G. ROSS.

Fluid Pressure Regulator.

No. 219,114. Patented Sept. 2, 1879.

Fig. 1.

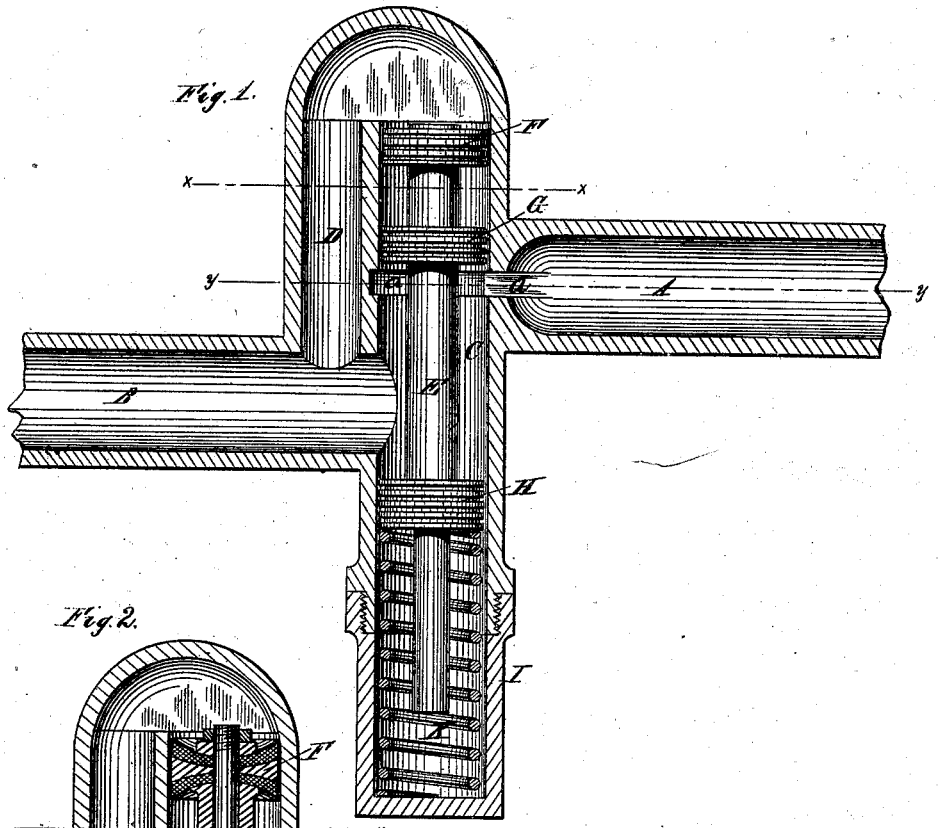


Fig. 2.

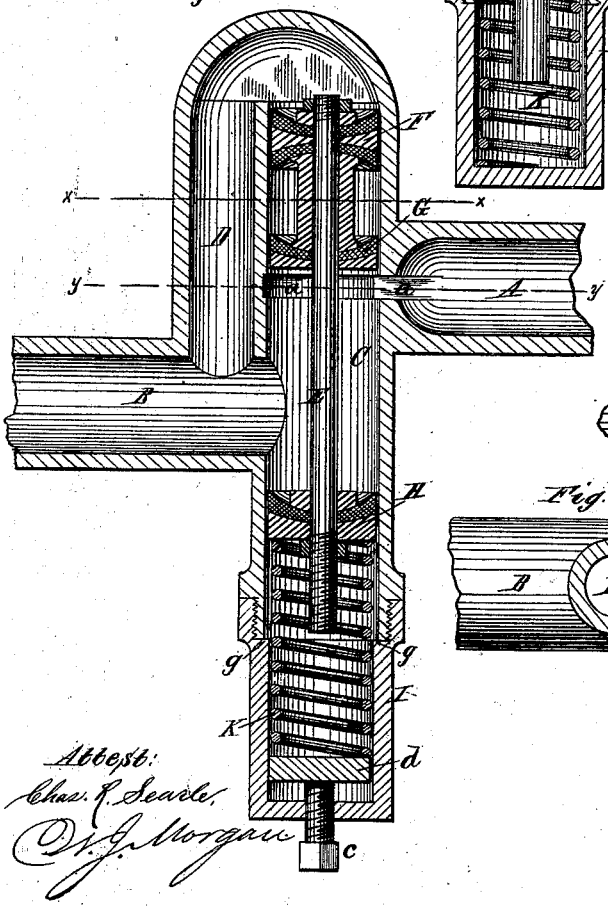


Fig. 3.

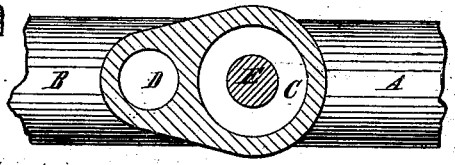
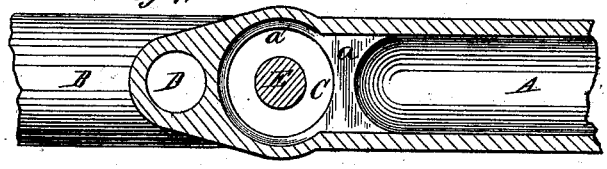


Fig. 4.



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UNITED STATES PATENT OFFICE

GEORGE ROSS, OF TROY, NEW YORK.

IMPROVEMENT IN FLUID-PRESSURE REGULATORS.

Specification forming part of Letters Patent No. **219,114**, dated September 2, 1879; application filed May 10, 1879.

To all whom it may concern:

Be it known that I, GEORGE ROSS, of Troy, county of Rensselaer, and State of New York, have invented certain new and useful Improvements in Fluid-Pressure Reducers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

Figure 1 is a vertical section illustrating an apparatus embodying my improvements, the view being taken upon a plane passing through the axis of the valve-stem. Fig. 2 is a similar view, showing a form of valve or packing therefor different from that of Fig. 1, and also illustrating one means of adjusting the tension of the loading-spring. Figs. 3 and 4 are, respectively, horizontal sections upon planes passing through lines *x x* and *y y* of the other figures.

Like letters in all the figures indicate corresponding parts.

In the transmission of fluids under pressure it is frequently desirable and oftentimes of very great importance that at some one or more points of the conduit the pressure shall be less than at other points; and it is of like desirability and importance that some automatically-operating means be adopted for maintaining the pressure within suitable limits without wasting the fluid.

Without attempting to mention all the circumstances of transmission (which would be practically impossible) to which the application of the principles of my invention will be found specially advantageous, the following most prominent circumstances are alluded to in order to afford a clear idea of the character, scope, utility, and adaptation of my improvements.

The ordinary water-service of cities and towns where a considerable head is obtainable, or where a considerable pressure is required, necessitates the employment of service-pipes capable of withstanding a pressure per square inch equal to that which may be at any time exerted within the mains, and this, of course, involves the use of heavier and more expensive conduits or piping proportionately as the main pressure is greater, to say nothing of the necessity of compensating for the water-hammering to which all service-pipes are liable, or of the precautions essential against damage by leakage, which damage is certain to increase with the main pressure.

Similarly in various systems of water-distribution calculated more especially for fire service, wherein an extraordinary pressure is maintained, it is of marked importance, for obvious reasons, that in some of the conduits the pressure be lower than in others.

In the distribution of gas for lighting purposes, steam for heating and other uses, air under pressure, and generally all liquids or gases, the application of my improvements will be found of marked value.

It is, therefore, the purpose or object of my invention to provide a mechanical device which, being located at any point within the fluid-conduit, will automatically prevent the fluid-pressure beyond it from exceeding any certain predetermined pressure per square inch independently of the pressure within that part of the conduit from which the fluid is conducted, and this without necessitating the wasting or discharging of any of the fluid.

To accomplish this, the invention consists in certain new and useful peculiarities of construction and relative arrangements or combinations of parts, all of which will be hereinafter first fully described, and then pointed out in the claims.

In the drawings, A indicates the inlet to the pressure-reducing apparatus from the main pipes, reservoir, or other vessel in which the fluid may be contained; and B is the outlet of the apparatus, intended to be connected with the pipes or other vessels within which it may be desired that the pressure shall not exceed a certain amount.

The two channels C and D communicate with each other at top and bottom, (before the valves or disks are located,) as plainly shown. They (the channels) are formed in the casing of the apparatus, and parallel with each other, thus avoiding the use of any return-pipe, and making the device simple and easy to construct, as well as compact and durable. Within the compartment C is located a spindle, E, which carries near its upper end the two disks F and G, and below the lower opening into D a third disk, H, all of which are made to

fit nicely against the walls of the chambers in which they are placed. Within a third chamber, I, directly in line with C, is located the loading-spring K, so arranged as to bear against disk H or some part of the spindle connected therewith. The chamber I is of the same diameter as channel C, so that the three disks are of like superficial area, and each in its movements is like a piston in an elongated cylinder, by which great accuracy may be secured.

The opening from inlet A into chamber C is slightly contracted, and communicates with a groove or furrow, *a*, formed in the walls of chamber C, so that the fluid from the inlet may pass around valve G and the stem, and find its way freely into outlet B, until valve G is carried down in its chamber below said groove or furrow. This contraction of the inlet-opening beyond the limits of the outlet-opening, and leaving the latter always free of any obstruction—that is, unobstructed by any valve or disk—is an important feature of the construction, tending to insure a uniformity of flow and equality of fluid-pressure, as well as greater sensitiveness of the valve-system than could otherwise occur. The enlarged and uninterrupted outlet affords a practically non-resisting passage for all fluid which may enter at the inlet, and thus the flow through the apparatus will not be subjected to the variations which may occur in the velocity of the incoming fluid, since as fast as any enters the apparatus it will find a free and ample passage-way to operate upon the valves or to enter the service-pipes in case the pressure be not too great. Were this outlet made small in comparison with the inlet, the fluid in the space between the two ports would be subjected to all the pulsations in the incoming fluid, and the outlet would offer a frictional resistance, which would have to be overcome before the valves could be moved. This, in addition to destroying the sensitiveness and accuracy of the apparatus, would increase the tendency to wear away the walls of the port, especially when passing muddy water, and would enhance the liability to clog up the outlet with such sediment as could come through the inlet without obstruction. The enlarged outlet obviates all these difficulties, is in a location to afford the most convenient access of passing fluid to the service-pipes, and renders it possible and easy to construct the apparatus on a small scale, which is advantageous in economy of material, as well as in the matter of setting up or fitting to place, and in saving of room.

Now, as to the operation of the device so constructed, it is apparent that if the spring be removed, any pressure whatever which may be exerted in the outlet B and chamber D (this pressure being at all times precisely the same as that in the piping within which it is desired there shall be no more than a given amount) will tend to drive the disks downward and to carry disk G below the inlet-opening. When this disk passes below the opening its further movement is arrested by some suitable form of stop or guard, and there will then be one valve, F, above and one, G, below the inlet, effectually cutting off the further flow of fluid; and as soon as this cutting off takes place no further increase of pressure can occur. The downward movement of the stem with its disks is due to the fact that there are two equal surfaces exposed to the downward pressure and but one to the upward pressure, as is plainly shown.

When the loading-spring is properly placed so as to press upwardly against the system of valves or disks, it is clear that before the inlet can be closed the tension of the spring must be first overcome by the pressure in B and D, and this affords an opportunity to limit the possible pressure within those chambers, and consequently within the piping beyond, with a great degree of accuracy.

The tension of the loading-spring may be controlled or adjusted by any suitable contrivance, one of which is indicated in Fig. 2, wherein a set-screw, *c*, bears against a washer, *d*, upon which the spring rides. Its operation is easily understood. In this figure (2) the movement of the valve-stem is arrested at the proper point by reason of the interposition of the shoulder *g* in the path of the lower disk.

The more accurately the disks are made to fit their casings the more perfect will be the operation of the device. Any style of packing may be employed. For ordinary uses that shown in Fig. 1 will be found to give excellent results.

In Fig. 2 the disks are provided with cup-packings of leather or other flexible material, properly secured in place, and so as to be forced to expand against the casing by the fluid-pressure thereon.

The apparatus is intended to be coupled with the conduits at the point where it is desired that the reduction of pressure shall commence. No special form of coupling is shown, since any may be adopted.

The operation of the device, as previously explained, is entirely independent of the pressure upon the inlet side. This pressure may be of any degree whatever, and if the loading-spring is properly set the inlet will be closed when the desired pressure is attained upon the other side.

The spring might be replaced by some other mechanical means which would afford the required resistance to the play of the valve-stem.

The invention is to be distinguished from all such devices as safety-valves in which, in order to control the pressure, it is necessary to provide an escape for the fluid, which will be opened whenever a certain degree is reached, and from all such regulators as employ a valve which controls the outlet-opening or in which the chamber forming the cylinder for the balanced pistons and into which the inflowing fluid is received is not in communication at top and bottom with the outlet side of the ap

paratus, or in which the pressure is exerted against a diaphragm.

My apparatus involves no waste of fluid whatever. When constructed and arranged substantially in accordance with the foregoing explanations the improved apparatus will be found to admirably answer the several purposes and objects of the invention as previously stated; and, further, it will be found durable, simple, and not liable to get out of order. It is entirely automatic in its several operations, opening the inlet whenever the pressure on the outlet side is reduced below the determined maximum, (as whenever water, or gas, &c., is drawn from the service-pipes,) and gradually closing the port without shock whenever the maximum is reached.

Having now fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an apparatus of the character and for the purposes herein specified, the combination, with the valve-chamber open at top and bottom, of the parallel channel communicating therewith at both ends, the three pistons or disks having equal surfaces mounted upon a single stem and adapted to be moved by the reduced pressure upon the outlet side of the apparatus or by the loading-spring, thus controlling the size of the contracted inlet-port and leaving the enlarged outlet unimpeded, substantially as shown and described.

2. The combination of the inlet A, outlet B, parallel chambers C D, communicating at top and bottom, chamber I, pistons F G H, balanced with respect to the inlet-pressure, of equal diameters, and adapted to regulate the size of the inlet while the size of the outlet remains unchanged, and an incased loading-spring, the arrangement being substantially as explained, so as to insure the cutting off of the inflowing fluid by a pressure upon the outlet side less than that within the main supply-tube, as shown and described.

3. The combination of inlet A, chamber C, grooved about the contracted inlet-port, parallel chamber D, communicating therewith at top and bottom, chamber I, pistons F G H, balanced with respect to the inlet-pressure, and adapted to regulate the size of the inlet while the size of the outlet remains unchanged, spring K, located in chamber I, adjusting device *c d*, and enlarged outlet B, the whole being arranged within a suitable casing, and otherwise constructed and arranged to operate substantially in the manner set forth.

In testimony that I claim the foregoing I have hereunto set my hand and seal in the presence of two witnesses.

GEORGE ROSS. [L. S.]

Witnesses:
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