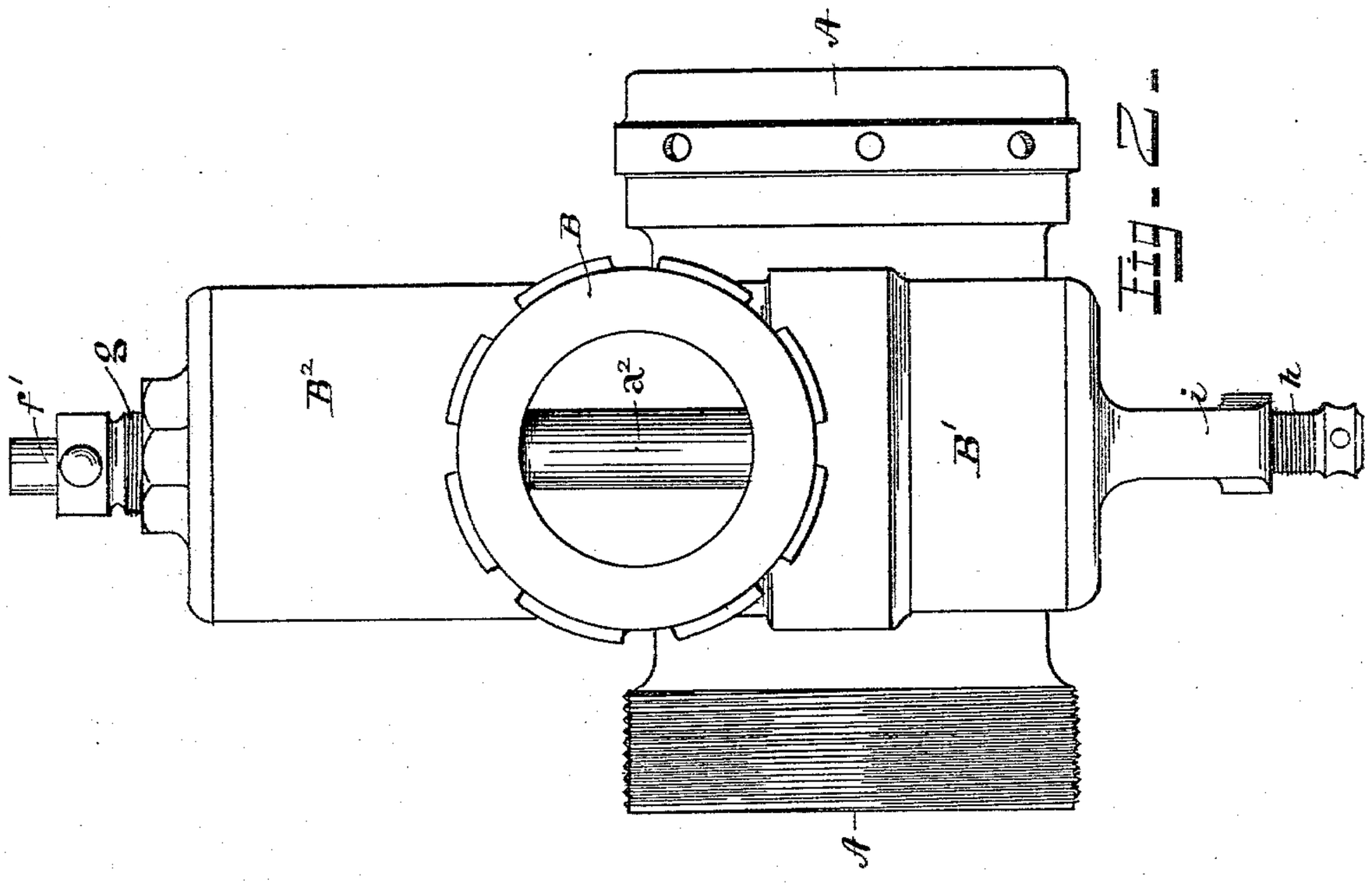
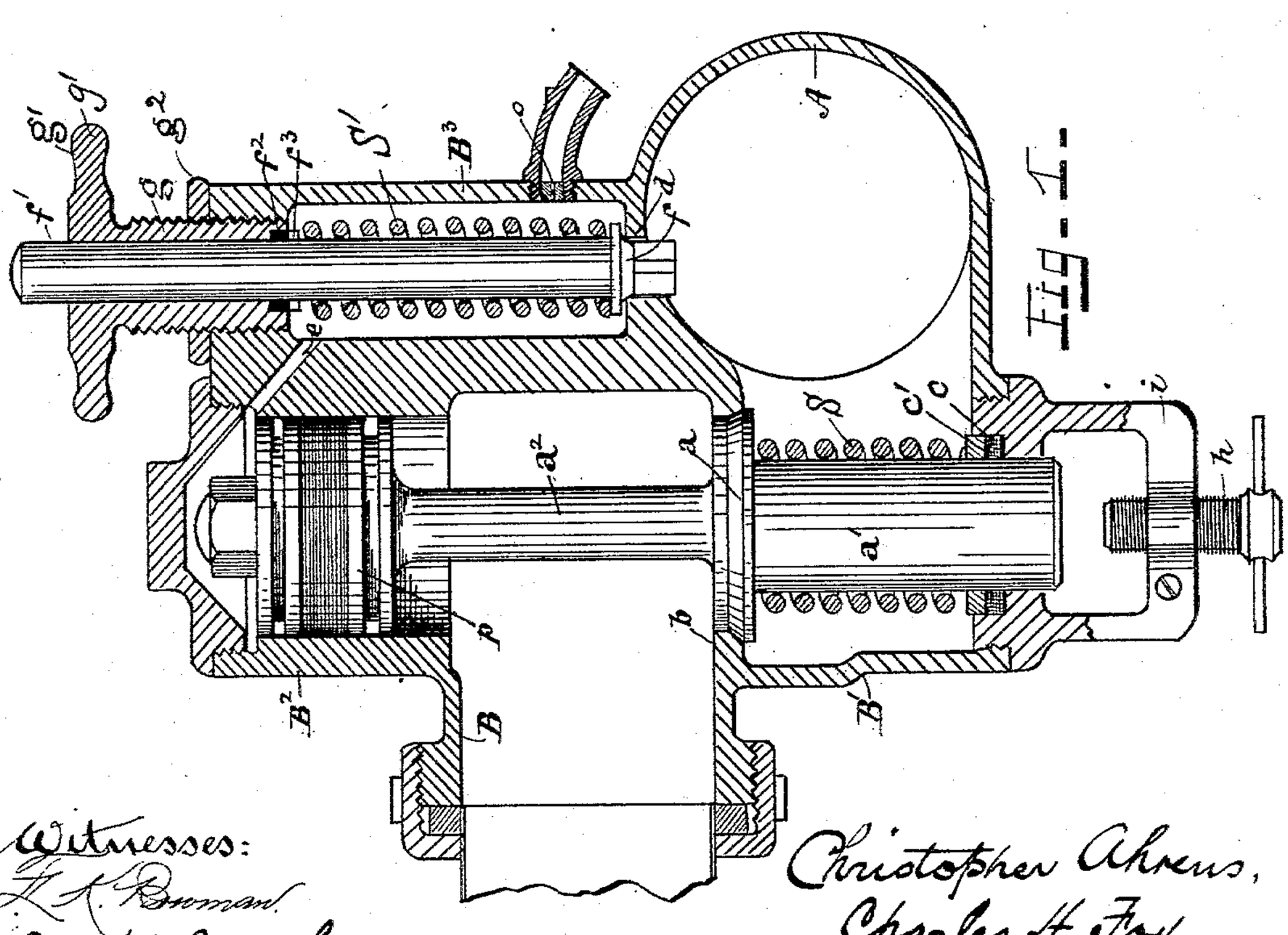
(No Model.)

C. AHRENS & C. H. FOX.

AUTOMATIC RELIEF VALVE.

No. 559,881. Patented May 12, 1896.





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UNITED STATES PATENT OFFICE.

CHRISTOPHER AHRENS AND CHARLES H. FOX, OF CINCINNATI, OHIO.

AUTOMATIC RELIEF-VALVE.

SPECIFICATION forming part of Letters Patent No. 559,881, dated May 12, 1896.

Application filed June 24, 1895. Serial No. 553,851. (No model.)

To all whom it may concern:

Be it known that we, CHRISTOPHER AHRENS and CHARLES H. FOX, citizens of the United States, residing at Cincinnati, Ohio, have invented new and useful Improvements in Automatic Relief-Valves, of which the following is a specification.

Our invention relates to relief-valves to be used in situations where a column of water is to be maintained under a limit of pressure—as, for example, in forcing water through hose, &c., liable to be burst through excess of pressure.

The object of the invention is to organize and produce a compact, simple, and effective device adapted to be attached, for example, to a fire-engine and capable of adjustment to any desired pressure and operating automatically as a safety-valve to prevent any undue pressure in the hose.

To this end our invention consists in the relief-valve construction hereinafter more fully described adapted to be applied to the discharge-main of a pump or pumps or in other situations to relieve undue pressure without loss in the normal discharge-column.

Mechanism embodying our invention is illustrated in the accompanying drawings, in which—

Figure 1 is a vertical axial section of the device in the line of vision indicated in Fig. 2, and Fig. 2 is an elevation of the device.

Referring now to the drawings, A designates a section of tubing adapted to be inserted in and constitute a part of the discharge-outlet, and B a lateral tube or passage formed as part of the same general casing, communicating, when the device is attached to a fire-engine and in operation, to the atmosphere or suction side of the pump. The tube B is attached laterally to the tube A through an intervening chamber B′, opening into both, the communication being through a perforated partition *b*, utilized as a valve-seat and controlled by a disk valve *a* seating upward. The valve *a* has an enlarged lower guide-stem *a′*, projecting through an opening in the casing B′ below, and an upper stem a^2, terminating in a piston P, operating in a vertical cylindrical extension B^2 of the casing B.

The piston P, stem a^2, valve *a*, and stem *a′* are arranged in the same axis and are preferably formed substantially as one piece of metal. The piston is furnished with the usual packing, and a stuffing-box for the stem *a′* is provided by countersinking the lower wall of the casing B′ around the aperture, in which is placed a leather or rubber gasket *c*, upon which a metal washer *c′* is superimposed, all being held in their places by a spiral spring S, surrounding the enlarged stem *a′* and bearing above against the under side of the valve *a*, the spring having the additional function of supporting the valve *a* against the weight of the parts and normally retaining the valve against its seat by its excess of pressure. The enlarged stem *a′*, besides serving as a guide to the valve in relation to its seat, has the further function of reducing the area of pressure upon the under side of the valve *a*.

The communication between the casing B′, at the under side of the valve *a*, and the tube A being free and open, the pressure in the tube A operates upon the annular under surface of the valve *a* around the stem *a′* to retain the valve *a* closed upon its seat, excepting as hereinafter described.

Adjacent to the upper extension B^2, and preferably parallel to it, is a tubular enlargement B^3 of the general casing opening below by a somewhat contracted aperture through a partition *d* into the tube A and above by a lateral passage *e* into the upper end of the cylindrical casing B^2 above the piston P. Upon the partition *d* is seated a plug-valve *f*, having a cylindrical stem *f′*, of corresponding diameter, with its seat-opening extended centrally through its sleeve *g*, threaded from above axially into the casing B^3, and embracing the cylindrical extension of the valve *f* with a close sliding fit. The lower end of the sleeve is countersunk, and contains a leather or rubber gasket f^2 and a metal ring or washer f^3, upheld by a spiral spring S′, embracing the stem *f′* and seated below upon an annular ledge of the stem, thus tending to retain the valve *f* normally seated. The tension of the spring *s′* is thus made a measure of force to retain the valve *f* seated against the upward pressure in the tube A, and may be increased

or diminished at will by rotating the sleeve g in its threads, thus compressing or relieving the spring. The upper end of the sleeve g is for this purpose provided with a handle g' and a "jam-nut" g^2 for conveniently operating the sleeve and retaining it in adjusted positions. A minute aperture o is provided through the side wall of the casing B^3, which remains constantly open to the interior space.

The general operation is as follows: The device being attached and connected as indicated, and the spring S', bearing upon the valve f, adjusted to a given pressure, so long as the pressure in the tube A remains below that retaining the valve f seated, no action of the device occurs. When, however, and so long as the pressure in the tube A exceeds the spring-pressure upon the valve f, the latter is raised from its seat, water flows upward through the casing B^3 and passage e into the casing B^2, and by pressure downward upon piston P (whose area exceeds the free area at the under side of the valve a) unseats the valve a, and thus opens communication from the tube A into and through the passage B into the suction-passage of the pump or to the atmosphere. As soon as the pressure in the tube A again diminishes to or below the given degree the valve f again seats and the water above the piston P escapes back through the passage e and out through the orifice o, thus relieving the pressure upon the piston and enabling the spring S and the liquid-pressure in tube A to seat the valve a, and it is retained seated by the pressure in the tube A until the described operation again takes place.

The superficial area of the piston P is the same as that of the opening of the valve-seat b, and it will be perceived from the described construction that as the valve-seat b and the piston-chamber open at opposite sides of the relief-passage B the piston P perfectly balances the valve a against any back pressure or vacuum in the chamber B, whereby the action of the device is entirely unaffected by either of these conditions in the relief-passage outward of the valve.

When the valve f is lifted and the pressure in the tube A is brought to bear upon the piston P downward, it exceeds the seating-pressure upon the valve a (omitting the force of the spring S from the consideration) in proportion to the difference in cross-area between the stem a' and the piston P, since the extension of the stem a' through the casing B' serves to relieve from pressure an area at the back of the valve equal to the cross-section of the stem. As the force of the spring S is practically only a counterbalance to the weight of the parts, with a slight excess, it does not materially affect the described action.

The limit of travel of the piston P (and by consequence the extent of the opening of the valve a) is regulated by an abutment-screw h, threaded through a yoke-standard i, extended beneath the casing B' across the projected axis of the stem a'. By setting up the screw the device may be made entirely inoperative when desired.

These being the principal features of the invention concerned in producing the desired functional operation, it remains to designate more particularly certain features of construction conserving efficiency of use under varied circumstances—cheapness of manufacture, durability, facility of maintenance, &c.

We prefer, therefore, to form the chambers A, B, B', B^2, and B^3 all as one entire casting, suitably cored, with full openings outward at the rear of the chamber B, bottom of chamber B', and top of chambers B^2 and B^3. The openings B' B^2 are supplied with screw-caps, constituting the upper and lower walls of the casings, respectively, by whose removal the interior parts can be inspected and adjusted or removed with facility. Thus by removing the cap at the top of chamber B^2 the packing of the piston p may be tightened. By removing the cap at the bottom of chamber B' the entire valve, stem, and piston can be removed and replaced. The upper opening of the casing B^3 is closed by the sleeve device before described, by whose removal the valve f and its stem, spring, and packing-rings can be lifted out. Either one of the internal moving parts can thus be removed or replaced without disturbing any of the pipe-joints or interfering with the general operation of the engine beyond temporarily stopping the flow of water through the tube A.

Not only is this construction simple and compact, but while in action all parts remain completely drained, excepting the chamber B', which is practically an enlargement of the tube A. The advantage in extremely cold weather is that there is no danger of freezing, inasmuch as the heat generated by pressure and friction in the tube A gives sufficient heat to all parts in immediate contact therewith and the remote parts are freely drained of water.

Incidentally the aperture o not only serves to drain the upper chambers, but also by the escape of water under pressure gives a visual indication to assist in adjusting the spring S' to any desired gage-pressure. Besides this, it allows leakage past the valve f to flow off without affecting the piston P. It will also be observed, as a further point of advantage, that there is no obstruction whatever in the waterway A, and also that no grit or sediment can interfere with the action of the parts.

We claim as our invention and desire to secure by Letters Patent of the United States—

1. In an automatic relief device of the character indicated, the combination of a transmitting-tube; a relief-passage; a valve-chamber connecting the transmitting-tube with the relief-passage; a cylindrical pocket opening from the relief-passage in the projected axis of the valve-chamber; a relief-valve seated in the wall separating the valve-chamber and

the relief-passage; a governing-piston operating the cylindrical pocket; a stem connecting the valve and piston across the relief-passage; and a cylindrical extension of said valve, approximating the diameter of its seat-opening, operating through the opposite wall of the valve-chamber, substantially as set forth.

2. In an automatic relief device of the character indicated, the combination of the transmitting main, lateral relief-valve chamber; relief-passage; cylindrical extension; and the valve constructed and operated as described; and a spring surrounding the valve-extension and upholding the valve against its seat independently but in aid of the water-pressure, substantially as set forth.

3. In automatic relief-valve apparatus of the character indicated, the combination of the relief-valve and its governing-piston, operating as set forth, the extension-plunger of the valve, and the set-screw abutment arranged at the outside of the casing to limit the movement of the relief-valve, substantially as set forth.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

CHRISTOPHER AHRENS.
CHARLES H. FOX.

Witnesses:
L. M. HOSEA,
F. K. BOWMAN.