine as follows: It flows down faster than it can escape through the nearly-closed valve S, and exerting the full pressure due to its rapidly-accumulating head presses on the upper face of the piston T, depressing it promptly and urging the valve B down tightly to its seats and stops the engine.

The outflow through the slightly-opened valve S tends to empty the water from the pipe R; but it does this slowly, and so long as the water in the tank remains above the point *p* the water will continue to flow gently out and keep the pipe R filled, and the pressure on the piston T will be maintained and the valve B will be kept tightly closed and the pumping-engine will be motionless; but so soon as the more or less rapid consumption of water through the building shall induce a lowering of the water in the tank P below the point *p* the water, being no longer sup-

plied from the tank, slowly lowers its level in the pipe R, and soon the diminished pressure on the piston T allows this piston and its connections, including the regulating-valve B, to be lifted by the force of the coiled spring I, and the pumping-engine is again started, governed, as at first, by the varying pressure on the lower piston G, in accordance with the invention set forth in our patent of 1884.

The apertures or cut-away portions of the wings B^3 in our regulating-valve B allow the steam to circulate more freely and without involving any change in the external dimensions of the valve. We allow the entire valve B to revolve on the stem B^4 by holding it loosely between a conical nut B^7, fitted on the stem B^4 above, and another conical nut B^8, fitted on the same stem below. These nuts, nicely finished on their conical faces and matching in correspondingly-conical cavities in the valve, keep the valve and the stem accurately centered, while allowing the valve to revolve with freedom. A jam-nut behind each of the conical nuts holds it rigidly when the right adjustment of the nut is attained.

In practice either or both the pistons G and T are liable to leak. The lower portion of the cylinder A^8 below the slots for the cross-head T^2 is made tight, and is drained by a pipe X, (see dotted lines for this drainage system,) which extends out laterally from a point near its base and connects by elbows and extensions to the lower part of the cylinder A′, which is also tight, and is drained by a pipe Y, extending laterally from its base into a drain-pipe Z. This latter connects through a valve *z* with the regulating-pipe M, and may serve to drain the connected parts whenever the apparatus is to be put out of use.

The under side of the piston G is formed with a boss or hub extending down into the interior of the spring I sufficiently to center it. The short tube A^7, extending up loosely around the rod F, performs the same function of steadying the spring and keeping it centered at the lower end, and in addition serves to retain any water which leaks down from the piston, compelling it to remain in the bottom of the cylinder A^8 until it rises to such a level as will allow it to flow out through the drain-pipe X.

We designate as the overflow-point *p* the orifice through the side of the tank P near the top, where the pipe Q emerges. This point determines the height to which the water-surface can rise before the action of the engine is arrested by the descent of the water in the pipe R.

An ordinary hand-wheel S′ serves to regulate the opening of the cock S. This cock should be adapted to regulate nicely the small flow of water which is allowed to escape from the pipe R. By turning the hand-wheel S′ to slightly open or close the cock S the time may be varied in which the pipe R will be emptied, and consequently the period will be varied during which the engine will be held motionless after the water-level in the tank has sunk below the overflow-point *p*.

We attach importance to the provisions for connecting the upper parts to the valve-casing A by means of the ring A^4 and pinch-screw A^6 taking hold on the boss A^5 around the valve-rod B^4. The construction not only facilitates repairs by making it easy to take apart and put together again, but also allows the upper parts to be conveniently adjusted in any position to allow the pipes and their connections to extend in any direction desired.

The wings B^3 serve as guides for the motion of the valve, and also as rigid connections and braces, connecting the large area of the two disks of the valve, so that they are enabled to withstand strong pressures without being distorted, while they also allow the steam or other fluid which is controlled to pass freely.

W is the upper hand-wheel. It is tapped upon the screw-threaded stem B^4, and performs the important function of locking the latter in any required position relatively to the hollow stem F.

Whenever it is desired to increase the general rate of pumping, the upper hand-wheel W is turned in the direction to screw it down to liberate the parts, and then the lower hand-wheel B^5, previously firmly set on the rod B^4, is turned, carrying around with it said rod in the direction to cause it to traverse upward farther into the stem F, which results in raising the valve B, admitting more steam, increasing the speed of the pump, and thereby raising the pressure in the pipe M and on the piston G. When this movement is judged sufficient, the upper hand-wheel W is again screwed up against the stem F and the parts are again allowed to work automatically. The piston G will now move the valve B downward only when a greater pressure is felt on the upper face G, and consequently a greater pressure obtains in the branch M. When it is desired to automatically adjust the pressure at a lower point, the reverse is performed. After slacking the pinching-screw A^6 the ring A^4 may be turned partially or entirely around relatively to the other parts, and thus change the positions required for the several pipes, and by tightening the screw A^6 it may be firmly held again. This allows the lower part A to be set with the receiving-nozzle *a* presented in any required direction to receive the steam, while the ring A^4, carrying the upper parts, may be adjusted so as to afford a clear view of the hand-wheels W and B^5 from any desired part of the engine-room.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention. We can make the upper piston T and its inclosing-cylinder A^8 larger or smaller than shown.

Parts of the invention can be used without the whole.

We can dispense with the action of the lower piston G and depend solely on the intermittent action of the overflowing water on the upper piston T.

We prefer to use the safety device T R S, &c., in combination with our regulating apparatus of 1884, and have so represented it. When such combination is used, the means for connecting the upper and lower pistons to each other and to the steam-valve may be varied in many ways. Fig. 3 shows in section one of the devices which we propose to use for such combination. There is a stuffing-box in the top of the cylinder A′, and a rod, shown as separate from the piston-rod of the lower piston, plays up and down through the packing in such stuffing-box, transmitting thereto the pressure of the water received on the upper piston with substantially the same effect as by the cross-head and connecting-bars above shown.

In case there is a liability of the pumping-engine to run too fast when the water in the tank is low and our valve B interposes no restraint or not sufficient restraint, there may be an additional governor of any ordinary or suitable style arranged to act on a separate valve, either before or behind our valve.

We can dispense with the adjustable ring A^4 without involving greater evil than having the arms A^3 obscure or partly obscure the view, and slightly obstruct the access to the hand-wheels when the receiving-pipe *a* is required to be presented in a certain direction.

We claim as our invenion—

1. The steam pumping-engine K, with suitable connections for steam and water tank P, pipe Q, connecting at the overflow-point *p*, descending pipe R, discharge R′, having a contracted aperture S, upper cylinder A^8, piston T, playing in the latter, and regulating-valve B, controlling the steam-supply to the engine, connected to such piston and arranged to be opened and closed by the motion thereof, in combination with each other and with the spring I or equivalent agent exerting a force opposed to the pressure of water in the pipe R, all arranged for joint operation, substantially as herein specified.

2. The adjustable valve S and means S′ for operating it to enlarge and contract the aperture, and thereby vary the rate of discharge from the pipe R, in combination with such pipe and with the tank P connected thereto at the point *p*, where it is desired to arrest the filling, and with the steam-pump K, valve B, controlling the access of steam thereto, and the piston T and its connections arranged to be operated by the pressure of water in pipe R, and the spring I or its equivalent, all substantially as herein specified.

3. The governor described, having, in combination, the two pistons T and G, actuated the one by the slight variations in the pressure in the water delivered from the pump as the resisting-head becomes greater or less, and the other by the gravity of water overflowing from the reservoir when it has exceeded a certain prescribed limit, as herein specified.

4. The combination, with a steam pumping-engine, of the following elements: a pump, a pipe conducting the water therefrom to an elevated point, a piston subject to the slightly-varying pressure of such water as the level of the surface rises and sinks, a spring resisting such pressure and inducing motion of the piston in opposition to such pressure when the pressure decreases, a connection from such piston to a regulating-valve controlling the admission of steam to the engine, and an overflow-connection at the point *p* at a high level, a pipe leading down therefrom, a discharging-aperture adapted to discharge the overflow water slowly from such pipe and empty it when the water sinks in the reservoir below the overflow-point *p*, and a piston and cylinder or equivalent provisions for receiving motion from the presence of such water in such pipe, and connections from such piston to such engine, arranged to completely arrest the motion of the engine whenever such overflow occurs, all substantially as herein specified.

5. The adjustable ring A^4 and confining means A^6, in combination with the valve B, receiving-pipe *a*, and delivering-pipe *a′*, and with the cylinder A′, piston G, spring I, and rod B^4, with suitable operating and indicating means, as W′ and B^5, arranged to allow the upper portion of the mechanism to be turned in any desired direction, as herein specified.

6. In a governor, the screw-threaded rod B^4, attached to the controlling-valve B, the hollow rod F, attached to the piston G, and the hand-wheels W′ and B^5, all combined and arranged for joint operation, substantially as herein specified.

In testimony whereof we have hereunto set our hands, at Marshalltown, Iowa, this 28th day of October, 1889, in the presence of two subscribing witnesses.

WILLIAM FISHER.
GEORGE H. BEEBE.

Witnesses:
J. F. MEEKER,
JAMES L. WILLIAMS.