No. 677,072. Patented June 25, 1901.

H. A. FISKE.

ALARM VALVE.

(Application filed Apr. 24, 1899.)

(No Model.) 2 Sheets—Sheet 1.

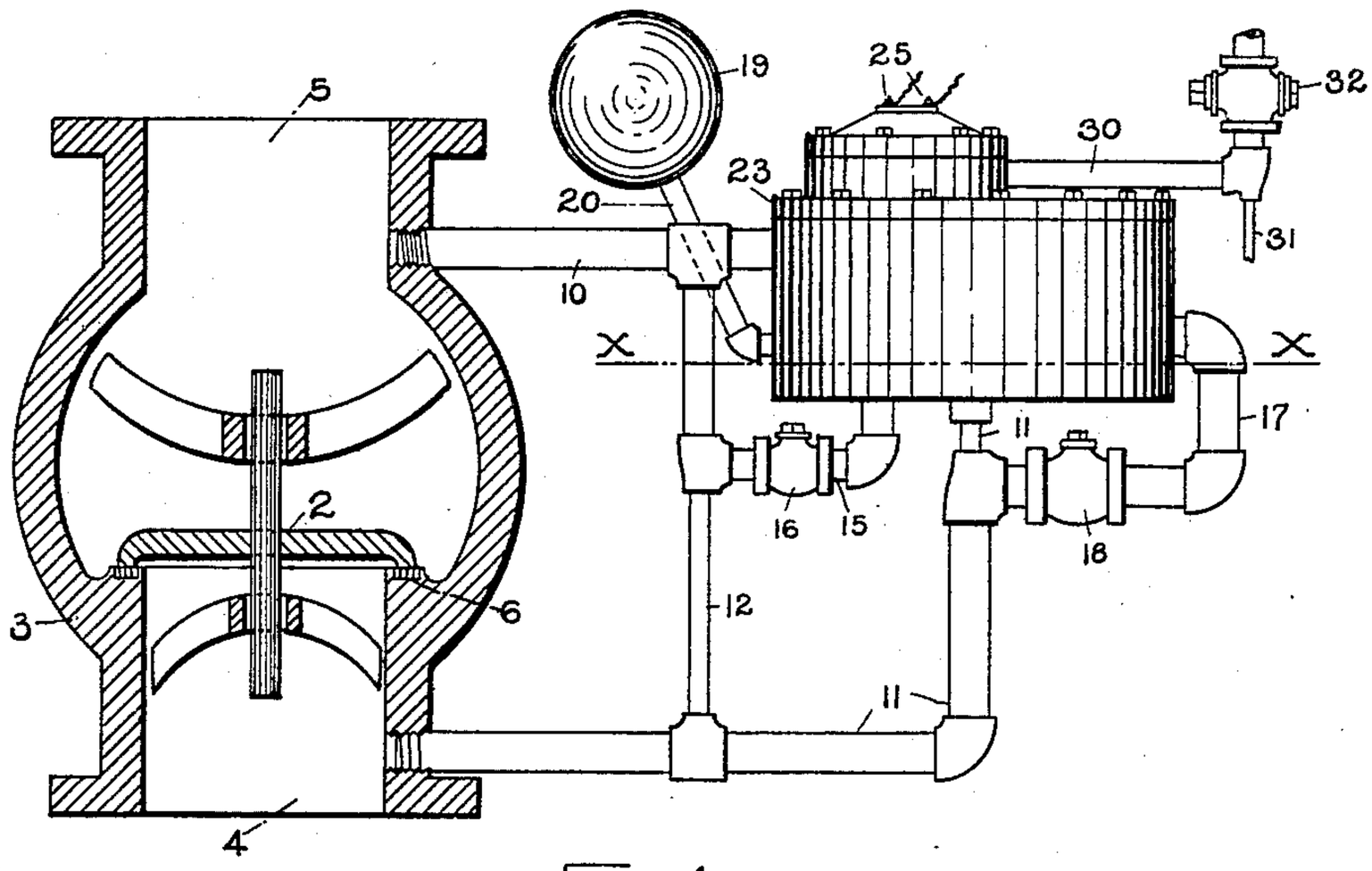

Fig. 1.

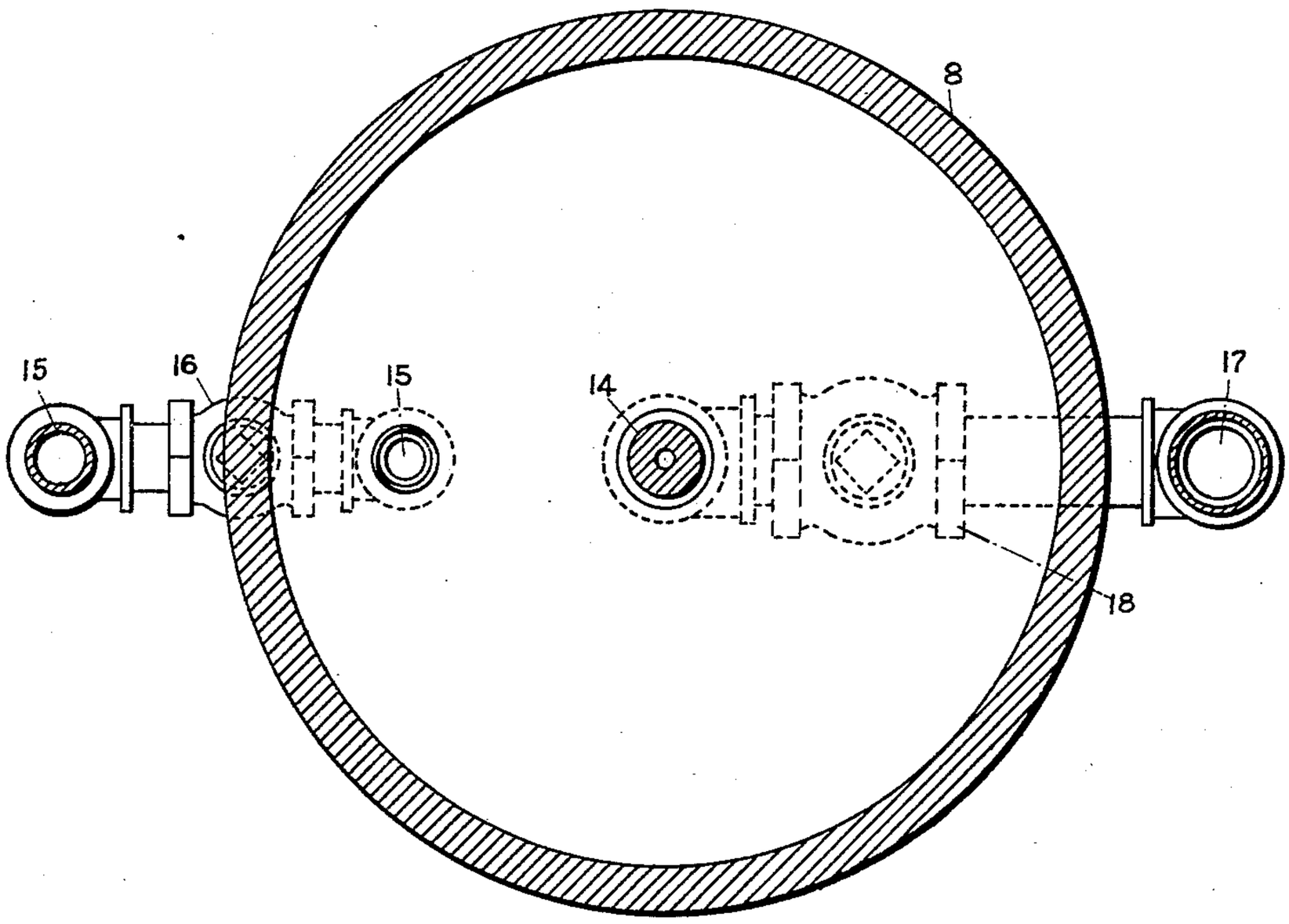

Fig. 2.

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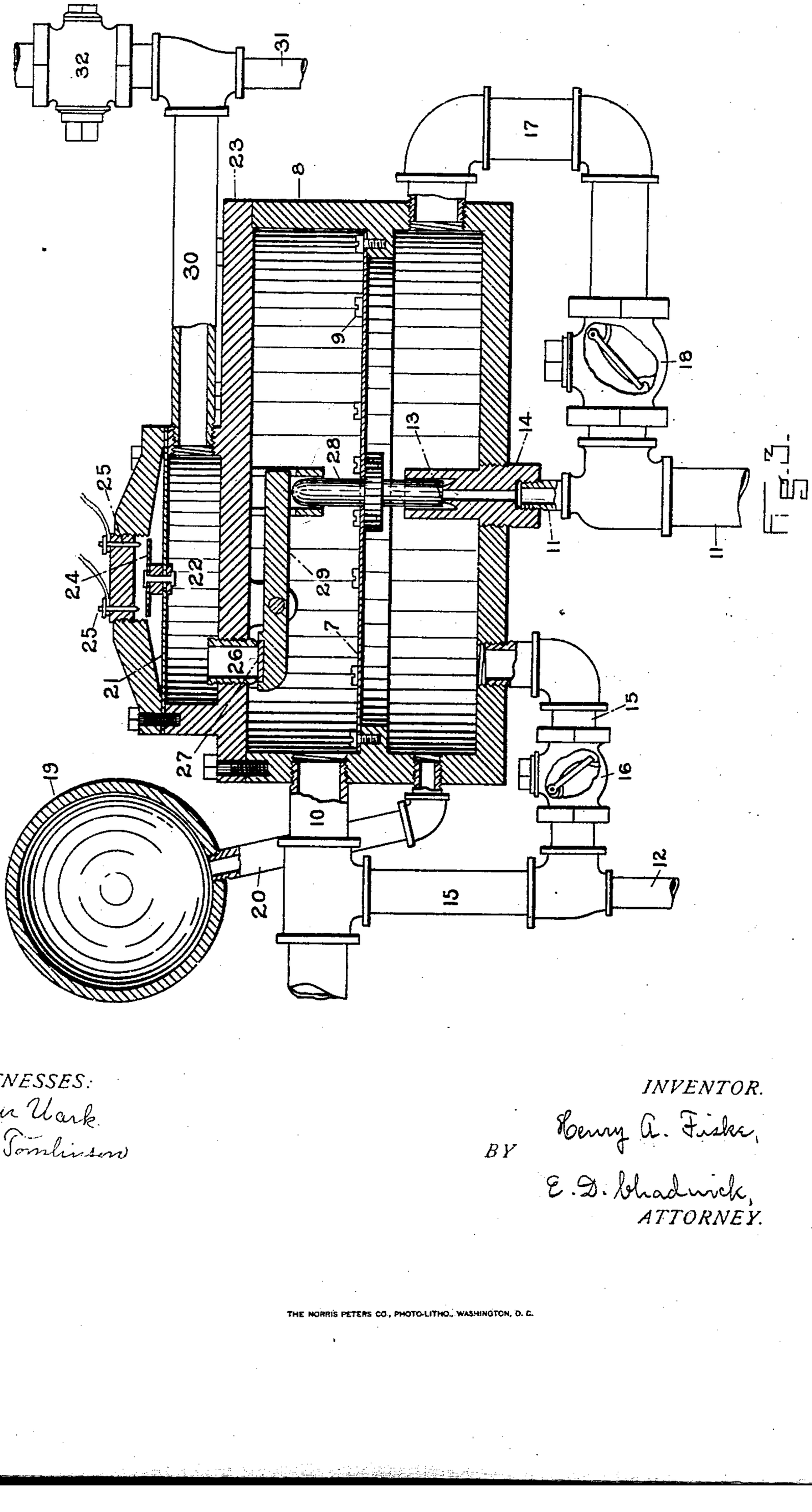

FIG. 2.

WITNESSES:
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UNITED STATES PATENT OFFICE.

HENRY A. FISKE, OF NEWTON, MASSACHUSETTS, ASSIGNOR TO THE GENERAL FIRE EXTINGUISHER COMPANY, OF NEW YORK, N. Y.

ALARM-VALVE.

SPECIFICATION forming part of Letters Patent No. 677,072, dated June 25, 1901.

Application filed April 24, 1899. Serial No. 714,205. (No model.)

To all whom it may concern:

Be it known that I, HENRY A. FISKE, a citizen of the United States, residing at Newton, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Alarm-Valves, of which the following is a specification.

My invention relates to the valves commonly used in automatic fire-extinguishing systems at the entrance to the system of sprinkling-pipes, and more particularly to those valves which are normally exposed on both sides to water under pressure as distinguished from the dry-pipe valves. Valves of the former class, so far as their regulation of the flow of water is concerned, are simply check-valves and have no other function than to cause an alarm to be given upon the occurrence of a fire and the consequent opening of a sprinkler, and hence are known as "alarm-valves." When the alarm mechanism of such valves is operated either by the valve itself as it opens or by the flow of water after it opens, as has commonly been the case hitherto, there has been found a tendency for false alarms to be given, the alarm mechanism being operated in some instances by a small but continuous leakage from the sprinkling system, but more often by an increase in the water-pressure below the valve, due to various causes, such as a water-hammer.

My present invention is intended to overcome the objections above mentioned and to provide an alarm mechanism which while sensitive to the flow of water produced by the opening of a sprinkler or by an excessive leakage from the sprinkling-pipes shall be free from all liability to be operated either by any slight leakage from the sprinkling system or by any increase of water-pressure below the valve which may occur.

A preferred form of valve embodying my invention is shown in the accompanying drawings, in which—

Figure 1 is an elevation, partly in section, of the complete device. Fig. 2 is a section, enlarged, on the line *x x* in Fig. 1; and Fig. 3 is a vertical central section of the casing shown in Fig. 2 and certain parts connected thereto.

In the apparatus shown in the drawings the valve proper, 2, is an ordinary check-valve operating in a suitable casing 3, which is adapted to be connected below the valve 2 to a supply-pipe 4 and above the valve 2 to the main delivery-pipe 5, leading to the sprinkling-pipes. It will be understood that the casing 3 and the pipes connected therewith on both sides of the valve 2 are normally filled with water under pressure. The valve 2 is preferably arranged so that its weight serves to keep it normally closed; but, if desired, it may be held to its seat by a spring or otherwise. If a fire occurs and one or more sprinklers in the system are thereby opened, it will be seen that before the valve 2 can open to supply the sprinklers the pressure on the top of the valve must be reduced by a certain amount, which in a valve having a knife-edge contact with its seat is determined by the weight of the valve or other force which in the absence of pressure would hold it to its seat, and in the case of a valve making a surface contact with its seat, as shown at 6 in the drawings, is determined by the weight of the valve plus the water-pressure above the valve acting on the area of contact between the valve and its seat, because in the latter case the pressure on such area is wholly unbalanced from below the valve. Thus before the valve 2 can open a considerable difference between the pressures above and below it must be produced, and it is such a differential pressure or a substantial reproduction thereof, whether produced by the valve, as above described, or by any equivalent device, which I employ for operating the alarm mechanism, to which end I make it operative upon a movable part distinct from the valve 2, whereby I am enabled not only to overcome the objections to prior alarm-valves hereinbefore set forth, but also to produce a more sensitive alarm mechanism, since in my device the operation of the alarm mechanism is effected through the reduction of pressure in the system and is not dependent upon the opening of the valve.

Certain other advantages obtainable from my invention will hereinafter appear.

The movable part, which is operated by the reduction of pressure in the system through the production of a differential pressure, is

preferably in the form of a diaphragm 7, contained within a drum-shaped casing 8 and secured thereto at its circumference, as by means of screws 9, thus dividing the said casing into two compartments, which are herein referred to as the "upper" and "lower" compartments, as the casing 8 is preferably so placed that the diaphragm is horizontal. The two compartments are so connected with each other and with the water-distribution system that under normal conditions the water-pressure on each side of the diaphragm is the same and is equal to the pressure in the system, the connections being such that any slight or gradual change in the pressure in the system is equalized in the compartments. When a sprinkler opens, however, there will be a rapid reduction of pressure in the system before the check-valve opens, and the connections between the two compartments are such that this reduction of pressure is not equalized, but will take place in the upper compartment more rapidly than in the lower chamber, thereby creating a differential pressure on the diaphragm, which moves said diaphragm and operates the alarm. The upper compartment is connected with the distribution system above the valve 2 by means of a pipe 10, and thus the pressure in this compartment is always the pressure in the system. Any gradual reduction of pressure in the system above the valve 2 and in the upper compartment is equalized in the lower chamber through a restricted passage, which is not, however, of sufficient size to equalize a rapid reduction of pressure above the valve 2.

In the embodiment of the invention shown the supply system below the valve 2 is connected with the distribution or sprinkler system above the valve 2 by a restricted passage or by-pass, so that under normal conditions the pressure is the same above and below the valve 2, said passage, however, being of such a size that a rapid reduction of pressure above the valve will not be equalized through said passage. In this construction also the lower compartment is connected with the system below the valve 2, so that the differential pressure produced at the valve 2 by the opening of a sprinkler is reproduced at the diaphragm 7.

The connections referred to between the compartments and system may be arranged in any desired manner, that shown being a simple and efficient arrangement. In this construction the pressures above and below the valve 2 are equalized under normal condition by means of a pipe 12 of small cross-section connecting the pipes 10 and 11 or their connections. In order to insure a similar normal equality of pressures above and below the diaphragm 7, I prefer to connect the lower compartment of the casing 8 with the pipe system above the valve 2 by means of a pipe 15, containing a check-valve 16, said check-valve operating to prevent any reduction of pressure below the diaphragm, even though a reduction occurs in the sprinkler-pipe system, and I also connect said lower compartment with the supply system below the valve 2 by means of a pipe 17, containing one or more check-valves 18, whereby a considerable reduction of pressure below the valve 2 will be quickly equalized independently of the by-pass 12, the function of the check-valve 18 thus being to keep the pressure below the diaphragm 7 as low as the supply-pressure, while preventing the transmission of pressure in the opposite direction.

For the purpose of maintaining the pressure below the diaphragm 7 during its operative movement I have shown in the drawings a pipe 11 connecting the lower compartment of the casing with the supply system below the valve 2, which pipe, if left open, will serve to keep equal the pressures in the supply system and the lower compartment of the casing independently of the pipes 12 and 15; but if said pipe 11 were to remain open at all times my alarm mechanism might be liable to be operated by a water-hammer or other sudden pressure in the supply system, and hence I prefer to make the aperture in which the pipe 11 terminates at casing 8 quite small and to keep it normally closed by valve 13, movable with the diaphragm 7, preferably by being attached thereto at or near its center, beneath which point the pipe 11 is led into the bottom of the casing through a valve-seat 14, secured thereto. Thus no sudden pressure from the supply system can be communicated to the lower compartment of the casing except by first opening the valve 13, and the exposed area of this valve is made so small that a slight force, such as the weight of said valve or the tension of the diaphragm 7, or both, will suffice to hold the valve closed against any such sudden increase of pressure which may occur, thereby making the alarm mechanism susceptible only to a reduction of pressure above the valve 2 and not to an increase of pressure below said valve. The valve 13 being normally closed, I provide means for giving the diaphragm 7 its initial movement when the pressure above it is reduced, preferably by means of a reservoir of compressed air, which may be provided in the top of the lower compartment of the casing or in a separate closed chamber 19, connected therewith by a pipe 20. The body of compressed air being always in free communication with the lower compartment of the casing, its pressure will obviously always be kept equal to the water-pressure in said compartment, and its function is simply to give an initial movement to the diaphragm 7, and thereby open the valve 13, whereupon water from the supply system will enter the lower compartment and maintain the pressure therein.

It will be apparent that when the pipes 12 and 15 or their equivalents are provided the only function of the pipe connection at the

valve 13 will be to keep the pressure constant below the diaphragm 7 after it has received its initial movement in giving an alarm, as above explained, and that said pipe connection may be rendered entirely unnecessary by making the chamber 19 so large that the compressed air within it will provide a pressure sufficiently sustained to operate the diaphragm 7 without further aid.

As an alarm mechanism to be operated by the movement of the diaphragm 7 I have shown a flexible diaphragm 21, covering a supplementary chamber 22, which may be secured to or made integral with the cover 23 of the casing 8. The diaphragm 21 carries an insulated metallic contact-piece 24, arranged to complete on the upward movement of the diaphragm an electric circuit through two conducting-terminals 25 25, properly insulated from each other, an electric bell or other alarm being included in said circuit and rung whenever contact is made with the terminals 25 25. The movement of the diaphragm 21 necessary to give an alarm is imparted by the entrance into the chamber 22 of water from the casing 8 through a pipe 26, which is normally closed by a counterbalanced valve 27, adapted to be opened by the pressure of the diaphragm 7 or a stem 28, attached thereto, against a pivoted lever 29, to which said valve 27 is attached. The valve 27 when closed is held firmly to its seat by the pressure of the water in the casing 8, and in order to insure a close contact of said valve with its seat a slight clearance should be left between the stem 28 and the lever 29, as shown in Fig. 3.

Provision may be made, if desired, for operating an additional alarm to the one above described by leading a pipe 30 from the chamber 22 to any suitable device adapted to be operated by a stream of water, such as a "water rotary," so called. In order to prevent the operation of either alarm by any slight leakage past the valve 27 which may occur, a drip 31 should be attached to the pipe 30.

It will be understood that the above-described alarm mechanisms operated by the movable plate or diaphragm 7 may be changed or modified at pleasure without affecting the remaining features of my invention.

The operation of the parts above described may be summarized as follows: The casings 3 and 8 and their pipe connections are normally full of water under pressure and at rest. The pressures on the two sides of the valve 2 and on the two sides of the diaphragm 7 are kept equal for all small variations above or below said valve by the by-pass 12, and the pressure in the upper compartment of the casing 8 must be the same as that above the valve 2 by reason of the open pipe 10. If the pressure below the valve 2 be considerably reduced from any cause, a corresponding decrease will at once occur above the valve 2 by loss through the pipe 15, lower compartment of the casing 8, and pipe 17, and the pressure in the upper compartment of the casing will simultaneously decrease by loss through the pipe 10, so that the pressure in the lower compartment of the casing 8 cannot be less than that in the upper compartment. If a sudden increase of pressure occur in the supply system below the valve 2, it cannot be transmitted through the pipes 11 and 17 to the lower compartment of the casing 8 because of the valves 13 and 18, and if transmitted through the valve 2 it will reach both compartments of the casing simultaneously through the pipes 10 and 15 and any motion which may be imparted to the valve 2 can have no effect on the alarm mechanism. If now a considerable loss of pressure above the valve 2 occurs, as by reason of the opening of one or more sprinklers by a fire, the reduction of pressure will immediately be felt in the casing 8 above the diaphragm 7, and since no reduction of pressure below the diaphragm 7 can occur (so long as the supply-pressure is maintained) on account of the check-valve 16 the diaphragm will instantly be forced upward by the differential pressure on it, thereby opening the valve 27 and causing an alarm to be given, as above described. The alarm may be shut off by closing a cock 32 in the pipe 30, whereupon as soon as the valve 27 closes the water in the chamber above it will drain off through the drip 31.

It will be seen that by properly proportioning the areas of the valve 27 and the diaphragm 7 with reference to the differential pressure obtainable at the valve 2 my alarm-operating mechanism may be made as sensitive as may be desired and in any case will give an alarm before the valve 2 opens, as above stated. The increased sensitiveness thus obtainable is especially advantageous, for the reason that most of the check-valves hitherto used as alarm-valves make a surface contact with their respective seats as distinguished from a knife-edge contact, and therefore the pressure above them must be very considerably reduced before they can open and cause an alarm to be given. A further advantage gained by my invention is found in the fact that a slight leakage through the main check-valve will have no effect on the alarm-giving mechanism, and hence it is not necessary that said check-valve shall be accurately ground or that especial care shall be used in setting it up. Furthermore, since my alarm mechanism is structurally independent of the main check-valve it can be added to old systems and can be connected to any make or type of check-valve, as will be apparent. It will also be seen that the differential pressure upon which my alarm mechanism depends for its operation might be produced by a fixed partial obstruction to the flow of water in the system; but in order to provide for a free flow of water in case of a heavy demand I prefer to make the obstruction movable, so as to per-

mit a free flow and to give it the form of an ordinary check-valve, as above set forth.

I claim as my invention—

1. In an alarm-valve, a main check-valve adapted to produce a differential pressure before opening, as described, and means operatively distinct from said check-valve and adapted to be operated by said differential pressure to give an alarm.

2. In an alarm-valve, a main check-valve, a movable part operatively distinct therefrom, means for reproducing thereat a differential pressure produced at said check-valve, and means operative with said movable part for giving an alarm.

3. The combination, with a water-distributing system, of a movable part normally subjected on both sides to the pressure in the system, and means for causing said movable part to be actuated by a reduction of pressure on one side thereof, but not by an increase of pressure on its opposite side.

4. The combination, with a water-distributing system, of a movable part, means for normally maintaining the system pressure on both sides of said movable part, and means for producing a differential pressure thereon upon a reduction of pressure in the system and for preventing such differential pressure being produced by an increase of pressure on the supply side of said movable part.

5. In an alarm-valve, a movable part adapted to operate an alarm, in combination with means for producing in the sprinkling-pipe system a differential pressure and for rendering said pressure operative upon said movable part, and means for preventing said movable part from being operated by an increase of pressure on the supply side thereof.

6. In an alarm-valve, means for obstructing the flow in the sprinkling-pipe system and thereby producing a differential pressure, in combination with a movable plate or diaphragm on which said differential pressure is adapted to operate to give an alarm, and means for preventing said movable part from being operated by an increase of pressure on the supply side thereof.

7. In an alarm-valve, the combination of a casing distinct from the main-pipe system, a plate or diaphragm movable therein and adapted to operate an alarm, means for obstructing the flow in said system and thereby producing a differential pressure, and means for rendering said differential pressure operative on said plate or diaphragm, and means for preventing said movable part from being operated by an increase of pressure on the supply side thereof.

8. In an alarm-valve, a main check-valve, a casing containing a movable plate or diaphragm, pipe connections between the sprinkling system and said casing on one side of said diaphragm, and between the supply system and the casing on the other side of said diaphragm, and means adapted to be operated by said diaphragm to give an alarm.

9. In an alarm-valve, a main check-valve a casing containing a diaphragm, two pipes connecting the sprinkling system with said casing above and below said diaphragm respectively, the latter pipe containing a check-valve, two pipes connecting the supply system with said casing below said diaphragm, one of said pipes containing a check-valve and the other being normally closed by a valve movable with said diaphragm, a chamber containing compressed air connected with said casing below the diaphragm, and means operated by said diaphragm for giving an alarm.

10. In an alarm-valve, a water-alarm mechanism, a pipe leading thereto from the sprinkler system and normally closed by a valve, and means for opening said valve comprising a movable plate or diaphragm normally subject on both its sides to the pressure in the system and a main check-valve adapted to produce a differential pressure on said plate or diaphragm.

In testimony whereof I have hereunto subscribed my name this 18th day of April, 1899.

HENRY A. FISKE.

Witnesses:

E. D. CHADWICK,

ALEX. P. BROWN.