(No Model.)

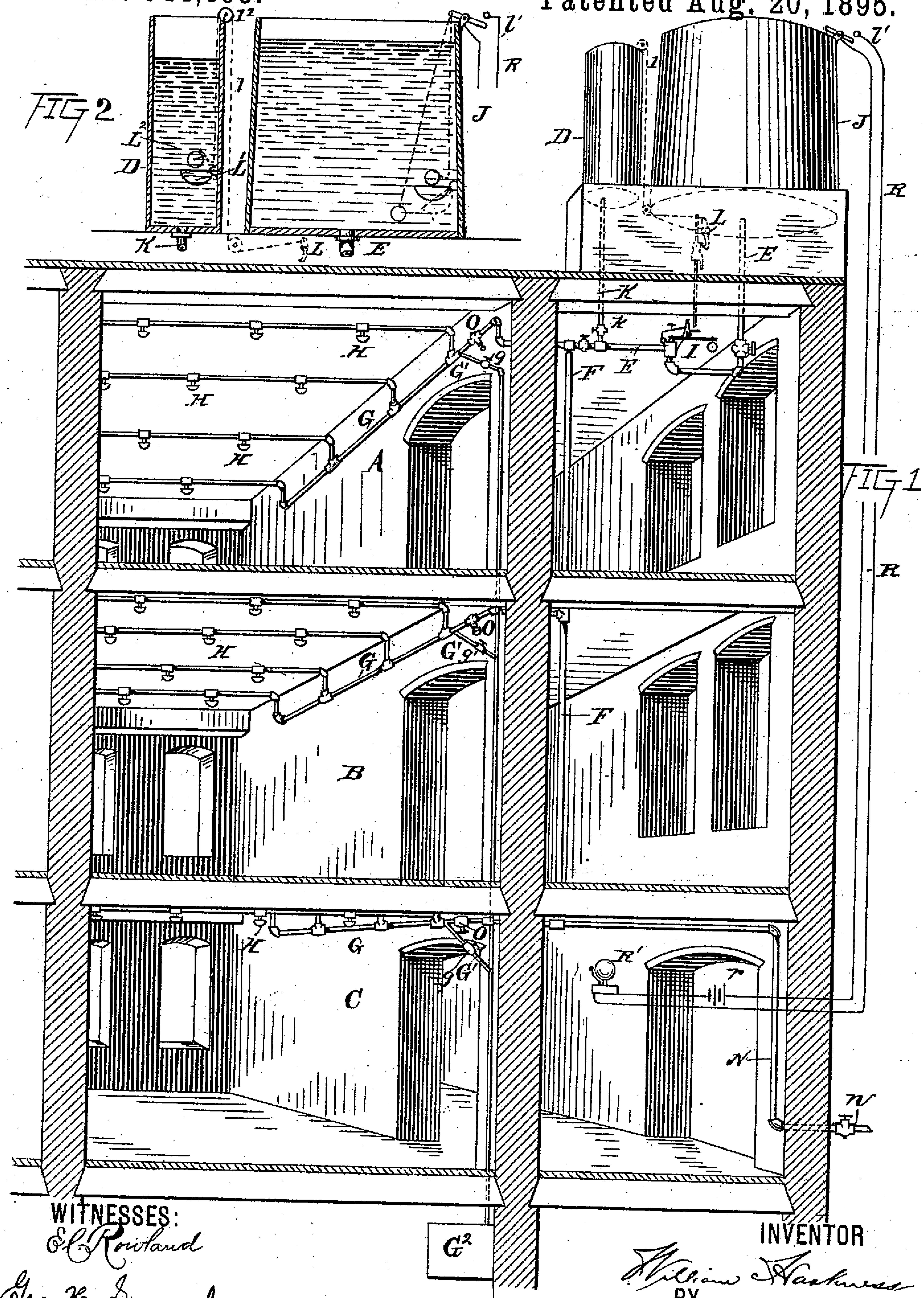
2 Sheets—Sheet 1.

W. HARKNESS.

AUTOMATIC FIRE EXTINGUISHER.

No. 544,895.

Patented Aug. 20, 1895.



WITNESSES:

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INVENTOR

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(No Model.) 2 Sheets—Sheet 2.

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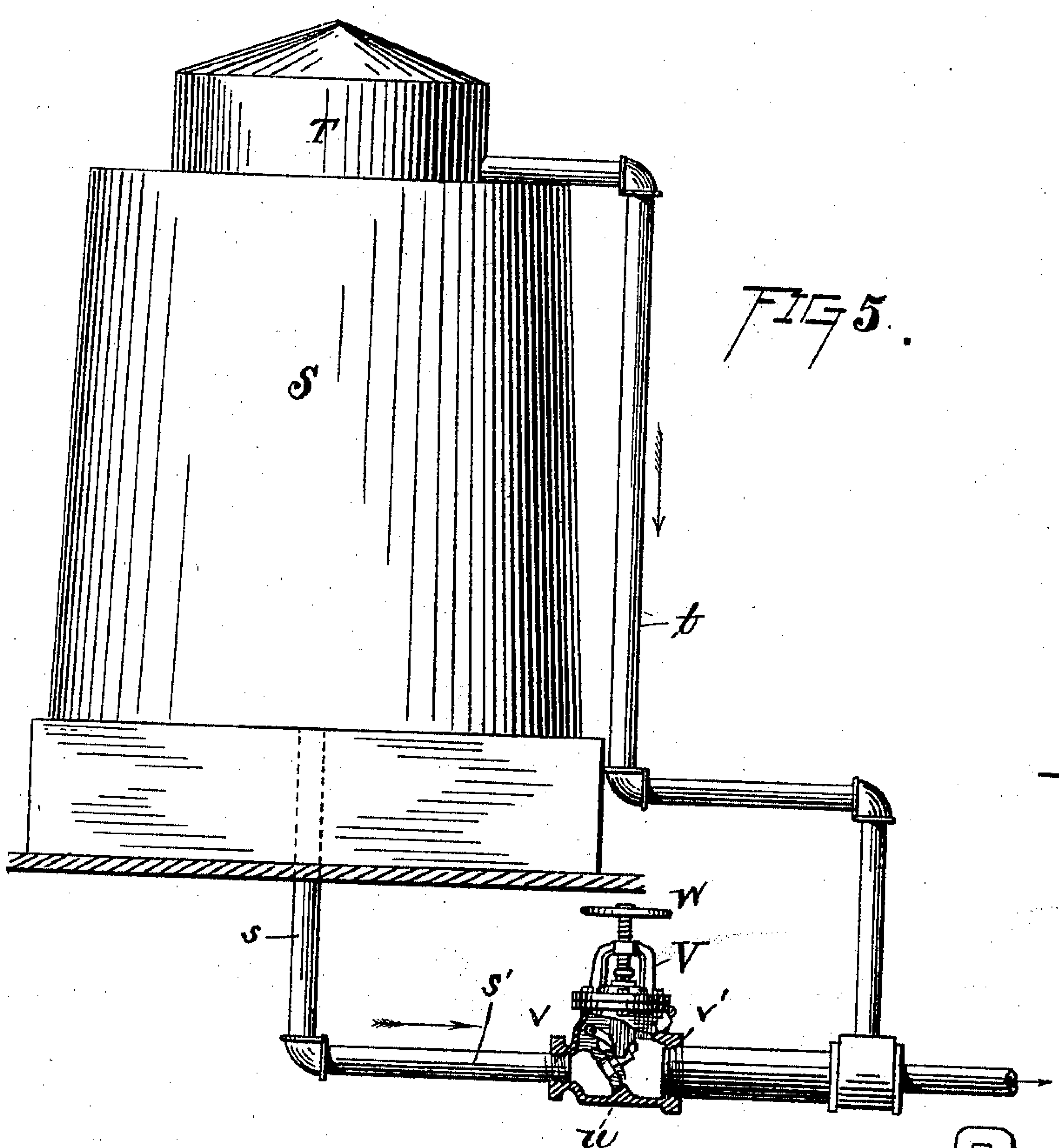

FIG. 5.

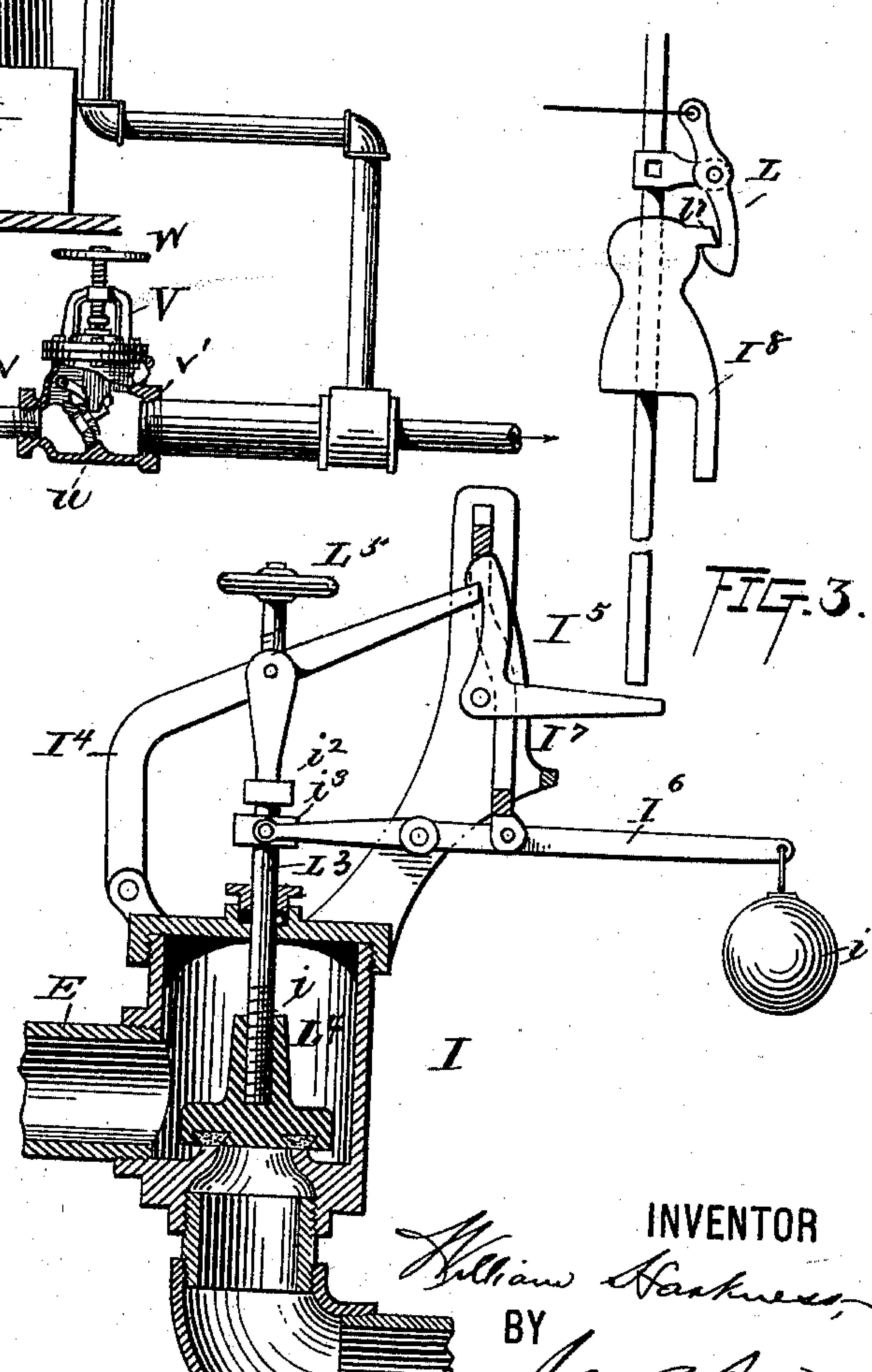

FIG. 3.

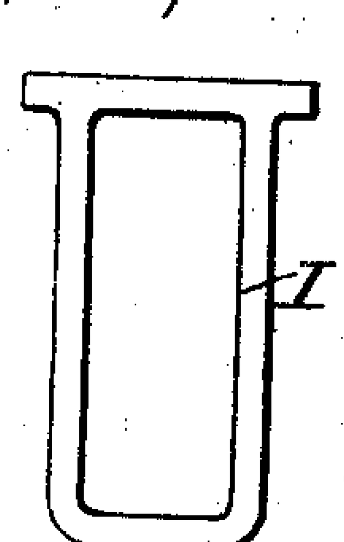

FIG. 4.

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AUTOMATIC FIRE-EXTINGUISHER.

SPECIFICATION forming part of Letters Patent No. 544,895, dated August 20, 1895.

Application filed April 21, 1890. Serial No. 348,837. (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 new and useful 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 fire-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 gradually to 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 frequently to 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, of September 19, 1876, and No. 199,950, of February 5, 1878.

In carrying out my invention I cause the pipes making up the system normally to 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. These several features and an 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 one arrangement of the tanks or reservoirs for the non-freezing liquid and the water. Fig. 3 is a sectional elevation of the main valve for turning on the supply of water. Fig. 4 is an elevation of the yoke of the automatic valve; and Fig. 5 is an elevation of a modified arrangement of tanks for the water and non-freezing liquid, and also a modification of automatic valve for holding the liquids separate.

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 system of pipes is 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 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 the valve I 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 connects 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 lead off upon the ceilings of the various rooms or compartments, and one or more automatic sprinkler-nozzles 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 F and to 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. 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, 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 we have the vertically-movable valve L^4 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 L^3 by means of a screw-thread i. The upper part of this stem is provided with a collar i^2 and a hand-wheel L^5. Hinged or otherwise loosely secured to the valve-check 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-cranked lever I^5. The hand-wheel and valve 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 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, which catches under a lug l^7 on the weight. This catch is operated by the automatic device 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 I^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^7 just after the lever I^5 has been struck and liberates 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, and I have shown a modified form of valve in Fig. 5. The automatic valves or sprinklers to be used with my system may be of any desired construction, and I refer to my patents, No. 323,578, granted August 4, 1885; No. 356,874, granted February 1, 1887, and No. 417,025, granted December 10, 1889, as types of this mechanism.

From the device thus far set forth it will be seen that if any one of the automatic valves or sprinklers H opens, in consequence of excessive heat, the liquid in the mains or conduits K F 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 flames 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 this 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 pipe 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. 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 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'.

In a fire-extinguishing system embodying my invention there is no risk of the apparatus getting out of order or becoming injured by the action of frost, because the fire-extinguishing liquid does not freeze, and I am also able to continue the supply of water after the non-freezing fire-extinguishing liquid has become exhausted; and, besides, it is many times as efficacious as water, and all materials with which it or its gases come in contact 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 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 J will be opened, thus preventing any dilution of the non-freezing liquid; and when the low-water level in the tank J is reached it may be indicated by an electric gong or bell operated by any suitable low-water device, or as shown in Fig. 1, wherein when the low-water level is reached in the tank J it is indicated by the 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 such as described as located in tank D.

In Fig. 5 is shown another arrangement of tanks or reservoirs for holding the non-freezing fire-extinguishing liquid and the water and an automatically-operated valve, which I now preferably employ in the place of the valve I, hereinbefore described. S is a tank or reservoir containing water, which is connected with the system of pipes by the pipe s. T is a tank or reservoir for containing non-freezing fire-extinguishing liquid and is connected with the system of pipes by the pipe t. This tank is, as shown, placed in an elevated position and rests upon the tank S and remains normally full, as does also the system of pipes connected therewith, with the non-freezing fire-extinguishing liquid, which is of much greater specific gravity than water. In the pipe s', which connects the pipes s and t together, is placed a valve V, which I term a "differential valve," and which normally keeps the water and the non-freezing fire-extinguishing liquid separate, but is operated automatically by the discharge of the non-freezing fire-extinguishing liquid in the manner I will now explain. The valve V has one side or opening v smaller than the other side or opening v', the smaller side being connected with the water-supply, and the larger side or opening being connected with the supply of non-freezing fire-extinguishing liquid, and there is a hinged flap w between the openings v v', which normally rests on its seat against the pressure of the water-supply, held there by the greater pressure of the non-freezing fire-extinguishing liquid, which, besides being of much greater specific gravity than water, comes from a source located at an elevated position, and the pressure thereof on one side of the flap w through the larger opening v' of the valve V is greater than the pressure of the water on the other side of the flap w, through the smaller opening v, thereby holding the flap w to its seat and keeping the water and the non-freezing fire-extinguishing liquid separate until the non-freezing fire-extinguishing liquid has reached such a low level in the tank T as reduces the pressure on the flap w to such an extent as to be overbalanced by the water-pressure on the flap, which will now open, permitting the water to flow therethrough, following the non-freezing fire-extinguishing liquid into the system of pipes, as hereinbefore explained. As also shown in the drawings, the valve V has a hand-wheel W, by which it may be screwed down so as to shut off the supply of water, if desired, for repairs or otherwise, and there may be separate valves separately operated for shutting off at any time the flow of water or non-freezing fire-extinguishing liquid, when desired, for any cause.

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 various details shall be followed out, though I prefer them substantially as described, since in practice they comprise an efficient fire-extinguishing system.

What I claim as my invention is—

1. In an automatic fire extinguishing system, the combination of a system of pipes for conveying liquids through the building, said pipes being provided with automatic fire extinguishing sprinklers or valves, a source of non-freezing liquid supply, a pipe connecting said source with said system of pipes, a source of water supply connecting by a separate pipe with said system of conveying pipes, an automatic valve in said water pipe to normally shut off the water, and an automatic device controlled by the discharge of non-freezing liquid to open said water pipe valve, whereby the water shall follow the non-freezing liquid through the system of conveying and distributing pipes.

2. In an automatic fire extinguishing system, the combination of a system of pipes for conveying and distributing liquids through the building, said pipes being provided with automatic fire extinguisher sprinklers or valves, an elevated tank, or reservoir containing a non-freezing liquid, a pipe connecting said tank with said system of distributing pipes whereby the latter are kept normally full of the non-freezing liquid, an elevated tank or reservoir of water connecting by a separate pipe with said system of conveying or distributing pipes, an automatic valve in said water pipe to normally shut off the water, and mechanism substantially as described, controlled by the discharge of the non-freezing liquid, to open said water pipe valve, whereby the water shall follow the non-freezing liquid through the system of distributing pipes.

3. In an automatic fire extinguishing system, the combination of a main for conveying liquids to distributing pipes through the building, said distributing pipes being provided with automatic fire extinguisher sprinklers or valves, an elevated tank or reservoir containing a non-freezing liquid, an elevated tank or reservoir containing water, said tanks being connected to a branch of the main by separate supply pipes, and a valve in the branch between the said supply pipes, whereby the non-freezing liquid and water are kept separated.

4. In an automatic fire extinguishing system, the combination of a main for conveying liquids to distributing pipes through the building, said distributing pipes being provided with automatic fire extinguisher sprinklers or valves, an elevated tank or reservoir containing a non-freezing liquid, an elevated tank or reservoir containing water, said tank being connected to a branch of the main by separate pipes, an automatic valve in the branch between said pipes, whereby the non-freezing liquid and water are kept separated, and an automatic trip device, actuated by the flow of the non-freezing liquid from its tank to open the automatic valve in the water pipe, to enable the water to follow the non-freezing liquid through the distributing pipes and sprinklers.

5. In an automatic fire-extinguishing system, the combination of a series of pipes for conveying liquids through a building, said pipes being provided with automatic fire-extinguishing sprinklers or valves, a source of non-freezing liquid supply, a pipe connecting said source with the series of conveying pipes, a source of water supply connecting by a separate pipe with said system of conveying pipes, an automatic valve in said water pipe to normally shut off the water, and an automatic device adapted to be actuated by the discharge of non-freezing liquid to open said water valve, said water valve after being actuated being independent of the discharge of non-freezing liquid, whereby the water will follow the non-freezing liquid through the system of pipes with a velocity due to the head of water, and without liability of being interfered with by back-flow into the conduit for non-freezing liquid; substantially as described.

6. In an automatic fire-extinguishing system, the combination of a system of pipes for conveying and distributing liquids through a building, said pipes being provided with automatic fire-extinguishing sprinklers or valves, an elevated tank or reservoir containing a non-freezing liquid, a pipe connecting said tank with the system of conveying and distributing pipes, whereby the latter are kept normally full of the non-freezing liquid, an elevated tank or reservoir of water connecting by a separate pipe with said system of pipes, a normally locked valve which when released is adapted to be opened by the pressure of water from the water tank, and a trip actuated by the discharge of the non-freezing liquid for releasing said valve, said valve after its release being entirely independent of the supply of liquid in the tank originally containing the non-freezing liquid; substantially as described.

This specification signed and witnessed this 4th day of April, 1890.

WILLIAM HARKNESS.

In presence of—
GEO. H. SONNEBORN,
A. W. KIDDLE.