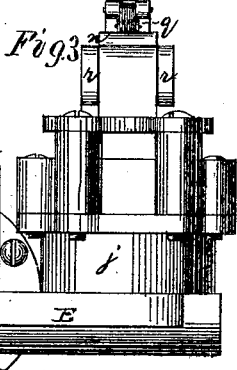
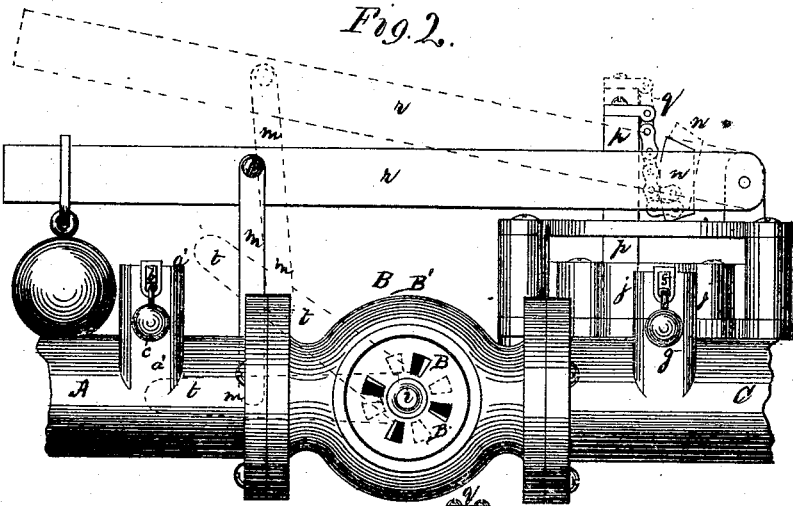
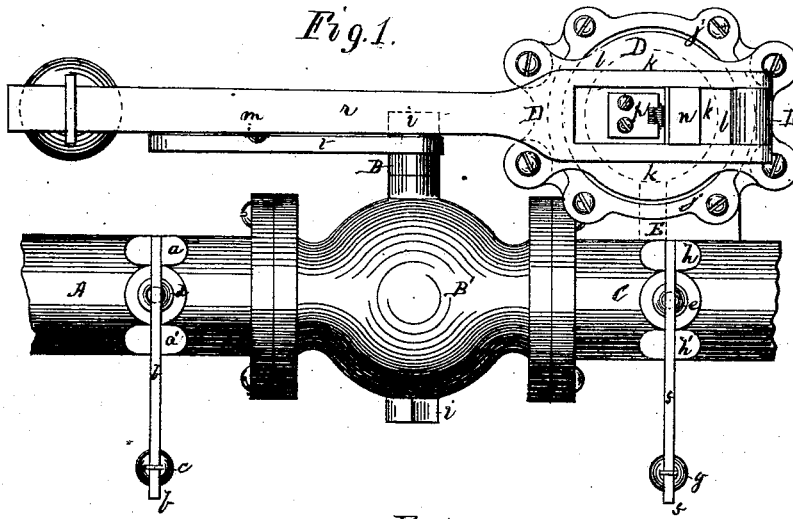


P. BALL & B. FITTS.

Pressure Regulator with Safety-Valve.

No. 163,720.

Patented May 25, 1875.



WITNESSES:

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UNITED STATES PATENT OFFICE.

PHINEHAS BALL AND BENALIAH FITTS, OF WORCESTER, MASSACHUSETTS,
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IMPROVEMENT IN PRESSURE-REGULATORS WITH SAFETY-VALVES.

Specification forming part of Letters Patent No. **163,720**, dated May 25, 1875; application filed
March 15, 1875.

To all whom it may concern:

Be it known that we, PHINEHAS BALL and BENALIAH FITTS, of Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Pressure-Regulators with Safety-Valves; and we do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification, in which—

Figure 1 represents a plan of a portion of a water-main having our improvements applied thereto; Fig. 2, a side elevation of the same, the cover of the valve-chamber being removed; and Fig. 3, an end view and partial section of the same. Fig. 4 represents a plan of the under side of the piston of the safety-valve.

Our invention relates to a new and improved mode of preventing such accidents to water-mains as arise from those hard quick blows technically called a "water-hammer," or, in other words, from that reactionary force engendered in the low service-main by the sudden closing of a hydrant or other large valve or valves.

Our invention, for this purpose, consists, first, in combining, with a low service-main and its pressure-regulator, a safety-valve so loaded as to bear or resist, without moving from its seat, the normal pressure to which it is regulated, and but little, if any, more, so that when reaction takes place, from the sudden closing of a hydrant or other large valve or valves, it will open just enough to give vent to a quantity of water sufficient to relieve the regulator from the force of the reactionary blow of the water-hammer, and which, if transmitted to the diaphragm or piston of the regulator, would be sufficient to suddenly close the governor-valve, and in so doing create a similar but still more dangerous reaction in the high service-main, which, if allowed to take place, would be apt to burst the latter, to the great damage of everything in its immediate neighborhood.

Again, as such casualty may ensue despite

all precautions, our invention further consists in combining with the high-pressure main, and with a pressure-regulator attached to the low service-main, a safety-valve so arranged, constructed, and loaded as to give vent under such reaction to a quantity of water sufficient to neutralize the force of reaction of the water-hammer.

This arrangement and combination of the safety-valve with the high service-main, and with a pressure-regulator attached to the low service-main, may be used of itself, and do good service without the aid of the safety-valve on the low service-main; but we prefer, as a rule, to use the two together, their combined action in this respect rendering them a perfect safeguard against the reactionary force of the motion of the water when suddenly checked.

To enable others skilled in the art to make, construct, and use our improvement, we will now proceed to describe it in detail.

In the drawings, A represents the high service-main, and is connected, in any suitable manner, with one end of the shell or chamber B' of the governor-valve B. To the other end of the valve-chamber is secured, in the same manner, the low service-main C. The governor-valve and its shell or chamber may be of any suitable and known construction, its peculiar construction forming no part of this application. The last section or pipe A of the high service-main is provided with a couple of standards, *a a'*, to one, *a*, of which is pivoted the end of a lever, *b*, which carries an adjustable weight, *c*, the lever being so pivoted as to be free to rise and fall, according to the pressure in the main, and which acts upon it through the instrumentality of a valve, *d*, which has its seat on the upper side of section A of the high service-main A, as shown in Figs. 1 and 3. Standard *a*, like the other, is provided with a slot, the sides of which act as a guide to the lever *b*, and its bottom as a rest for the latter, when the valve is forced home to its seat by the weight *c* on lever *b*.

The safety-valve *d* may be of any suitable construction—as, for instance, it may be constructed upon the principle of a piston inclosed within a cylinder, such as that shown

in Figs. 3 and 4. This piston, as there shown, is provided with a cap or flange, *o*, on its upper end, the under side of which is beveled so as to fit its seat. The piston part *n* of valve *d*, instead of being made round, so as to fit the cylinder, in which it is made to slide up and down, may be provided with grooves throughout its length up to the under side of its cap or flange, so that when slightly raised the grooves will allow the water to escape at the seat; or, for the same purpose, the piston may be made of any form other than cylindrical, as, for instance, that of a square or an equilateral triangle, as shown in Fig. 4; or it may be made cylindrical, and so as to fit the cylinder, by making it tubular from the bottom up to the under side of the cap, or a little within the same, but not so as to pass entirely through the cap, and then making a series of openings or channels around its periphery, immediately under the cap *o*, to communicate therewith, so that when the valve is raised from its seat by an excess of pressure of the water in the main on the under side of the piston and its cap, the water will pass freely through the tubular part of the piston, and out through the channels just referred to into the open air, or into a waste-pipe or other receptacle arranged to receive and conduct it wherever desired. The low-pressure main *C* is also shown as provided with a safety-valve, *e*, constructed and arranged in the same or similar manner, and with a pressure-regulating lever, *f*, and weight *g*, constructed and mounted in standards *h h'* in the same manner as lever *b* and weight *c*. At one side of the low service-main is arranged the pressure-regulator *D*, and which communicates, on the under side of its piston or diaphragm, with the former through a channel, *E*. (Shown in dotted lines in Fig. 1.) This regulator may be of any suitable construction, its peculiar construction forming no part of this case so long as, by suitable appliances connected therewith, it is made to operate the governor-valve *B*. A suitable regulator and appliances for this purpose are shown in the drawings. There the regulator is shown as consisting of a cylinder, *j*, in which a plunger, *k*, and diaphragm *l*, through a piston-rod, *p*, and chain *q*, is made to operate the weighted lever *r*, through which the governor-valve *B* is operated, the stem *i* of the valve for this purpose being provided with a crank-lever, *t*, and the latter then connected to the lever *r* of the regulator by a link-rod, *m*. (Seen in Fig. 2.) Chain *q* is secured at one end to the top of piston-rod *p*, and at its other end to the under side of a block, *n*, which is made fast to the bifurcated end of lever *r* a short distance in advance of its pivotal point. The governor-valve *B*, thus connected to the lever *r* of the pressure-regulator, is made to move in harmony with the lever *r* of the latter, they being so connected that when the lever is down, as shown in full lines in Fig. 2, valve *B* will be fully open, to allow free passage to the wa-

ter from the high service-main *A* to the low service-main *C*, and when raised, as shown in dotted lines, the valve will have been correspondingly closed, the range of the movements of the lever being such as to entirely open or close the valve, or only partially to effect the same, according to the pressure of the water in the low service-main on the diaphragm and its plunger *k*.

The connection between the low service-main and the cylinder *j* of the regulator may be made in any suitable manner, that section, *C*, to which it is attached being so constructed as to correspond with the construction of the lower part of the regulator, and so that when properly secured and fitted to each other, communication may ensue between the interior of the main and that of the cylinder of the regulator.

The operation is as follows: Suppose the governor-valve *B* to be open, so that the water can pass freely through at the required pressure from the high service-main *A* to the low service-main *C*. As water is being drawn from the latter from a hydrant or other large valve, and the latter then to be suddenly closed, the reaction ensuing from this sudden checking of the motion of the water, where there is no safety-valve *e* provided, has the tendency to create a short sharp blow on the under side of the piston of the regulator, which is frequently strong enough to suddenly raise the latter and its lever *r*, and thus cut off communication with the high service-main, thereby reproducing a stronger and still more dangerous reaction in the latter; but by our combination of the safety-valve *e* with the regulator, the force of the reaction is expended on that valve, raising it from its seat, and allowing sufficient water to escape to neutralize the effects of the reaction, and that without having so effected the action of the regulator as to close the governor-valve, and thereby preventing reaction in the high service-main.

Under ordinary circumstances, the use of safety-valve *e* would be sufficient; but where a number of valves may be open, drawing water at the same time, and therefore giving an accelerated motion to the water in the mains, and several should then happen to be suddenly and simultaneously closed, such would produce a much harder and sharper reaction, and one sufficient not only to open valve *e*, but to operate the regulator itself, and that to an extent sufficient to suddenly close the governor-valve, and thereby create a reaction in the high service-main, which, under such circumstances, would be very apt to burst and commit great damage to everything in its immediate neighborhood. This liability to burst is remedied by the application of the safety-valve *d* to the high service-main, which is then forced open, and allows sufficient water to escape to neutralize the effect of the blow in that main.

It will also be observed that while the valves *d* and *e* will act as above described they will

also act in their usual capacity as a safety-valve whenever from a too great head of water the pressure in either of the mains shall exceed the pressure to which they are adjusted to bear through their respective weights *c* and *g* and levers *b f*.

Having described our invention, we claim—

1. The combination of a pressure-regulator, governor-valve *B*, and safety-valve *e*, with a water-main, in which the safety-valve is applied to the low-service end *C* of the main, so as to operate in the manner substantially as and for the purposes set forth.

2. The combination of a pressure-regulator, governor-valve *B*, and safety-valve *d*, with a water-main, in which the safety-valve is independently attached to the high-service end *A*

of the main, so as to operate in the manner substantially as and for the purposes set forth.

3. The combination of a water-main, governor-valve, and pressure-regulator, with a safety-valve, *d*, applied to the high-service end *A*, and a safety-valve, *e*, to the low-service end *C*, in the manner substantially as and for the purposes set forth.

In testimony that we claim the foregoing as our own we affix our signatures in presence of two witnesses.

PHINEHAS BALL.
BENAIAH FITTS.

Witnesses:

ABIEL E. WILSON,
S. AUGUSTUS WELCH.