A. M. GRANGER.

AUTOMATIC SPRINKLER SYSTEM.

APPLICATION FILED SEPT. 28, 1907.

994,255.

Patented June 6, 1911.

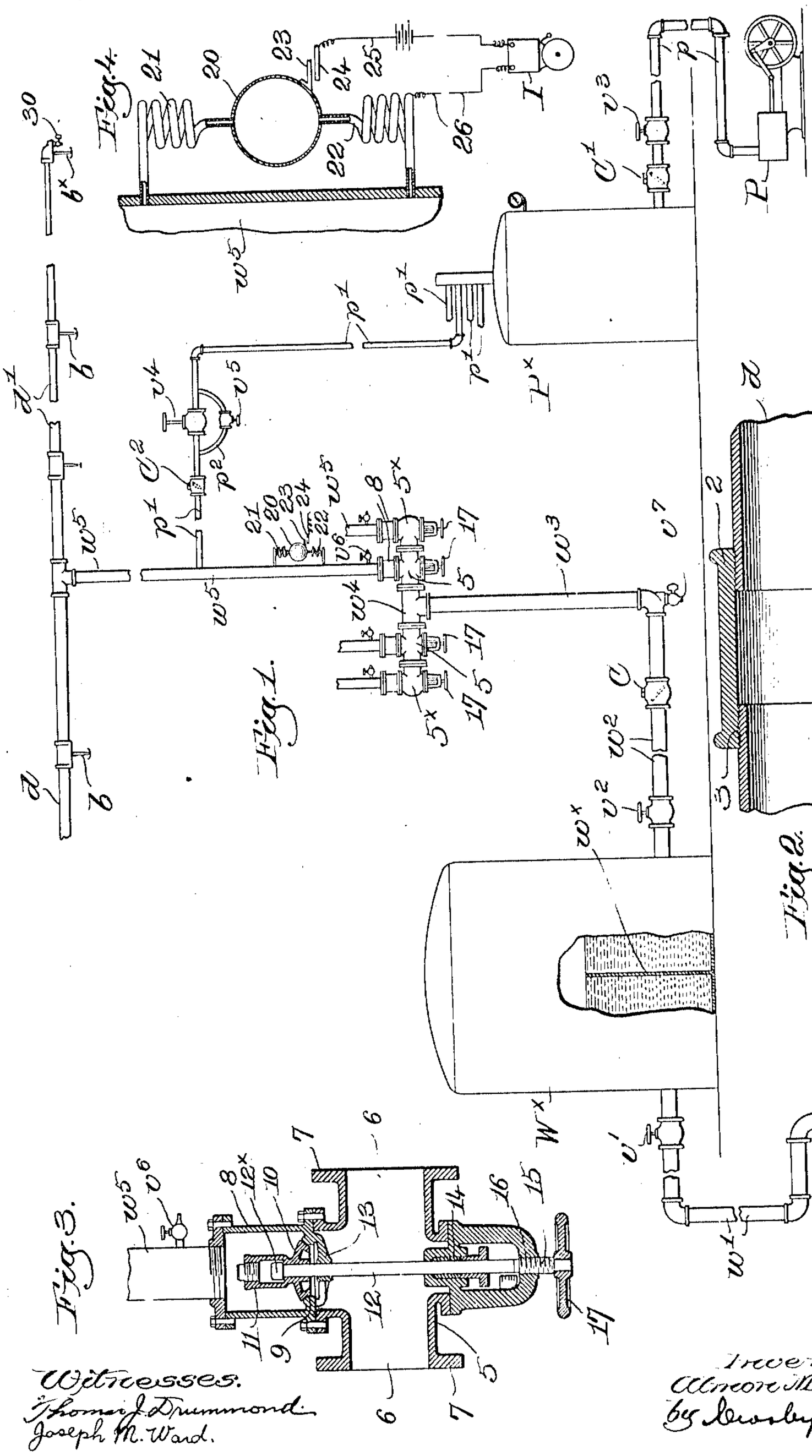

Fig. 1.

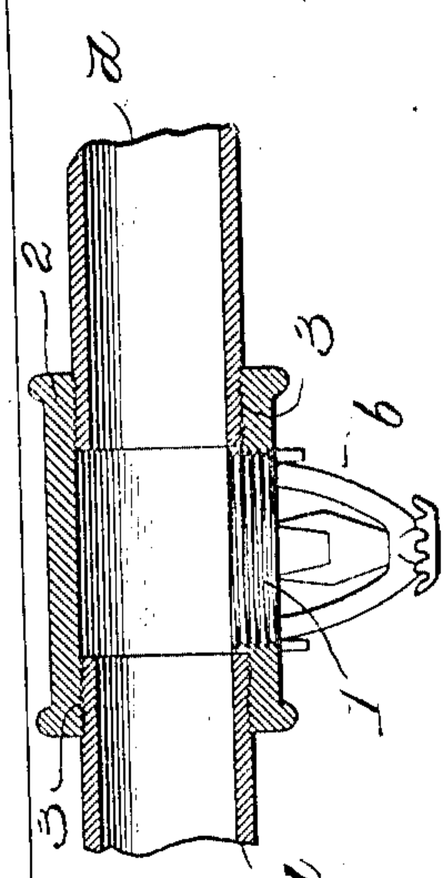

Fig. 2.

Fig. 3.

Witnesses.
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UNITED STATES PATENT OFFICE.

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AUTOMATIC SPRINKLER SYSTEM.

994,255. Specification of Letters Patent. Patented June 6, 1911.

Application filed September 28, 1907. Serial No. 395,017.

To all whom it may concern:

Be it known that I, ALMON M. GRANGER, a citizen of the United States, and resident of Medford, county of Middlesex, State of Massachusetts, have invented an Improvement in Automatic Sprinkler Systems, of which the following description, in connection with the accompanying drawing, is a specification, like letters on the drawing representing like parts.

This invention relates to automatic sprinkler systems employed for fire protection purposes, and more particularly to the so-called "dry" pipe type wherein under normal conditions the main water supply or distribution pipes are empty, the water under pressure being held back by air pressure acting upon expensive and more or less cumbersome differential valves until the air pressure is reduced by the opening of one or more sprinkler heads in the distribution pipe. Such systems are objectionable because of the expense of installation, and also, particularly in marine work, because of the fact that it is impossible to drain the system without removing the individual sprinkler heads from the distribution pipes.

My present invention overcomes these objections by greatly reducing the cost of installation and simplifying the construction, and while not restricted to such use it is peculiarly adapted for use on steamboats and other marine structures by reason of the drainable features embodied therein, as will be apparent hereinafter.

Broadly considered my invention comprises a distribution pipe provided with the requisite number of sprinkler mechanisms or heads, as usually designated, means connected with said pipe to supply the same with water under pressure, and means acting normally to maintain the distribution pipe filled with air at higher pressure and prevent the entrance of water to such pipe, said latter means including a service inlet for air of less area than the outlet of a sprinkler head.

My invention also comprehends the use of pendent drainable sprinkler heads, whereby the danger to the system from corrosion and freezing is wholly obviated.

In carrying out my invention the water distribution pipe is divided into as many sections as may be necessary, each being connected with a supply of water under pressure, and each section having a check-valve of simple and efficient construction to admit the water to the distribution pipe when a sprinkler head is opened.

The check-valves are normally held closed by air pressure in the distribution pipe, the air pressure being greater than the water pressure, and the apparatus is so constructed and arranged that after the air pressure in the system is established the air under pressure is constantly maintained in the distribution pipe of each section by a service inlet of less area than that of a sprinkler outlet, whereby when a sprinkler head is opened the reduction in the air pressure is practically instantaneous, to at once effect the opening of the water inlet valve.

A suitable automatic alarm is provided to indicate the admission of water to the distribution pipe of a section, the entrance of the water thereto operating the alarm.

Compressed air is provided by means of any suitable form of automatically controlled air pump, in itself forming no part of my invention, compensating for any leakage in the piping and by means of a storage chamber or tank maintaining at all times a substantially constant pressure in the system.

If one or more of the sprinkler heads is opened, as by fire in the vicinity, the air pressure in the system is instantly reduced to below that of the water, the check-valve or valves at once opening automatically and admitting the water to the system. I have also provided means to prevent water-hammer in the water-supply, as will be explained hereinafter, and I consider this an important feature of my invention.

Herein I have shown my invention embodied in a drainable system, using in connection therewith pendant drainable sprinkler heads such as shown in another application Serial No. 390326, filed by me the twenty-seventh day of August, 1907, such sprinkler heads depending from the distribution pipe and by their construction permitting ready drainage of the system.

While for many purposes, particularly in

steamboat installations, I prefer a drainable system with pendant sprinkler heads of the character referred to it will be manifest from the following specification that certain valuable features of my invention are in no wise restricted thereto.

Up to the present time no installation of pendent drainable automatic sprinklers has been made because I believe I am the first to devise such apparatus, forming the subject-matter of my other application referred to.

The largest equipment of sprinklers yet introduced on a steamboat is largely non-automatic in operation, reliance being placed upon thermostats at the side of each sprinkler to announce an adjacent fire on an annunciator in the engine room. When such announcement is made the engineer is expected to open the water inlet valve for the section or sections, where the sprinklers should be made operative, reducing the action of the system to manual operation.

The various novel features of my invention will be fully described in the subjoined specification and particularly pointed out in the following claims.

Figure 1 is a diagrammatic view in elevation of an automatic sprinkler system embodying my present invention, the piping being broken out at intervals to save space, and with typical forms of water and air pumps illustrated; Fig. 2 is an enlarged sectional detail of a drainable sprinkler fitting and connected pendant sprinkler head; Fig. 3 is an enlarged vertical section of the check-valve introduced between the main water supply and each section of distribution piping, whereby the admission of water thereto is controlled; Fig. 4 is an enlarged detail of the automatic alarm by means of which the admission of water to a section is indicated at any convenient point.

Referring to Fig. 1 a portion of a section of the water supply or distribution pipe is indicated at d, d', and herein I have shown the pipe as having a slight pitch sufficient for drainage, the pipe being provided at the requisite intervals with sprinkler mechanisms or heads b of suitable construction. Herein I have shown pendent sprinkler heads, of a drainable type such as forms the subject-matter of my pending application before referred to, the part 1 of the sprinkler head, Fig. 2, containing the usual outlet valve being connected with the bottom opening of a fitting 2 having lateral openings 3 into which are screwed the ends of the distribution pipe d. The construction is such that the sprinkler head depends from the fitting with the outlet valve of the sprinkler head adjacent the lower level or bottom line of the distribution pipe, thereby providing for automatic drainage of the sprinkler head when the water is drained from the distribution pipe. By using pendent drainable sprinkler heads I obviate the danger of corrosion or freezing at the heads after water has been admitted to the system. It will be understood that the distribution pipe d, d' may be of any suitable length and arrangement, according to circumstances.

Referring to Fig. 1 I have shown at W a pump of any suitable construction, having its inlet at w and its outlet is connected by a suitable pipe w' with a relatively large tank or chamber W^x, the pipe w' having a valve v' to shut off the pump from said chamber when desired. The chamber is herein shown as provided with a transverse diaphragm or partition w^x, Fig. 1, which extends to the water level, as indicated, the inlet for the chamber being at one side of the partition, while from the opposite side leads a water outlet pipe w^2, connected with the distribution pipe of each section, as will be described. A valve v^2 in the pipe w^2 is arranged to manually cut off the chamber from the sections, when desired, said valve under normal conditions being open. A check-valve C of any suitable character is located in the pipe w^2, opened automatically by water pressure to permit the passage of water to the various distributing sections, and normally such check-valve will be maintained closed by air pressure, as will be explained. The chamber W^x contains air above the water, forming an effective cushion, the partition w^x causing the incoming water to be deflected before it can pass out through the outlet pipe w^2, the construction serving to effectually prevent water-hammer in the piping of the sprinkler system.

At the right, Fig. 1, I have shown at P an air pump or compressor of suitable form, having its outlet p connected with an air storage reservoir P^x, with a manually operated valve v^3 and a check-valve C', the valve v^3 being open under normal conditions so that the check-valve automatically admits air to the reservoir P^x, but prevents return thereof to the pump.

In my present invention if the water pressure due to pump W be, say sixty pounds, then the air pressure in the reservoir P^x will be maintained at a higher pressure, for instance about eighty pounds, and the storage reservoir may have a capacity of about forty gallons to about two hundred gallons for the chamber W^x.

It will be understood that in a system of this character the water and air pumps will be automatically controlled in any usual way, forming no part of my invention so that the requisite air and water pressures will be maintained, the storage reservoir preventing variations in the air pressure in the sprinkler system.

The water-supply pipe w^2 is upturned at w^3 and I have shown it terminating in a

T-coupling w^4, to the opposite ends of which are connected the main check-valves interposed between the means for supplying water and the distribution pipes of the several sections.

One of the main check-valves is shown in section on an enlarged scale in Fig. 3, it comprising a casing 5 having opposite ports 6, 6 provided with annular flanges 7, a valve chamber 8 being bolted to the open top of the casing.

An annular valve-seat 9 is formed in the bottom of the chamber, for the check-valve 10, slidably connected by a housing 11 with the upper end of a depending, rotatable stem 12 guided by a spider 13 below the check-valve and by a suitable gland 14 at the bottom of the casing 5.

The lower end of the stem outside the gland is screw-threaded at 15 to coöperate with a threaded bearing 16 formed in a depending extension of the gland, the stem having an attached hand-wheel 17.

By turning down the stem the check-valve 10 is firmly seated, as shown in Fig. 3, and by turning up the stem the head $12^{\times}$ thereon is raised from the valve, releasing it from control of the stem, while the extreme upward movement of the stem brings its head against the top of the housing 11 to lift the valve from its seat, when it is desired to blow out the valve casing, for cleansing, etc.

Referring to Fig. 1 I have shown one of the check-valve devices as attached to each end of the T-coupling w^4, by means of the flanges 7, and to the outer end of each of the casings 5 I have bolted another similar casing $5^{\times}$, showing a set of four main check-valves. It will be seen that the end casings $5^{\times}$ are closed at their outer sides, but it will be manifest that by assembling the casings 5 by their end flanges 7 a greater number may be connected, with one of the casings $5^{\times}$ at each end of a set. The water passes from the supply pipe w^3 to the coupling w^4 and thence in each direction to the casings of the several valve devices, somewhat in the manner of a header, as will be obvious. A connecting pipe w^5 leads from the valve-chamber 8 of each of the check-valves to one of the sections of distribution pipes, and herein I have shown only one section connected, it being understood that each of the other sections will be connected in a similar manner. When the stem 12 of any check-valve is turned up the valve 10 thereof will be free to open or shut as the pressure below or above it is greater, so that at such time the valve is automatic in its operation. An air supply pipe p' leads from the storage reservoir $P^{\times}$ to each connecting pipe w^5 between the distribution pipe d, d' and the main check-valve, as shown in Fig. 1, the pipe p' having a main shut-off valve v^4 and a by-pass p^2 around the valve, as herein shown, the by-pass having an area less than the area of the outlet of a spinkler head, say about one-twentieth (1/20th) of the area of such outlet.

I prefer to provide the by-pass with a valve v^5 so that when desired I may completely shut the by-pass, as by closing both valves v^4 and v^5 the air supply is completely shut off from the particular section with which it is connected.

The valve v^4 may be termed the air-charging valve, while the by-pass with its restricted area constitutes a service inlet for the air, as will be apparent hereinafter.

I interpose a common check-valve C^2 between the by-pass and the connecting pipe w^5, to close automatically when water is admitted to the distributing section, to prevent the passage of water to the air-supply pipe p', whenever from any cause the air-pressure becomes reduced below the water-pressure.

Supposing that the water and air pumps have been put in operation to obtain pressures of say sixty pounds in the chamber $W^{\times}$, and eighty pounds in the storage reservoir $P^{\times}$, the valve v^2 being closed, and also the valves v^4, v^5, the several check valve spindles 12 are turned down by means of the hand wheels 17 to firmly seat the main check valves 10, after which the valves v^4, v^5 are opened, admitting air under pressure to the various sections connected by the pipe p' with the reservoir P in order to establish in the distribution pipes the air pressure, say eighty pounds to the square inch. The air-charging valve v^4 in each of said pipes p' is then closed, leaving the communication between each section and the storage reservoir through the restricted or service inlet afforded by the by-pass p^2. The spindles 12 are now turned up to release the check-valves 10 but the latter will remain seated by reason of the air pressure of eighty pounds previously established after which the valve v^2 in the water outlet pipe w^2 is opened, admitting the water under pressure of say sixty pounds to the several casings 5 underneath the check valves 10. The latter, however, will be retained seated against the water pressure by the greater air pressure on the upper sides of the valves, and the system is in condition for use. The air pressure in the several sections of distribution pipes and connecting pipes w^5 is maintained by or through the service inlet provided by the several by-passes p^2, any leakage in the piping being compensated for by the constant supply of air thereby rendered available. If now one or more sprinkler-heads be opened by fire in the vicinity thereof, the stored up air in that particular section is instantly released, and the air pressure reduced below that of the water, so that the corresponding main check-valve 10 is

instantly opened by the pressure of water beneath it, the water rushing through the connecting pipe w^5 into the distribution pipe of the particular section, to be showered upon the fire through the open sprinkler head or heads.

By making the area of the service inlet so much smaller than the outlet of a sprinkler head, the drop in the air pressure is instantaneous when a head is opened, so that the action of the water to open the main check valve 10 is immediate, the distribution pipe of that section being at once filled with the water under pressure, so that the operation of the system is entirely automatic.

I prefer to provide an automatic alarm to indicate the particular section which has been brought into operation, and in Fig. 4, I have shown an enlarged detail of a convenient form of alarm, the same comprising a metallic sphere 20 communicating at its upper end with the connecting pipe w^5 by a small pipe spirally coiled at 21 to suspend the sphere and also to admit water to it. a similar spirally coiled pipe 22 connecting the bottom of the sphere with the pipe w^5. The elasticity of the coils 21, 22 normally retains the sphere in the position shown in Fig. 4, but when the pipe w^5 is filled with water, the sphere is also filled, and the increased weight causes it to descend, bringing a contact 23 attached to the sphere into engagement with a fixed contact 24 in circuit with a bell or other indicator I by means of a wire 25, the circuit being completed by wire 26.

In Fig. 1, I have shown one of the alarm devices, it being understood that in practice each of the connecting pipes w^5 will be so provided, and it will also be manifest that several indicators or alarms I may be audible or visual as desired, and located in any convenient place.

After a section of the system has been automatically operated, as described, and the fire put out, the check valve 10 of that particular section is closed by turning down its spindle 12, this cutting out of a section from the means for supplying the water in no way interfering with any of the other sections, and the air service inlet of the opened section is shut-off by the valve v^5, so that the section is shut-off from both the air and the water supply. A drip valve v^6, Fig. 1, in the lower end of the connecting pipe w^5 is then opened to effect the drainage of the water from the distribution pipes d, d' down through the pipe w^5, and out through the valve v^6, and if desired air may be thereafter admitted from the reservoir $P^\times$ to blow out any remaining moisture by opening the main charging valve v^4 before the open sprinkler heads are replaced or closed.

If the distribution pipe terminates in a "dead end," as at the right hand end of the distribution pipe d', Fig. 1, the endmost sprinkler head $b^\times$ is provided with a drainage cock 30 through which such part of the distribution pipe can be drained of any remaining water and blown out by the air.

By using pendent, drainable sprinkler heads, such as described in my pending application, one form of which is shown herein in Fig. 2, the collection of water in the piping after the operation of a section of the system is prevented, thereby obviating corrosion at the sprinkler heads or any danger from frost.

I may if desired remove drainage water through a drainage valve v^7 at the bottom of the pipe w^3 by shutting down the check-valves 10 of such sections as are not to be drained, closing the valve v^2, and opening the drainage valve v^7, it being understood that if such mode of drainage is adopted the valves v^6 will not be opened. In this latter mode of drainage, the water remaining in the distribution pipes will travel down through the casings 5 in which the valves 10 are open, it being remembered that opening of the valves 10 can be effected by turning up their spindles 12 to the full extent of their movement, and an opportunity is thereby afforded to clean out the main check-valve casings and valve seats. After a section has been operated and has been drained, the open sprinkler heads are replaced, the check-valve 10 of that section is shut down manually and the section charged with air under pressure by means of the charging valve v^4, and after the pressure has been established the check-valve 10 is opened, as has been described, the air charging valve v^4 closed, and the air pressure maintained in the section by means of the service inlet through the by-pass. The check-valve C prevents any accidental entrance of air under pressure from the system to the chamber $W^\times$, and in a similar manner the check-valve C^2 prevents entrance of water to the air piping or air reservoir. The main check valve 10 for each section serves as a controller to regulate the passage of water to the distribution piping of that section, such controller being governed wholly by the air pressure in the section after the check valve has been released from the control of its spindle 12.

So far as concerns the mode of connecting the sections with the air storage reservoir, by means of the main charging valve and the air service inlet, it is immaterial whether the system be provided with pendent drainable sprinklers or not, as this part of my invention is applicable to any dry pipe system irrespective of the position or particular construction of the sprinkler heads. So too, the arrangement of the main check-valves is adapted to dry pipe systems in general whether drainable or not, and the same is

true of the device for preventing water hammer.

Heretofore dry pipe systems have depended upon periodical supplies of air to the piping mains to act upon differential air valves, or small diaphragms actuating leverage mechanisms, to open or release the main water supply check-valve when the stored air in piping system had been reduced to the tripping point of the differential valve or its equivalent diaphragm.

My novel system herein explained is more simple, of less expense and is more reliable both in its automatic maintenance of desired normal conditions and in its simplified and certain automatic admission of water supply; freed as it is from all care of differential valve apparatus and diaphragms operating valve mechanisms, and from the care of inautomatic air and water supplying apparatus.

My invention is not restricted to any particular form of pump or apparatus for generating and maintaining the desired water and air pressures, as will be manifest from the foregoing description taken in connection with the drawings, and changes may be made in various details of construction and arrangement by those skilled in the art without departing from the spirit and scope of my invention as set forth in the following claims.

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

1. In an automatic sprinkler system, a distribution pipe provided with sprinkler-heads, means connected with said pipe to supply the same with water under pressure, a connection to said distribution pipe for charging the same with air under pressure, a valve in said connection, and a by-pass around said valve of less area than the outlet of a sprinkler-head.

2. In an automatic sprinkler system, a distribution pipe provided with sprinkler heads, means connected with said pipe to supply the same with water under pressure, an air-storage reservoir to supply air to said distribution pipe, a connection between the reservoir and the distribution pipe, a valve in said connection, and a by-pass around said valve, of less area than the outlet of a sprinkler head.

3. In an automatic sprinkler system, a distribution pipe provided with sprinkler-heads, means connected with said pipe to supply the same with water under pressure, an air storage reservoir to supply air to said distribution pipe, a connection between the reservoir and the distribution pipe, a manually operated valve in said connection, a by-pass around said valve of less area than the outlet of a sprinkler-head, and a check-valve in said connection to prevent the flow of water to said reservoir.

4. In an automatic sprinkler system, a distribution pipe provided at intervals with pendent automatic sprinkler heads, means to supply said pipe with water under pressure, a connection between said means and the distribution pipe, including a check-valve and a manually operated valve-closer, manually-operated means to drain the distribution pipe through said connection, means acting normally to maintain the distribution pipe filled with air at higher pressure than that of the water, and a manually-operated charging valve for said latter means provided with a by-pass having a restricted opening, the check-valve being shut by the valve-closer when the charging valve is opened to charge the system with air under pressure, the air maintaining the check-valve closed when the valve-closer is rendered inoperative.

5. In an automatic sprinkler system, a distribution pipe provided with sprinkler heads, means connected with said pipe to supply the same with water under pressure, means to introduce air at greater pressure than that of the water to said distribution pipe and normally maintain the same filled with air, a manually operated charging valve and a by-pass around it, interposed between the air introducing means and the distribution pipe, and a shut-off valve for the by-pass, the area of the latter when open being less than the area of the outlet of a sprinkler head, the charging valve being closed after the system has been filled with air under pressure.

6. In an automatic sprinkler system, a distribution pipe provided with sprinkler heads, means to supply water under pressure to said pipe, said means including an air-chamber having separated inlet and outlet ports for the water, to prevent water-hammer, and means to maintain the distribution pipe filled with air under pressure greater than that of the water until a sprinkler head is opened.

7. In an automatic sprinkler system, a distribution pipe provided at intervals with sprinkler heads, means to supply water under pressure to said pipe, said means including an air-chamber having a water inlet at one side and a water outlet at the other side, a baffle wall interposed between said inlet and outlet, a check-valve between the air chamber and the distribution pipe, and means to maintain the distribution pipe filled normally with air at a pressure greater than that of the water and the check-valve shut.

8. In an automatic sprinkler system, a distribution pipe provided at intervals with automatic sprinkler heads, means to supply

water under pressure, a connection between said means and the distribution pipe, means to supply air under pressure greater than that of the water, a manually controlled valve to admit the air under pressure to said connection between the distribution pipe and the means to supply water, to charge the system with air, and a restricted by-pass to establish communication between the means to supply air and the sprinkler system when said valve is shut, to hold the air pressure while permitting a quick drop in such pressure when a sprinkler head is opened.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

ALMON M. GRANGER.

Witnesses:
JOHN C. EDWARDS,
THOMAS J. DRUMMOND.