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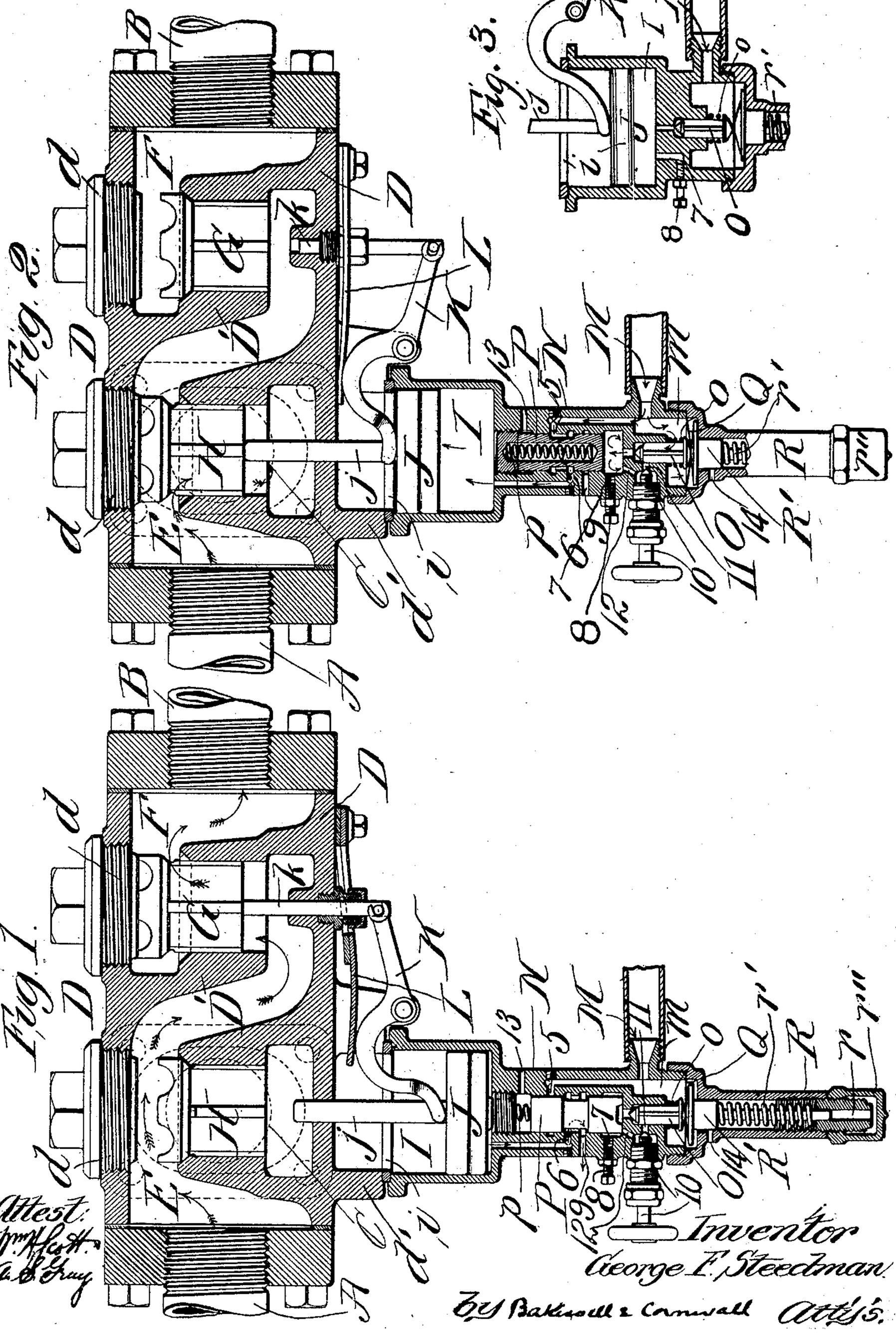
G. F. STEEDMAN.

RELIEF GOVERNOR FOR AIR COMPRESSORS.

(Application filed Sept. 30, 1899.)

(No Model.)



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RELIEF-GOVERNOR FOR AIR-COMPRESSORS.

SPECIFICATION forming part of Letters Patent No. 686,778, dated November 19, 1901.

Application filed September 30, 1899. Serial No. 732,198. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. STEEDMAN, a citizen of the United States, residing at the city of St. Louis, State of Missouri, have invented a certain new and useful Improvement in Relief-Governors for Air-Compressors, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a sectional view illustrating my improved governor in its normal operating position. Fig. 2 is a similar view showing the parts in position, wherein the relief-valve is open to establish communication between the discharge-passage from the compressor and the atmosphere, and Fig. 3 is a detail view of a modification.

This invention relates to a new and useful improvement in a relief-governor for air-compressors, the objects being to construct a governing device which shall be economical of the power necessary to drive the compressor, absolute in its action, mechanical in its details, and one which is not liable to get out of repair.

With these objects in view the invention is embodied in the novel parts, arrangement, and combinations of parts hereinafter described, and particularly set forth in the claims, and which comprises, generally speaking, a casing formed with a suitable chamber, which is part of the discharge-pipe of the air-compressor, and in which chamber are arranged two valves, one a check-valve normally open to the passage of the compressed air through the discharge-pipe of the compressor, so as to admit the compressed air to the reservoir, and the other a valve which is normally closed, but which when open connects the discharge-pipe of the compressor with the open air at a point between said compressor and said check-valve. Two valves are so arranged that when one is closed the other is open, and a feature of my invention is therefore the provision of automatic mechanism operated by pressure from the reservoir, whereby these valves may be operated when said reservoir-pressure reaches a predetermined maximum. Another feature resides in the provision of a manually-operated valve, whereby the valves above referred to may be operated at will, and, finally, the invention consists in the construction, arrangement, and combination of the several parts, all as will hereinafter be described and afterward pointed out in the claims.

In the drawings, A indicates a discharge-pipe leading from the compressor into the relief-valve casing, and B represents a discharge-pipe leading from said relief-valve casing to the reservoir or other suitable receptacle for the compressed air.

C represents the blow-off pipe or relief-pipe, leading from the relief-valve and discharging into the atmosphere at any desired point. This pipe is shown by dotted lines in Figs. 1 and 2.

D indicates the casing of my improved governing mechanism, which casing is preferably provided with caps *d* for the valves carried therein. This casing is formed with a passage or chamber E, which receives air from the pipe A, while a chamber F is provided, from which latter chamber the pipe B leads. Chambers E and F are separated from each other by a partition-wall D′, formed with an opening, (at one end of which is arranged a valve-seat,) in which opening operates a check-valve G, whose function is to admit air from chamber E into chamber F whenever the pressure in E exceeds F, said valve obviously closing, if permitted to do so, when pressure in chamber F exceeds that in the chamber E. For the purpose of explanation I will refer to this valve G as opening toward the reservoir, and it will be understood that while I have shown an ordinary winged check-valve a flap-valve will answer the same purpose.

H indicates a valve which controls an opening leading from chamber E, which opening when valve H is raised establishes communication between chamber E and the blow-off or relief pipe C. This valve H is shown as a winged check-valve, although other forms of valves may be employed, if desired, and is normally closed by the pressure of the compressed air in the chamber E on its upper surface. When valve H is closed, valve G is designed to be open, so that the compressed

air discharged from the compressor passes through chambers E and F and onto the reservoir.

Secured to one side of casing D and preferably in axial alinement with valve H is a cylinder I, carrying a piston J, whose rod *j* extends through casing D in line with the valve H. This cylinder is preferably insulated from casing D by a rubber or other suitable non-heat-conducting washer *i* for the purpose of preventing said cylinder from becoming heated and carbonizing the leather in piston J.

As shown, cylinder I is secured to a flange *d'*, extending from the casing D, which flange is open at one side for the reception of a lever K, which is pivoted to said flange, a spring L bearing upon one member of said lever for the purpose of forcing the same into engagement with the piston J and holding said piston in the outer end of cylinder I, as shown in Fig. 1. The other, or, as I will term it, the "outer," end of lever K has a connection, preferably a slot-and-pin connection, with a rod *k*, which enters casing D (suitable packing being provided) in axial alinement with valve G. Through the instrumentality of spring L, lever K, and rod *k* valve G is normally held open, as shown in Fig. 1, while valve H is closed.

Fig. 1 represents the normal or running position of the governor, and it will be noticed that valve G, acting simply as a check-valve, being raised from it seat, as above dscribed, will not move with every pulsation of the compressor, and so does not wear itself out. The valve H is never moved except when called upon to open communication between chamber E and the atmosphere to relieve the compressor from the work of forcing air into the reservoir when the reservoir has received its maximum pressure.

I will now describe the mechanism for operating valve H when the maximum pressure in the reservoir is reached and will state that this mechanism consists of valves arranged in suitable casings preferably extending from the cylinder I.

M indicates a pipe leading from the reservoir or other place where it is desired to prevent the pressure from exceeding the maximum limit, said pipe supplying pressure to a chamber *m* in the outer end of a casing N. Arranged in chamber *m* is a valve O, consisting of a suitable head, wings, and valve proper, under which head is arranged a spring *o*, whose tendency is to raise said valve from its seat, but due to the pressure on said head said valve is normally closed. The port or opening controlled by this valve leads behind valve P, held in position by a spring *p*. Valve P is preferably in the shape of a cylindrical valve formed with a reduced portion about midway its ends, which reduced portion coöperates with suitable ports for admitting pressure from chamber *m* behind piston J when said valve is in one position, and when said valve is in its other position said reduced portion coöperates with ports for exhausting pressure from behind piston J.

Valve O, before referred to, bears at one end against a diaphragm Q, forming the end wall of chamber *m*.

R indicates an extension secured to the valve-casing containing a spring-pressed plunger R', bearing against the outer face of the diaphragm Q, the tension of which spring is sufficient under ordinary circumstances to keep the valve O in a closed position. However, when the pressure in chamber *m* reaches its maximum to overcome the tension of this spring-pressed plunger said plunger will be forced back, permitting the spring *o* under the head of valve O to raise said valve from its seat. A follower *r* is introduced into the outer end of the extension R for the purpose of adjusting the tension of the spring *r'*, so as to regulate and adjust the pressure of the plunger-head against the diaphragm to accommodate the governor to various conditions by regulating the tension of spring *r'* to resist movement up to a certain pressure, beyond which the diaphragm will be forced outwardly against the pressure of said spring-pressed plunger and permit the valve O to be raised from its seat.

Jam-nut or cap *r''* is preferably threaded on the follower *r* to engage with the same and the casing R, said follower being threaded in said casing. If desired, a lock may be provided for this cap *r''* to prevent the pressure on the plunger-head from being changed by unauthorized persons, who might unwittingly rotate the follower *r*.

Under normal running conditions the parts should occupy the position shown in Fig. 1; but should pressure in the reservoir reach its maximum a like pressure in chamber *m* would overcome spring *r'* and raise valve O from its seat, thus establishing communication between pressure in chamber *m* and the space under the piston-valve P. This pressure would act to force piston-valve P upwardly against the resistance of its spring *p*, and the reduced portion of said piston-valve would register ports 5 and 6, 5 leading from chamber *m* to the reduced portion of the valve around the valve-waist and into port 6 to behind the piston J. This pressure from chamber *m* behind piston J will force said piston J upwardly, as shown in Fig. 2, so as to permit valve G to close, after which a continued movement of piston J upwardly will raise valve H from its seat and establish communication between chamber E and blow-off pipe C, so that under these conditions no more pressure can enter the reservoir through valve G on account of the pressure on top of valve G, and said pressure in chamber E having an easier escape the parts will remain in the above-described position as long as the pressure in the reservoir is sufficient to overcome the resistance of the spring-pressed plunger behind the diaphragm; but as soon as the

pressure in the reservoir decreases said spring-pressed plunger will assert itself, so as to close valve O, which thereby closes communication between chamber *m* and the space behind the piston-valve P. The air behind piston-valve P now escapes through a port 7, controlled by a leak-valve 8, which leak-valve consists of a slitted bolt introduced into the valve-casing for the purpose of adjusting the amount of leakage from the space behind the piston-valve. Spring *p* asserts itself to throw said valve back to its normal position, in which the reduced portion of said valve registers port 7 with an exhaust-port 9, so that the air behind piston J will be exhausted, and said piston will be forced down to its normal position by the inner end of lever K and spring L, bearing thereagainst. Pressure in chamber E will now act to seat valve H and spring L will act to raise valve G. It will be noted, however, that valve H closes before valve G is opened, there being considerable lost motion between the valves and the rods which raise the valves from their seats, so that it is impossible to raise both valves from their seats at the same time. It will be observed also that it will be impossible to prevent egress of the air through the valve G in case of any accident—as, for instance, when the pressure in the chamber E is at any time greater than the pressure in the chamber F said valve will rise. When there is pressure in the reservoir and for any reason it is desired to shut down the compressor, it is extremely hard to again start the compressor under a heavy load, and I have therefore provided a valve designed to be operated manually at the will of the operator, so that in starting the compressor should there be pressure in the reservoir valve G will be closed and valve H will be open, so that the compressor will have little or no work to do until it attains the proper speed, after which the manually-operated valve may be turned so as to permit valve H to seat itself and valve G to be raised, as in the normal running conditions. 10 indicates this manually-operated valve, which closes a port 11, opening in chamber *m*. When valve 10 is open, pressure from chamber *m* enters through port 11 and passes through port 12 into the space behind the piston-valve P, raising said valve, so that it will establish communication between chamber *m* and the space behind piston J, throwing said piston upwardly and elevating valve H from its seat. Whenever the compressor has attained speed, valve 10 is closed, and the pressure behind the piston-valve leaks out through the valve 8, as above described, permitting the piston-valve to be thrown by its spring and exhaust the pressure behind piston J, so that valve H will close and valve G open. I prefer to provide a port 13 in front of piston-valve P for obvious reasons and likewise a port 14 behind the plunger R′, both of which ports are for the purpose of accommodating the displacement of air due to the movement of parts or leakage.

It will be observed that in the above construction the valves have little work to do, and therefore will remain tight for a long time, and that it is impossible to waste any air from the reservoir by having both valves open at the same time. It is also impossible to stop up the discharge-pipe of the compressor, because even though the relief-valve were not operated the pressure will still enter the reservoir and not be confined to said discharge-pipe. The device is positive in its action, quick-acting, and practically automatic, requiring little or no attention, except when starting the compressor with pressure in the reservoir, which requires the manual manipulation of one valve, which should remain open a sufficient time to enable the compressor to attain speed. For illustration the rod *k* may be omitted, in which event the valve G would not be held in its raised position, but could seat itself by gravity or whenever the pressure in chamber E was less than in F. Also it will be obvious that the piston-valve P and its associate ports may be omitted and the valve O control an opening directly under the piston J, in which event the leak-valve 8 would serve to exhaust pressure from beneath the piston J after the valve O was closed.

I am aware that minor changes in the arrangement, construction, and combination of the several parts of my device can be made and substituted for those herein shown and described without in the least departing from the nature and principle of my invention.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination with a suitable casing provided with two chambers, E and F, a check-valve for admitting pressure from chamber E to chamber F, a valve for controlling an opening leading from chamber E to the open air, mechanical means for positively opening said check-valve, when the pressure in chamber F is normal, and a piston actuated by pressure from chamber F for displacing said positive mechanical means when pressure in chamber F reaches a desired maximum, so as to permit said check-valve to close, said piston then opening communication between chamber E and the open air; substantially as described.

2. The combination with a suitable casing formed with chambers E and F, of a check-valve for opening communication between said chambers, a valve for controlling communication between chamber E and the open air, a piston for actuating said last-mentioned valve, a lever, means acting on said lever tending to raise the check-valve between said chambers when the valve in chamber E is closed, and automatically-actuated valves for admitting and exhausting pressure to and

from behind said piston; substantially as described.

3. The combination with a suitable casing provided with two chambers E and F, of a check-valve G for controlling communication between said chambers, a valve H for opening communication between chamber E and the open air, a piston for actuating valve H, a spring-pressed lever coöperating with said piston and with the valve G, a piston-valve coöperating with ports to admit and exhaust pressure to and from the chamber behind said piston, and a valve O for admitting pressure behind said piston-valve; substantially as described.

4. The combination with a suitable casing provided with two chambers E and F, of a check-valve G for controlling communication between said chambers, a valve H for opening communication between chamber E and the open air, a piston for actuating valve H, a spring-pressed lever coöperating with said piston and with the valve G, a spring-pressed piston-valve coöperating with suitable ports to admit and exhaust pressure behind said piston, a valve O for admitting pressure behind said piston-valve, a diaphragm coöperating with said valve O, and a spring-pressed plunger coöperating with said diaphragm; substantially as described.

5. The combination with a suitable casing provided with two chambers E and F, of a check-valve G for controlling communication between said chambers, a valve H for opening communication between chamber E and the open air, a piston for actuating valve H, a spring-pressed lever coöperating with said piston and with the valve G, a piston-valve having a reduced portion coöperating with ports 6 and 7 when said valve is in one of its positions, to admit pressure behind said piston, said reduced portion coöperating with ports 7 and 9 when said piston-valve is in its other position, to exhaust pressure from behind said piston, a spring for throwing said piston-valve in one direction, a valve O for admitting pressure behind said piston-valve to throw the same against the pressure of said spring, a diaphragm, and a spring-pressed plunger coöperating with said diaphragm to hold said last-mentioned valve to its seat, and a leak-valve for exhausting the pressure from behind said piston-valve when valve O is closed; substantially as described.

6. The combination with a suitable casing provided with two chambers E and F, of a check-valve G for controlling communication between said chambers, a valve H for opening communication between chamber E and the open air, a piston for actuating valve H, a spring-pressed lever coöperating with said piston and with the valve G, automatic means actuated by pressure from chamber F for throwing said piston and opening valve H, when a maximum pressure in chamber F is reached, and a manually-operated valve for admitting pressure from chamber F to behind said piston for opening said valve H at will; substantially as described.

7. The combination with a suitable casing containing chambers E and F, of a check-valve G, controlling communication between said chambers, a valve for controlling communication between chamber E and the open air, a piston J for operating said last-mentioned valve, suitable mechanism utilizing the pressure of chamber F when said pressure reaches its maximum for moving said piston J to open the valve which it controls and establish communication between chamber E and the open air, and a manually-operated valve for opening and closing communication between the pressure of chamber F and the space behind piston J for moving said piston at will; substantially as described.

8. The combination with a suitable casing provided with chambers E and F, a check-valve for admitting pressure from chamber E to chamber F, a valve for controlling an opening leading from chamber E, a piston for opening said latter valve, a lever, a spring for moving said lever to open said check-valve, and means actuated by pressure in the chamber F for moving said piston, said lever being moved by said piston to permit the closing of said check-valve.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 25th day of September, 1899.

GEORGE F. STEEDMAN.

Witnesses:
WM. H. SCOTT,
A. S. GRAY.