(No Model.) 2 Sheets—Sheet 1.

W. HARKNESS.

FIRE EXTINGUISHER.

No. 544,894. Patented Aug. 20, 1895.

FIG. 2

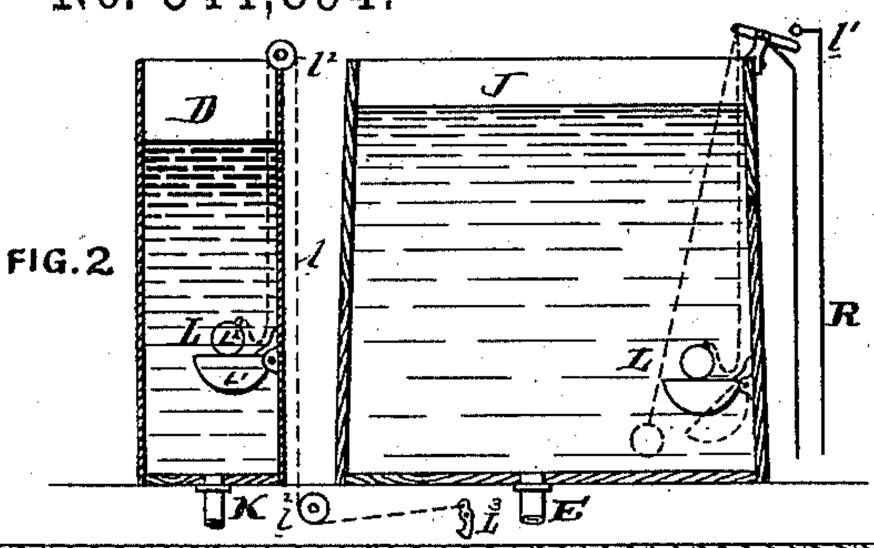

FIG. 1

Attest:
Henry Drury
Geo. H. Sonnebarn.

Inventor:
William Harkness
By Jos. R. Bennett
atty

(No Model.)

2 Sheets—Sheet 2.

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FIRE EXTINGUISHER.

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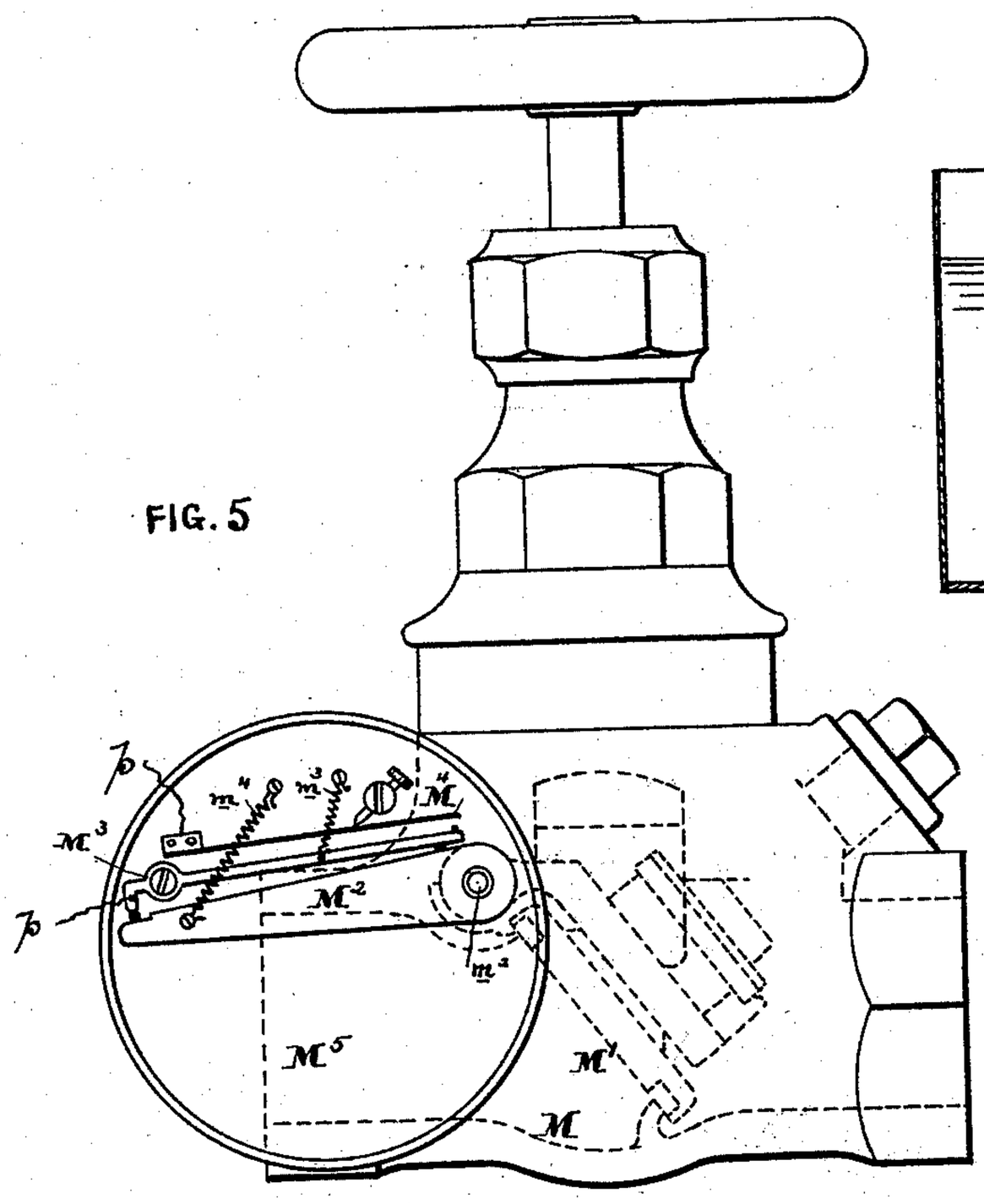
FIG. 5



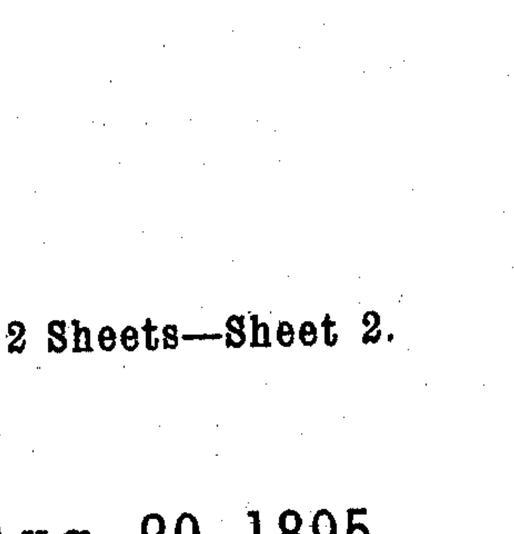


FIG. 7

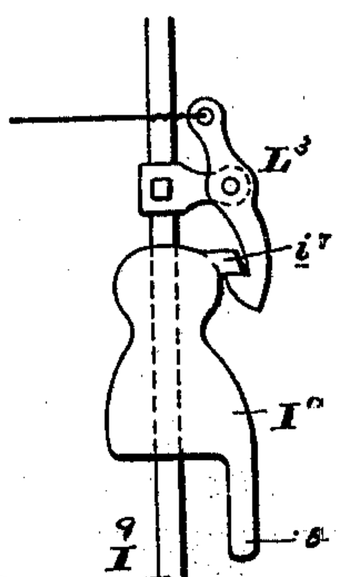
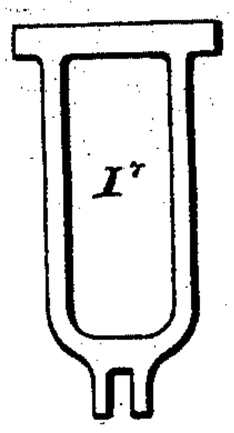


FIG. 6



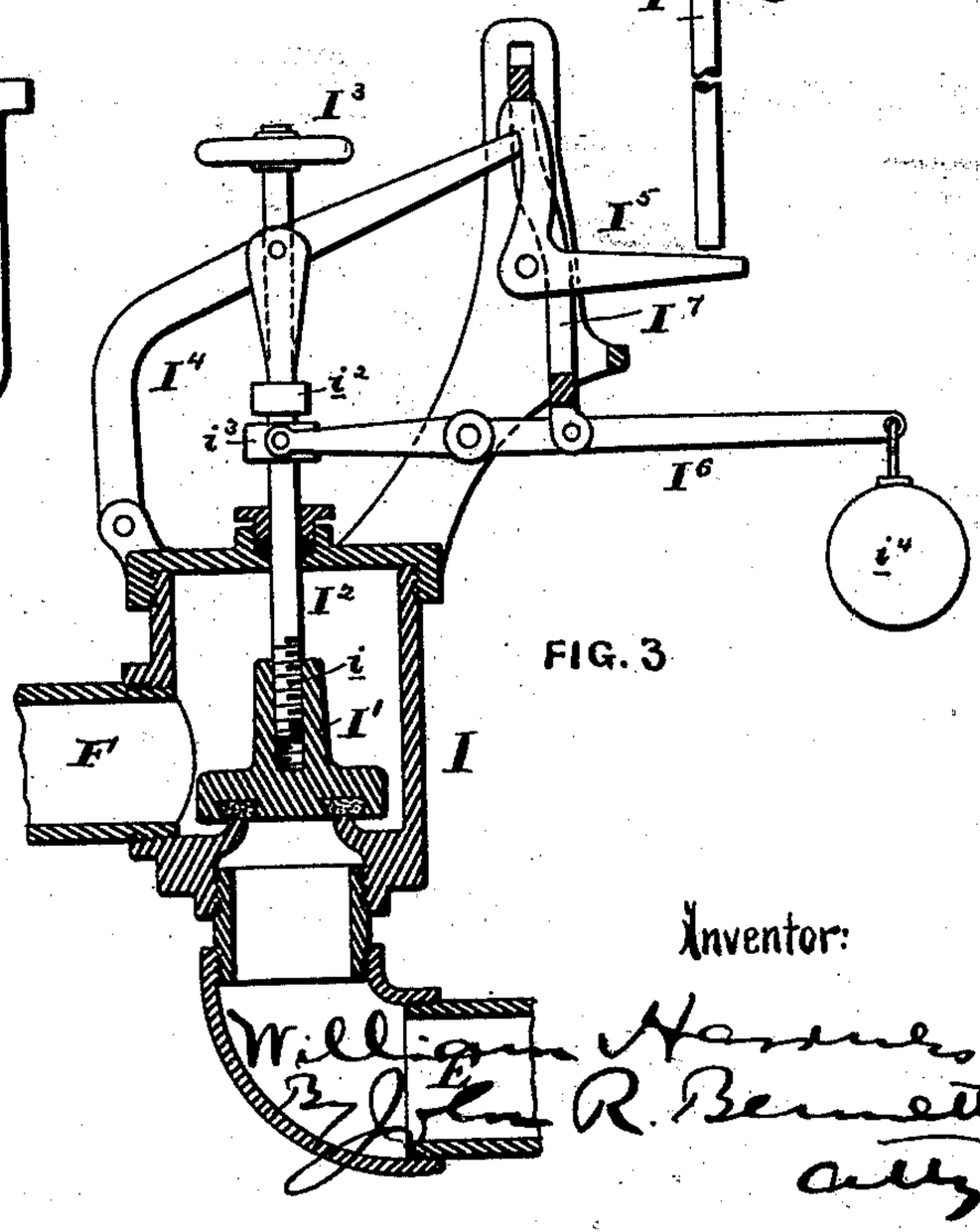


FIG. 3

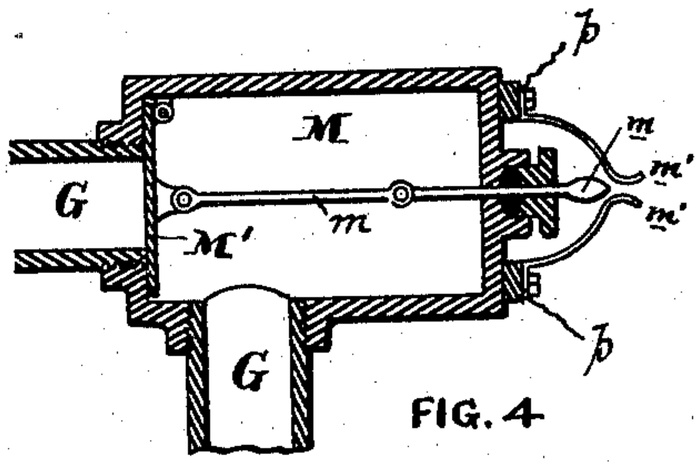


FIG. 4

Attest:
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UNITED STATES PATENT OFFICE.

WILLIAM HARKNESS, OF NEW YORK, N. Y., ASSIGNOR TO THE GENERAL FIRE EXTINGUISHER COMPANY, OF NEW YORK.

FIRE-EXTINGUISHER.

SPECIFICATION forming part of Letters Patent No. 544,894, dated August 20, 1895.

Application filed August 13, 1888. Serial No. 282,544. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM HARKNESS, of the city, county, and State of New York, have invented certain Improvements in Automatic Fire-Extinguishers, which are fully set forth in the following specification and shown in the accompanying drawings, which form part thereof.

This invention relates to that class of extinguishing apparatus which acts automatically or which is set in operation by the heat of the fire.

Heretofore in wet-pipe systems buildings have been equipped with automatic sprinklers, the pipes of which have been filled with water. In systems of this kind difficulties have arisen, such as the freezing of the water in the pipes and the consequent rendering of the equipment inoperative. Efforts have also been made to use what is known as the "dry-pipe" systems, the pipes of which are charged with compressed air to prevent the opening of the main valve at the tank. Compressed air cannot be held for a lengthy period by a metal as porous as iron with any certainty, and the vibration of the building is liable to crack or loosen the joints of the system of pipes, causing the air to gradually escape and remove the pressure necessary to its operativeness. This kind of equipment is complicated, expensive, and difficult to keep in an operative condition. It is necessary to frequently use the air-pump, and the system requires much care and labor.

To overcome the difficulties above specified it is necessary to use a liquid which will not freeze and not injure fabrics or metals more than water. A liquid of this character is described in Letters Patent No. 182,508, dated September 19, 1876, and No. 199,950, dated February 5, 1878.

In carrying out my invention I cause the pipes making up the system to normally stand full of a non-freezing and preferably fire-extinguishing liquid, as above referred to, and whereby when a fire takes place the sprinkler-nozzles in the vicinity of the conflagration discharge the non-freezing and fire-extinguishing liquid upon the flames, and as soon as a given quantity has been discharged the water is automatically turned on to the system of pipes and then discharges through the open nozzles in place of the non-freezing liquid. I also provide a system of automatic electric signals to indicate in which location or portion of a building the fire is taking place, and also a signal to indicate when the water in the elevated tank, when a tank is used, forming the source of water-supply has reached a certain point below which it is not desirable to have the water go. These several features and the apparatus for putting the same into effect will be more particularly specified in referring to the accompanying drawings, in which—

Figure 1 is a perspective view of a building equipped with my improved non-freezing wet-pipe system. Fig. 2 is a sectional elevation of the tanks for the non-freezing liquid and the water and their connections. Fig. 3 is a sectional elevation of the main valve for turning on the supply of water. Figs. 4 and 5 show forms of electric circuit-closing valves for indicating the flow of the liquid in the pipes and locating the fire. Fig. 6 is an elevation of the yoke of the automatic valve, and Fig. 7 shows a modified arrangement of float and ball for use in tanks D and J.

My invention is intended to combine with the system of stationary pipes and automatic sprinklers the non-freezing fire-extinguishing liquid above referred to, and with this object in view I make use of a tank D in an elevated position, which is filled with the said non-freezing fire-extinguishing liquid, to which tank the systems of pipes are connected, and I also provide a water-supply to follow the non-freezing fire-extinguishing liquid through the system of pipes where the discharge takes place. For this said water-supply a tank or reservoir J in an elevated position is also provided, and from the bottom or lower part of this tank a pipe E, separate from that connecting the tank D and the cistern, is connected, in which a valve I of novel construction is placed; but I do not limit myself to the arrangement of these tanks or reservoirs shown and described, but the location or arrangement of these tanks with relation to each other may be varied without departing from my invention so long as the non-freezing fire-extinguishing liquid is caused to

flow first, to be followed by water. The construction of this valve is shown in Fig. 3, and will be explained in detail hereinafter. It is automatic in its action, causing the opening of the water-pipe upon the discharge of the non-freezing liquid, so that said water may follow the non-freezing liquid in its passage to the sprinkler-nozzles H; but of course I do not limit myself to this particular valve, since a valve of any other construction that will bring about the desired result can be employed without departing from the spirit of my invention, the main pipe E, connected with the line-pipe F, extending through the building from floor to floor and from which the mains G lead off and enter each room or compartment to be protected. From these mains G branch pipes *g* lead off upon the ceilings of the various rooms or compartments, and one or more automatic sprinkler-nozzles H are connected with each of said branch pipes, as shown in Fig. 1.

The tank D for the non-freezing liquid is located in an elevated position and preferably beside the water-tank J on the roof or tower, and connects with the main E on the discharge side of the valve I by a pipe K, and may have a valve *k* to shut off the supply when necessary for repairs or otherwise. This tank D, I should prefer to be five or more feet high and two to three feet in diameter. It is provided with an automatic trip L, actuated by the liquid-level becoming low, and consists of a hinged float L′, arranged to fall but not to rise above a given position. Upon this float is supported a metal ball L^2, to which is connected a chain or cord *l*, extending up over and around pulleys l^2 to a catch L^3, which controls the valve I in the manner now to be explained.

The valve I for automatically turning on the water is constructed substantially as shown in Fig. 3, in which I have the vertically-movable valve I′ closing down upon its seat against the pressure of the water. This valve is carried by and is adjustable upon the end of a valve-stem I^2 by means of a screw-thread *i*. The upper part of this stem is provided with a collar i^2 and a hand-wheel I^3. Hinged or otherwise loosely secured to the valve-chest is a locking-lever I^4, which presses down upon the collar i^2 and holds the valve tightly upon its seat. The free end of this arm or lever is held down by a bell-crank lever I^5. The hand-wheel and valve-stem may be turned to force the valve down upon the seat and make a perfectly liquid-tight joint. It is evident that if the bell-crank lever be thrown back the lever or arm I^4 will be released and the pressure of the water will force the valve up and escape from pipe E into the pipe F and thence into the other mains. To automatically move this lever I^5, I provide a falling weight I^8, guided down upon the lever by a rod I^9, and in falling it strikes the lever, and through the concussion due to the impact forces the lever I^5 back, releasing the valve. Normally this weight I^8 is held up by a catch L^3, which catches under a lug i^7 on the weight. This catch is operated by the automatic device L in the tank D, above referred to. As an additional precaution I provide a second lever I^6, which is connected to the loose collar i^3, encircling the valve-stem and resting against the under side of the collar i^2 on the said valve-stem. The other end of this lever is weighted, as at i^4, and is also connected to a yoke L^7, which extends over the top of the bell-crank lever i^5 and holds said lever in a raised position. The weight I^8 is also provided with a downwardly-extending projection, which, when the weight falls, strikes the lever I^6 just after the lever I^5 has been struck and liberated the yoke. The object of this is to force up the valve-stem and its valve by a positive movement and thus avoid relying solely on the pressure of the water. It is evident that the form of automatic valve here shown is only one type of what might be used, and hence I do not limit myself to the details thereof; but, as before stated, any valve or other device which will hold the water separate from the non-freezing liquid and designed to operate automatically by the discharge of the non-freezing liquid, so that the non-freezing liquid shall flow first, to be followed by the water, may be employed in carrying out my invention without departing therefrom.

It is to be understood that the arrangement of tanks or reservoirs for holding the water and the non-freezing fire-extinguisher liquid and the pipes, mains, or conduits containing the fire-extinguisher liquid and water may vary in different buildings, ahd I have shown a practical and operative system, including the arrangement of tanks shown, the vertical main, horizontal main or conduits, branch pipes to the automatic sprinklers, and automatically-operating devices, for the purposes desired. These automatic valves or sprinklers may be of any desired construction, and I refer to my Patent No. 323,578, granted August 4, 1885, and also to my Patent No. 356,874, granted February 1, 1887, or to the one set forth in my application for Letters Patent of even date herewith as types of this mechanism.

From the devices thus far set forth it will be seen that if any one of the automatic valves or sprinklers H open in consequence of excessive heat the liquid in the mains or conduits K E G and branch pipes *g* will be discharged from the opened sprinkler, and, the liquid falling upon and around the fire, acts to extinguish the flame both by direct contact therewith and by the gases and fumes thus evolved by the contact of the liquid with the fire. The supply of the non-freezing fire-extinguishing liquid will usually be somewhat limited, and to guard against a lack of fire-extinguishing liquid I combine with the devices before described means of supplying water in two places. This is done

by connecting to the lower part of the system of pipes a second supply-pipe N, that extends through the wall of the building to the street, so that a hose from a fire-engine can be screwed upon the end of the pipe and water forced into and through the system of pipes and discharged through the opened sprinklers which have been released by the heat of the fire. It is necessary to introduce a check-valve *n* into the pipe N, which extends to the street to prevent the loss of the said fire-extinguishing liquid and to allow free ingress of water from the fire-hose attached to same, when desired. I also provide a valve O in the mains G for each floor of the building, by which the further discharge of water or liquid can be stopped when the fire has been extinguished. For the purpose of making repairs, such as require the pipes to be free from liquid, a drip-pipe G′ is placed in the main pipe G of each floor, which pipe is also provided with a valve *g′*. The said pipe G′ receives the drain from the branch pipes *g* and main G after the valve O of the same has been closed. This drip-pipe discharges into a receiving-tank G^2 to prevent any waste of the non-freezing liquid. This receiving-tank can be placed at any desirable place.

It is also important in case of fire to sound an alarm automatically. To accomplish this object I make use of a galvanic battery P, placed in any convenient locality, preferably the office of the building, and circuit wires *p* from the same to electromagnetic gongs *q*, located where desired, both in and outside of the building. The said circuit-wires *p* lead to an automatic circuit-closer on each pipe G. This circuit-closer may be of any desired character. It may be as sectionally shown in Fig. 4, in which there is a disk or flap M′ attached to a circuit-closing rod *m*, which disk or flap lays or hangs across the end of the supply-pipe, so that it will remain in a vertical position until deflected by a rush of the non-freezing fire-extinguishing liquid through the pipe in consequence of the opening of one or more of the automatic sprinklers H. The moving of this disk or flap presses the head of the circuit-closing rod *m* between the circuit-springs *m′*, which closes the electric circuit *p* and causes the gongs to be sounded. Another method may be used, as shown in Fig. 5, in which a swing-check combination-valve may be employed. The usual wire holding the swing disk or valve M in position may be taken out and replaced by an arbor or rod M^2, which shall extend through a packing-box on the casing or body M of the valve, and on the end of this rod is placed a box M^5, made of hard rubber or other materials, and in the said box is placed a circuit-closer, which consists of one or more levers M^2 M^3, so arranged that any movement of the disk M′ of the valve will close the electric circuit *p*, and cause the gong *q* to ring. The circuit-closer shown in this construction is the spring M^4, which makes contact with the lever M^3 through the agency of the spring m^3 as soon as the lever or arm M^2 is depressed and so as to release the lever M^3. A spring m^4 may be used to normally hold the arm or lever M^2 up and valve M′ shut. These circuit-closing valves may be made in conjunction with valves O, if so desired, and as indicated the circuits *p* terminate at said valves. The mains are used as return-circuits, though it is evident that wire-circuits might be used wholly, if so desired, and any other like means placed in a pipe and operated by the movement of the liquid, substantially as described, may be employed. I also provide an annunciator Q, which can be placed in the office or any other desirable place, and I place one of the above-described circuit-closers in the main pipes G, which supply the system of pipes on each floor and provide wires for connecting the annunciator to each of the circuit-closers. By these devices I am enabled to register in the office or other desired place the location of the fire, and the watchman or other person in waiting is enabled to shut off the flow of the liquid as soon as the fire is extinguished, preventing further waste or damage by the liquid or water. I prefer in all cases to place a valve O in the main pipe G of each floor for the purpose of controlling the flow of the liquid in case of fire or accident in one floor independently of the other floors. The various floors are marked A, B, and C.

The operation is as follows: Where a fire occurs and the heat has become sufficient to unseal the sprinkler above, the non-freezing liquid, which normally fills the pipes, will be scattered over the fire and extinguish it. When the liquid has been drawn from the smaller elevated tank or reservoir D down to or below the hinged float L′ placed on the inside the ball L^2, which rests on this float, will roll off and when the chain *l*, to which it is attached becomes taut the sudden stop of the ball will throw out the latch L^3 of the valve I to which the other end of the chain is fastened and let the weight I^8 fall, opening the valve I and allowing the flow of water from the larger elevated tank J to pass through pipe E and into the pipe F, leading into the system of pipes G *g*. When the sprinkler is released by the heat of the fire and the flow of the liquid commences, the inside and outside gongs will sound and the annunciator will register the location of the fire. By this system I am enabled to avail of the most rapid and efficient means for extinguishing a fire in its incipient stages and to continue the supply of water after the non-freezing fire-extinguishing liquid has been exhausted. There is no risk of the apparatus getting out of order or becoming injured by the action of frost, because the aforesaid fire-extinguishing liquid does not freeze, and besides it is ten times as efficacious as water, and all materials with which it or its gases comes in con-

tact are rendered incombustible, and the fire being extinguished reignition is impossible.

It is necessary in a fire-extinguishing apparatus in which a non-freezing fire-extinguishing liquid is used in the system of pipes that provision should be made for expansion and contraction of the liquid under changes of temperature. By my improvement, in which an elevated tank D is used for the non-freezing fire-extinguishing liquid, ample space is allowed for expansion and contraction, and a sufficient provision is made for the loss by evaporation. The water from tank J does not flow until the non-freezing liquid has passed below a certain point, which in the device shown and described is the float, which is located near the bottom of the tank D.

Another great advantage of an apparatus thus constructed and embodying my invention is that if an accident happens to the system the valve on the floor where the accident has occurred can be closed before the valve holding the water in the water-tank D will be opened, thus preventing any dilution of the non-freezing liquid. When the low-water level is reached in the tank J, it may be indicated by an electrical gong or bell R′ in the circuit R, including a battery *r* and circuit-closer *l′* at the tank, which is closed by a float-and-ball device L, such as described as located in tank D. (See Fig. 2.) In place of the automatically-actuated switch *l′* shown in the right-hand part of Fig. 2, I may employ that shown in Fig. 7, in which the float-lever L′ is made to rise and fall with the liquid in the tank J, and in shifting is made to operate a circuit-closer *l′* to send a current over the circuit R to sound the alarm.

The particular construction or location of the circuit-closers or electric-current-controlling devices is immaterial and might be at each nozzle, if so desired; but it is evident that as in the construction shown only one circuit-controller to each floor or compartment is necessary such construction is far more preferable. It is also evident that in place of open circuits ordinary closed circuits may be used, the alarms being given upon opening the circuit.

It is evident that so far as the invention, broadly considered, is concerned the non-freezing liquid might be replaced by any fire-extinguishing liquid, even water itself, and it is also evident that it is not essential that the valve I shall be automatic or that the various details shall be followed out, though I prefer them substantially as described.

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

1. In an automatic fire extinguishing system, the combination of a liquid supply pipe, branch pipes for conveying the liquid into different rooms of the building, said pipes having automatic fire extinguisher nozzles or sprinklers, a tank for containing a non-freezing liquid, a source of water supply, said tank and said water supply being connected with the supply pipe by independent connections, a movable gate or valve located in the branch pipe in one of the rooms, and arranged to normally obstruct the flow of liquid therethrough, an electric circuit closer actuated by said valve, an alarm bell or signal located in a different room, and an electric circuit including the alarm and circuit closer; substantially as described.

2. In an automatic fire extinguishing system, the combination of a liquid supply pipe, branch pipes running into the several rooms, said pipes having automatic fire extinguisher nozzles or sprinklers, a tank for containing a non-freezing liquid, a source of water supply, said tank and water supply having separate connections with the supply pipe, movable gates or valves located in the pipes within the different rooms, and arranged to normally obstruct the flow of liquid therethrough, an electric circuit closer or switch in each room actuated by the corresponding valve in the pipe in that room, an alarm bell or signal located in a different room, and an electric circuit including the alarm and the several circuit closers; substantially as described.

3. In an automatic fire extinguishing system, the combination of a liquid supply pipe, branch pipes for conveying the liquid into different rooms of the building, said pipes having automatic fire extinguisher nozzles or sprinklers, a tank for containing a non-freezing liquid, a source of water supply, said tank and water supply having separate connections with the liquid supply pipe, movable gates or valves located in the branch pipes within the several rooms, and arranged to normally obstruct the flow of liquid therethrough, an electric circuit closer or switch in each room operated by the corresponding valve in the pipe in that room, an alarm bell or signal and an annunciator in a separate room, and an electric circuit including the alarm, the annunciator, and the several circuit closers; substantially as described.

4. In an automatic fire extinguishing system, the combination of a liquid supply pipe, branch pipes running into the several rooms, said pipes having automatic fire extinguisher nozzles or sprinklers, a tank for containing a non-freezing liquid, a source of water supply, said tank and source of water supply having independent connections with the supply pipe, movable valves or gates located in the branch pipes in the different rooms, and arranged to normally obstruct the flow of liquid therethrough, an electric circuit closer or switch in each room actuated by the corresponding valve in the pipe in that room, an alarm bell or signal, and an annunciator located in a different room, a separate alarm bell or signal located outside the building, and an electric circuit including the alarms, the annunciator and the several circuit closers; substantially as described.

5. In an automatic fire-extinguishing sys-

tem, the combination of a system of pipes for conveying and distributing liquids throughout the building, said pipes being provided with automatic fire-extinguisher nozzles or sprinklers, a source of non-freezing liquid supply, a pipe connecting said source with the system of pipes, a source of water supply connected by a separate pipe with said system of distributing pipes, an automatic valve in said water-pipe normally shutting off the water, an automatic device controlled by the discharge of non-freezing liquid to open said water-pipe valve, movable valves or gates located in the distributing pipes within the several rooms and normally obstructing the flow of liquid therethrough, an electric circuit closer or switch in each room actuated by the corresponding valve in that room, an alarm bell or signal located in a different room, and an electric circuit including the alarm and the several circuit closers; substantially as described.

6. In an automatic fire-extinguishing system, the combination of a system of pipes for conveying liquids throughout the building, said pipes being provided with automatic fire extinguisher nozzles or sprinklers, an elevated reservoir containing a non-freezing liquid, a pipe connecting said reservoir with the conveying pipes whereby the latter are kept normally full of non-freezing liquid, an elevated reservoir of water, connected by a separate pipe with the conveying pipes, an automatic valve in said water pipe normally shutting off the water, an automatic device controlled by the discharge of the non-freezing liquid from its reservoir to open said water pipe valve whereby the water shall follow the non-freezing liquid through the conveying pipes, movable valves or gates located in said pipes within the several rooms and normally obstructing the flow of liquid therethrough, an electric circuit closer or switch in each room actuated by the corresponding valve in that room, and an alarm bell or signal and an electric annunciator in a separate room; substantially as described.

7. In an automatic fire-extinguishing system, the combination of pipes for conveying and distributing liquids throughout the building, said pipes having automatic fire-extinguisher nozzles or sprinklers, an elevated reservoir containing non-freezing liquid, an elevated reservoir containing water, said reservoirs having separate connection with the distributing pipes, an automatic valve in the water pipe normally shutting off the water, an automatic device actuated by the discharge of the non-freezing liquid from its reservoir to open the water pipe valve and allow the water to follow the flow of the non-freezing liquid through the distributing pipes, movable valves or gates in said pipes in the several rooms and normally obstructing the liquid flow therethrough, an electric circuit closer or switch in each room actuated by the valve in that room, an electric signal, and an electric indicator in a separate room, and a second electric signal outside the building, and independent electric circuits connecting said circuit closers or switches with said two alarms and the indicator.

8. The combination of the water tank, the non-freezing liquid tank, said tanks being connected to the system of distributing pipes, the valve I′, its stem I^2, a collar on said stem, a lever I^4 pivoted at one end and adapted to engage said collar, a pivoted bell-crank latch lever I^5 engaging the opposite end of the lever I^4 and holding it down upon the collar on the valve stem, an automatic trip for the latch lever, and connections between said trip and a float in the non-freezing liquid tank; substantially as described.

9. The combination of the water tank, the non-freezing liquid tank, said tanks being connected to the system of distributing pipes, the valve I′, its stem I^2, a collar on said stem, a lever I^4 pivoted at one end and adapted to engage said collar, a pivoted bell-crank latch lever I^5 engaging the opposite end of the lever I^4 and holding it down upon the collar on the valve stem, a supplemental, pivoted, weighted, lever I^6, a yoke I^7 connected to said lever and engaging the latch arm of the bell crank lever I^5 to hold it in engagement with the lever I^4, an automatic trip, and connections between said trip and a float in the non-freezing liquid tank; substantially as described.

WILLIAM HARKNESS.

Witnesses:
GEO. H. SONNEBORN,
E. GATTERER.