No. 625,748. Patented May 30, 1899.

J. H. DERBY.

AUTOMATIC VALVE.

(Application filed Apr. 15, 1898.)

(No Model.) 2 Sheets—Sheet 1.

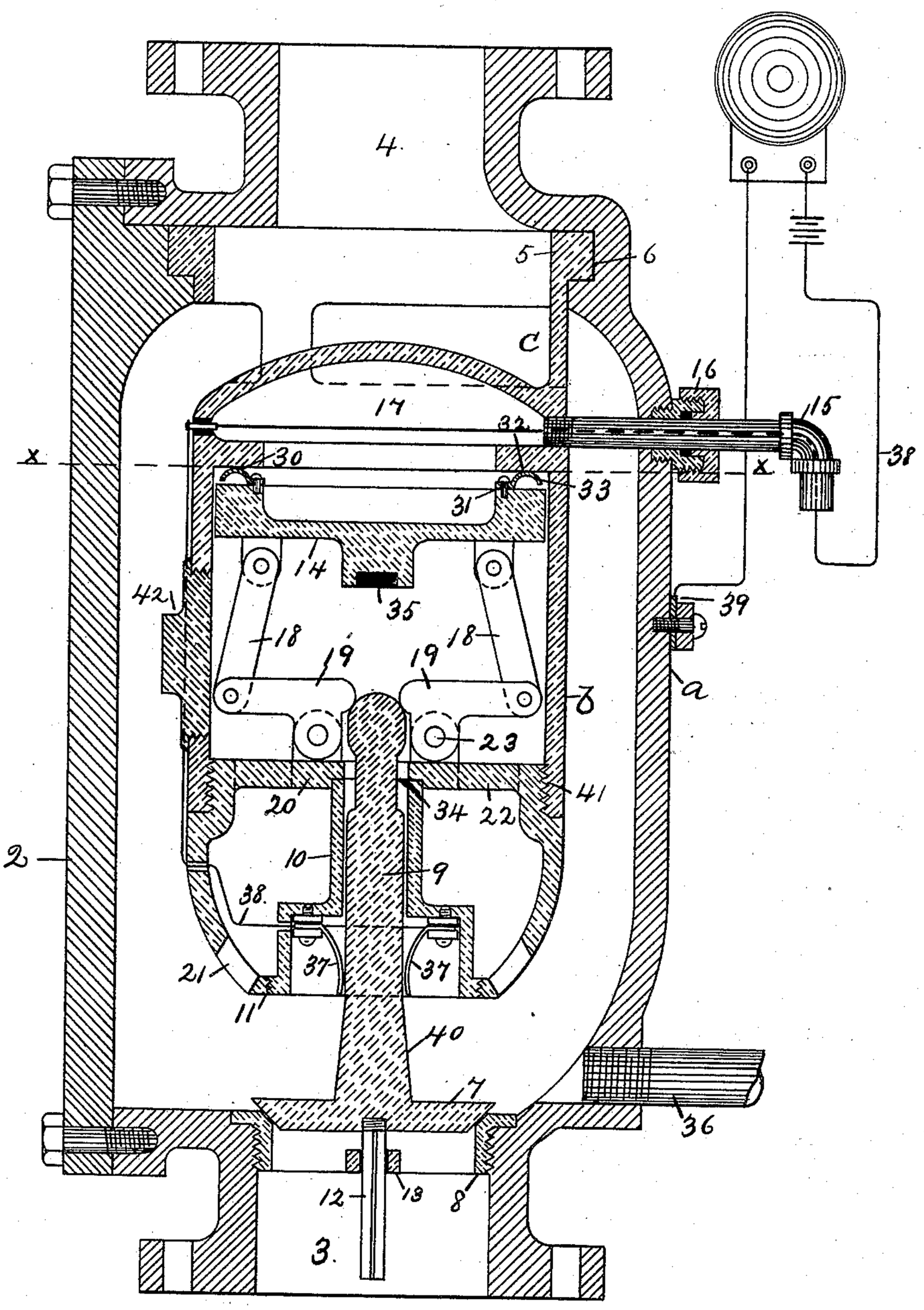

FIG. 1.

WITNESSES:

E. W. D. Hamilton.

L. M. Crosby

INVENTOR

John H. Derby,

BY

E. D. Bradwick,

ATTORNEY.

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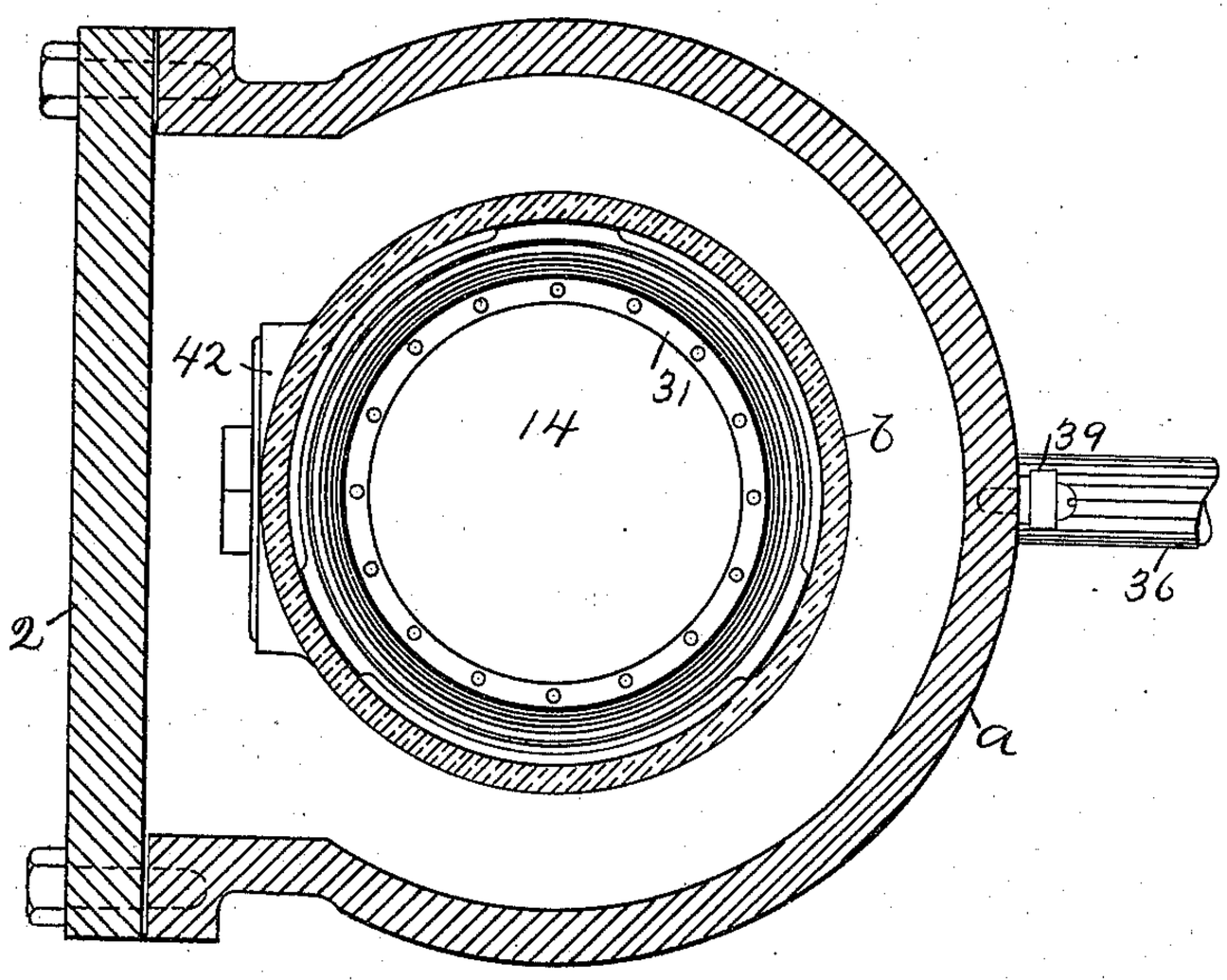

FIG. 2.

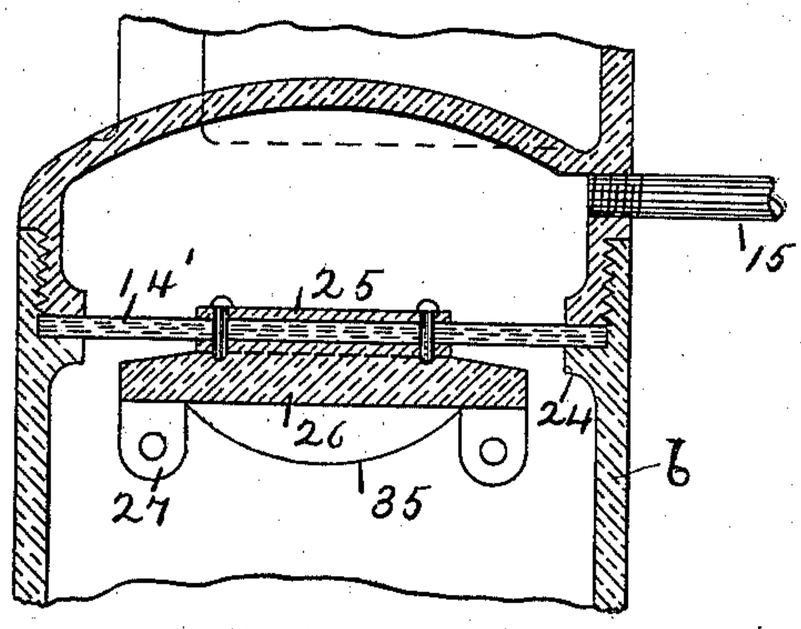

FIG. 3.

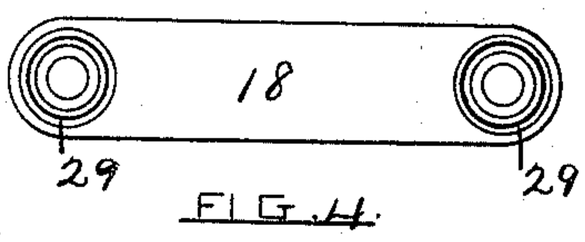

FIG. 4.

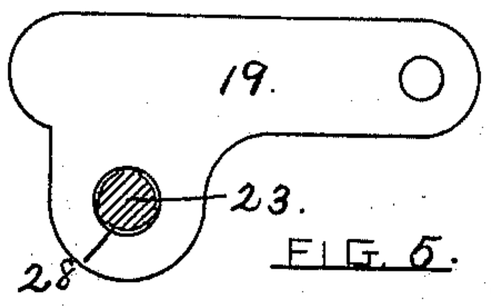

FIG. 5.

WITNESSES:

E. W. D. Hamilton.

D. H. Derby

INVENTOR

John H. Derby,

BY

E. D. Chadwick,

ATTORNEY.

UNITED STATES PATENT OFFICE.

JOHN H. DERBY, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO EVERETT D. CHADWICK, TRUSTEE, OF SAME PLACE.

AUTOMATIC VALVE.

SPECIFICATION forming part of Letters Patent No. 625,748, dated May 30, 1899.

Application filed April 15, 1898. Serial No. 677,656. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. DERBY, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Automatic Valves, of which the following is a specification.

My invention relates to automatic valves—that is to say, to valves which are designed to operate automatically as soon as the resultant pressure within or upon them reaches a predetermined amount.

My invention is shown and described herein as embodied in a "dry valve" for use in connection with automatic fire-extinguishing systems, it being more particularly intended for that purpose.

The function of a dry valve is to normally keep the water out of the system of sprinkling-pipes and to open automatically in case of fire to admit the water to said pipes. It is a common practice to keep these dry valves closed by pumping air into the system of pipes until its pressure is sufficient to hold the valve closed against the pressure of the water in the inlet-pipe, the compressed air being automatically liberated upon the occurrence of a fire and the valve being thereupon forced open by the water-pressure. Inasmuch as the pressure of the water-supply per square inch is often considerably greater than it is desirable to give to the air in the pipe system, the valve must in such a case be provided with some means whereby the effect of the air-pressure may be increased, and a main feature of my present invention relates to means whereby this result may be accomplished.

My invention in its preferred form also operates to lock the valve against closing after it has once been opened, this being desirable for reasons hereinafter set forth.

A preferred form of my invention embodying the features just referred to, together with certain others hereinafter described, is illustrated in the accompanying drawings, in which—

Figure 1 is a central vertical section of a complete valve. Fig. 2 is a cross-section on the line *x x* in Fig. 1. Fig. 3 is a detail section on the same plane as Fig. 1, showing a modification hereinafter described. Figs. 4 and 5 are enlarged side views of a connecting-link and a locking-lever hereinafter described.

So far as the automatic mechanism of my valve is concerned the valve-casing may be of any desired construction, so long as it provides for the proper operation of said mechanism. I prefer, however, to employ the casing shown in the drawings, which comprises an outer casing *a* and an inner casing *b*, the latter being suspended within the former to provide a passage between the two for the water to flow through when the valve is open. The outer casing *a* has substantially the form of a cylinder flattened on one side, said flat portion consisting of a removable cover 2, adapted to be bolted to the body of the casing, as shown, and covering an aperture of sufficient size to permit of the insertion and removal of the inner casing *b* through the same. The casing *a* has also a water-inlet 3 at one end and an outlet 4 at its other end and is flanged at both ends, so that it may be conveniently bolted to the water-supply pipe and to the system of sprinkling-pipes. The inner casing *b* is also substantially cylindrical in shape and is secured to the casing *a*, as by means of a flange 5 at its upper end, which is held within an annular groove 6 of corresponding dimensions formed in the casing *a* and cover 2 and is clamped therein by said cover when the latter is in place. The casing *b* is thus rigidly suspended within the casing *a*, but may be removed therefrom after the cover 2 has been taken off. Large apertures *c* are provided in the side walls of the casing *b* below the flange 5 for the passage of the water, and below said apertures the top of the casing is closed for a purpose which will presently appear. A removable hand-plate 42 gives access to the interior of the casing *b* when desired.

The water-inlet 3 is normally closed by a suitable valve proper, which may be a circular plate 7, seating against a valve-seat 8 and having a stem 9 extending upward into a loosely-fitting tube 10, which is secured to the casing *b*, as at 11, and acts as a guide for said stem 9. I also attach, preferably, a supple-

mentary guide to the bottom of the plate 7, which guide may consist of a triangular rod 12, screwed into the bottom of the plate 7 and arranged to slide in a circular perforation formed in a cross-bar 13, secured to the valve-seat 8. The purpose of making the rod 12 triangular and the perforation circular is to secure a "three-point-contact" guide, the corrosive action of the water being much less in such a construction than where considerable areas of the moving parts are in sliding contact with each other.

The operating mechanism for the valve proper, 7, is contained within the casing *b*, and one of its elements is a movable plate 14, which is in communication with the system of sprinkling-pipes on one of its sides only, its other side being exposed to the normal atmospheric pressure by means of a pipe 15, open at its outer end and led through a packing-box 16 into a chamber 17, provided in the casing *b* and normally closed by the plate 14. Thus when the sprinkling-pipes contain compressed air its pressure is operative upon the movable plate 14 and is transferred thence to the valve proper by means of suitable intermediate mechanism, which may consist of links 18, each pivoted at one end between a pair of ears attached to the plate 14 and at the other end to a lever 19. The levers 19 are preferably two in number and are pivoted on a cross-plate 20, which forms a part of the casing *b*, in such manner that the free end of each lever 19 will normally bear upon the end of the valve-stem 9 to hold the valve closed. The air-pressure in the system of which the casing *a* is a part is given access to the under side of the plate 14 through suitable connections with said system, such as apertures 21 and 22, (the latter being shown in dotted lines in Fig. 1,) formed in the casing *b* and in the cross-plate 20, respectively.

It will be seen that with the above construction the air-pressure in the system acts not only on the area of the valve proper itself, but also on an additional area furnished by the movable plate 14, its effect on both these areas being combined to normally hold the valve closed, thus permitting the use of a less pressure per square inch in the air system than is opposed thereto in the inlet 3. If a still further reduction of the working air-pressure is desired, the levers 19 may be so pivoted that their respective arms which bear against the valve-stem 9 shall be shorter than their arms which are pivoted to the links 18, and their effectiveness may be increased in this manner to any desired extent. In fact, the valve may be held closed wholly by means of the pressure transmitted through these levers 19 in case the valve-casing be for any reason so constructed that the valve proper is not itself subjected directly to the air-pressure in the system.

In order that a slight movement of the plate 14 may be sufficient to withdraw the levers 19 from the path of the valve-stem 9 and permit the valve to open, the pivots 23, on which said levers rock, should be offset from the longitudinal axis of said levers, as shown, it being obvious that the greater the amount of this offsetting the less the angular movement necessary to be given to the levers 19 in order to withdraw them from the valve-stem 9. By means of the arrangement just described the necessary movement of the plate 14 may be made so small that said plate may consist simply of a flexible diaphragm 14′, as illustrated in Fig. 3, secured at its edge to the casing *b* in such manner as to be air-tight, preferably by making the upper portion of the casing *b* detachable and clamping the diaphragm between it and an annular ledge 24, formed on the lower portion of said casing. The diaphragm 14′ (shown in Fig. 3) is made of a sheet of rubber of sufficient thickness to withstand the air-pressure in the system and stiffened at its center by plates 25 and 26, placed above and below it and bolted together, as shown, the lower plate 26 being provided with ears 27, to which the links 18 are pivoted. The flexible diaphragm 14′ of course need not necessarily be made of rubber, but may consist of corrugated sheet metal or any other material of sufficient strength and flexibility.

The pivots 23 are preferably channeled, as shown at 28 in Fig. 5, to provide a three-point-contact bearing for the levers 19, for the reason previously stated in regard to the valve-guide 12, and for the same reason the sides of the links 18, where they bear against the parts to which they are pivoted, are provided with knife-edges 29.

The movable plate 14 (shown in Fig. 1) resembles a piston, being fitted to slide easily within the casing *b* and seating like a valve against a seat 30 in order to close the chamber 17 air-tight. The plate 14 preferably has a three-point contact with the casing *b*, as illustrated in Fig. 2. I prefer to provide for a yielding contact between said plate and its seat 30, since otherwise a very accurate adjustment of the parts of the valve would be necessary in order to insure the contact of the valve 7 and the plate 14 with their respective seats simultaneously with the firm pressure of the levers 19 on the valve-stem 9. A rough adjustment of these parts may be provided for by making the lower part of the casing *b* separate from the upper part and screwing the former into the latter, as at 41, so that by screwing the lower part of the casing up or down the levers 19, links 18, and plate 14, which are attached to said lower part only, will be moved up or down also, and thereby adjusted with respect to the fixed valve-stem 9. The yielding contact above referred to may consist of a ring 31 of thin flexible sheet metal tightly secured at its edge to the plate 14 and curving upwardly, as at 32, to bear against the seat 30, thus forming a species of elastic packing. It will be seen that the outer or free edge 33 of the packing-ring 31 is normally

subjected on both its top and bottom to the pressure within the casing, and hence cannot be deformed in any way by said pressure.

The operation of my valve may be described as follows: Suppose the parts to be in the positions shown in Fig. 1 and the system of sprinkling-pipes, including, of course, the casing *a* and all of casing *b* below the plate 14, to be filled with air sufficiently compressed to hold the valve 7 closed against the pressure of the water in the inlet 3 in the manner above set forth. If now by reason of a fire at the remote sprinklers or from any other cause the air in the system be allowed to escape, its pressure will be quickly diminished so much that the water-pressure acting against the valve 7, and thereby transmitted through the levers 19 and links 18 to the plate 14, will draw said plate downward a sufficient distance to permit the stem 9 of the valve to pass upward between the ends of the levers 19, thus opening the valve and allowing the water to flood the system. After the valve has once been opened it is desirable that it should be positively locked open in order to prevent water-columning—*i. e.*, the accidental closing of the valve and the holding of it closed by the weight of the water column in the system of pipes after they have been filled—and I am able to accomplish this result in my valve by simply reducing the size of the valve-stem 9 for a short distance below its head, as at 34, the reduced diameter being not greater than the distance between the ends of the levers 19 when in the position shown in Fig. 1. When thus constructed, the water on passing through the valve immediately rushes into the casing *b* through the apertures 21 and 22 and forces the plate 14 upward into its normal position, in which action it is assisted by the striking of the head of the valve-stem against a buffer 35 on the plate 14, and thereby the free ends of the levers 19 are made to enter the groove 34 and engage with the under side of the head of the valve-stem 9, and thus prevent the valve from closing. The plate 14 is held firmly pressed upward by the water-pressure until it is desired to set the valve again, which is accomplished by turning off the water-supply and draining the system through a pipe 36, which also serves as a leakage-drain and should be connected with an automatic alarm-trap. When the system has been drained, the plate 14 will fall of its own weight, and thus allow the valve to close, after which compressed air is pumped into the system again and immediately raises the plate 14 to its seat and locks the valve closed.

It is sometimes desirable to cause the opening of the valve to give an alarm, and I have devised an arrangement for this purpose comprising two insulated metallic clips 37, secured to the casing *b* and connected to each other by an insulated wire 38, which is carried through the external casing *a* at any convenient point, preferably by being passed into the chamber 17 and out through the pipe 15, from all of which it is insulated. It is then connected with an electric battery and a bell-alarm, the other terminal of which is electrically connected directly to the casing *a*, as at 39. The clips 37 are normally just out of contact with the valve-stem 9, which tapers outwardly below said clips, as shown at 40, so that upon the rising of the valve as it opens the tapering portion of the stem 9 will make contact with the clips, and thus establish an electric circuit through the alarm and cause the latter to ring.

I claim as my invention—

1. In an automatic valve, a valve proper, a pressure-operated plate having a flexible seat, and one or more levers each positively connected at one end to said plate and arranged to have its other end held thereby in engagement with the valve proper to hold it closed, said levers being disconnected from said valve proper and adapted to be moved out of the path thereof when the pressure on said plate is reduced.

2. In an automatic valve, a valve proper having a stem, pivoted levers arranged to bear against said stem to hold the valve closed, said levers being disconnected from said stem and having their pivots offset, as set forth, and a pressure-operated plate provided with a flexible seat and positively connected to said levers, whereby the pressure on said plate is directly opposed to the pressure on the valve proper.

3. In an automatic valve, the combination with a valve proper of locking mechanism arranged to positively lock said valve proper against closing after it has once been opened, and means actuated by the pressure of the entering fluid for positively operating said locking mechanism.

4. In an automatic valve, a valve proper having a recessed stem, one or more locking-levers arranged to engage said stem when the valve proper is open, and a movable plate exposed to the pressure of the entering fluid and connected to said lever or levers to operate the same.

5. In an automatic valve normally containing air under pressure, the combination with a valve proper of locking mechanism arranged to hold said valve either open or closed, said mechanism being positively actuated by the air-pressure when the valve is closed and by the pressure of the entering fluid when the valve is open.

6. In an automatic valve normally containing air under pressure, in combination, a valve proper, a movable plate subject to the air-pressure in the system when said valve proper is closed and to the pressure of the entering fluid when said valve proper is open, and one or more levers connected to said plate and arranged to engage the valve proper to lock the same in either its closed or its open position.

7. In an automatic valve, a valve proper having a headed stem, locking mechanism

adapted to engage said head either above or below the same, and a pressure-operated plate arranged to actuate said locking mechanism.

8. In an automatic valve, a valve proper having a headed stem, pivoted levers arranged to bear against said head either above or below the same and having their pivots offset as set forth, and a pressure-operated plate connected to said levers to actuate the same.

9. In an automatic valve normally containing air under pressure, a casing containing the valve proper, a second casing provided with a chamber communicating with the external air, a movable plate forming one wall of said chamber and exposed to the pressure in the system, and locking mechanism for said valve actuated by said plate when under pressure.

10. In an automatic valve normally containing air under pressure, a valve proper, valve-locking mechanism, a chamber communicating with the external air, and a sliding plate exposed to the pressure in the system and connected to said locking mechanism to operate the same, said plate being provided with a flexible packing whereby it is adapted to close said chamber air-tight.

11. In an automatic valve, in combination, an outer casing provided with an inlet and an outlet, an inner casing suspended within said outer casing in such manner as to leave a free passage from said inlet to said outlet, a valve proper adapted to close said inlet and having a stem extending into the inner casing, a pressure-operated plate contained in said inner casing, and valve-locking mechanism connected to said plate.

12. In an automatic valve normally containing air under pressure, the combination of an outer casing provided with a valve proper, an inner casing suspended within said outer casing and communicating therewith, a chamber in said inner casing communicating with the external air, a movable plate closing said chamber on one side and exposed to the pressure in the casings, and valve-locking mechanism connected to said movable plate.

13. In an automatic valve normally containing air under pressure, the combination of an outer and an inner casing spaced apart as described, the outer casing being provided with an inlet and an outlet, a valve proper adapted to close said inlet and having a stem extending into the inner casing, a chamber in said inner casing communicating with the external air, a movable plate closing said chamber on one side and exposed to the pressure in the casings, and pivoted levers connected to said movable plate and adapted to normally bear against the stem of said valve proper to hold it closed.

14. In an automatic valve normally containing air under pressure, the combination of an outer and an inner casing spaced apart as described, the outer casing being provided with an inlet and an outlet, a valve proper adapted to close said inlet and having a stem extending into the inner casing, said stem having a groove or recess for the purpose set forth, levers mounted on offset pivots in said inner casing and arranged to engage said valve-stem, and a pressure-operated plate contained in said inner casing and connected to said pivoted levers to operate the same.

15. In an automatic valve normally containing air under pressure, the combination of an outer and an inner casing spaced apart as described, the outer casing being provided with an inlet and an outlet, a valve proper adapted to close said inlet and having a stem extending into the inner casing, pivoted levers mounted in said inner casing and arranged to bear against said valve-stem, a chamber in said inner casing in communication with the external air, a sliding plate connected to said pivoted levers and arranged to close said chamber, and a flexible packing located between said sliding plate and its seat.

16. In an automatic valve, an outer casing provided with an inlet and an outlet and having one of its sides removable, and an inner casing adapted to contain valve-operating mechanism and provided at its top with means whereby it may be detachably secured within said outer casing in such manner as to provide a free space between the two casings, said inner casing being removable from within said outer casing after the removable side of the latter has been taken off.

17. In a valve, an outer casing having an inlet and an outlet and provided with a valve proper, a detachable plate closing one side of said casing, said plate and casing being provided with a circumferential groove near their tops, and an inner casing provided with a flanged top adapted to fit said groove, whereby it may be rigidly suspended within said outer casing to provide a free passage between the two casings.

In testimony whereof I have hereunto subscribed my name this 12th day of April, A. D. 1898.

JOHN H. DERBY.

Witnesses:
E. D. CHADWICK,
E. B. TOMLINSON.