(No Model.)

2 Sheets—Sheet 1.

J. R. FREEMAN.

AUTOMATIC FIRE EXTINGUISHER.

No. 440,704. Patented Nov. 18, 1890.

Fig. 14.

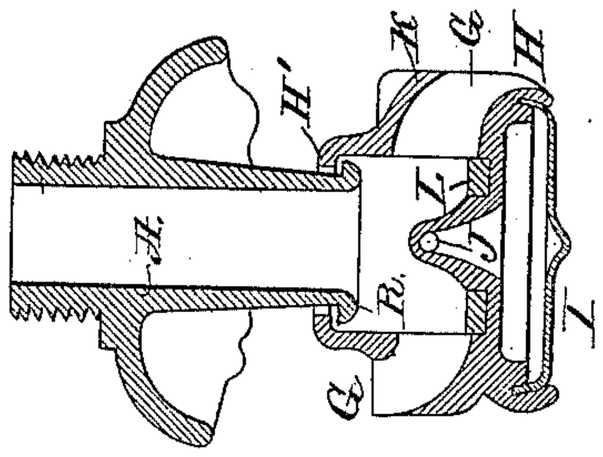


Fig. 15.

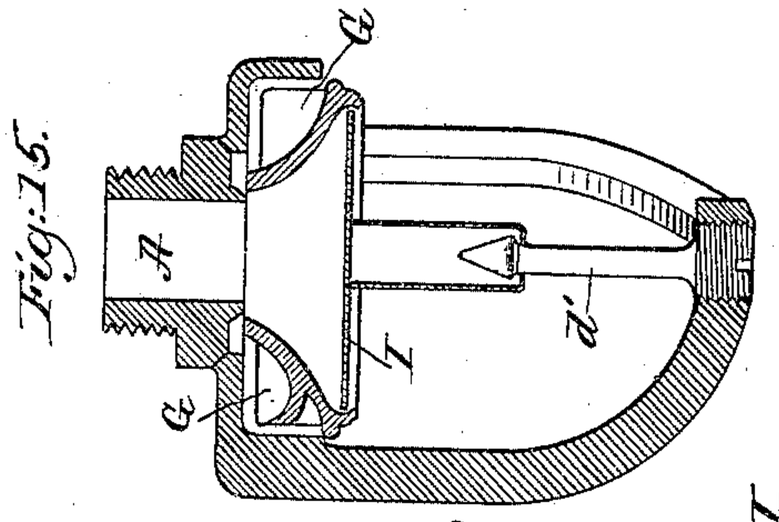


Fig. 12.

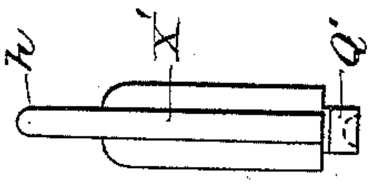


Fig. 13.

Fig. 11.

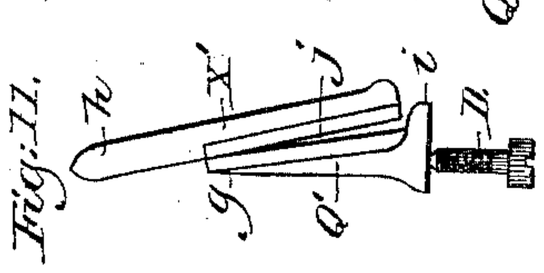


Fig. 16.

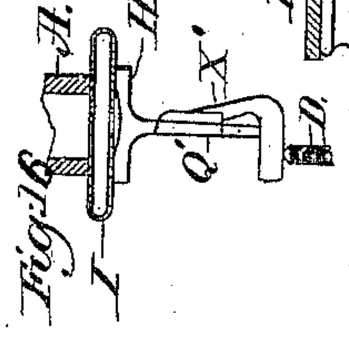


Fig. 17.

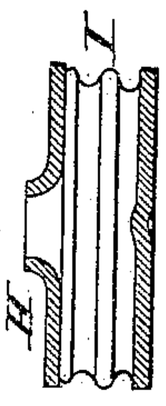


Fig. 2.

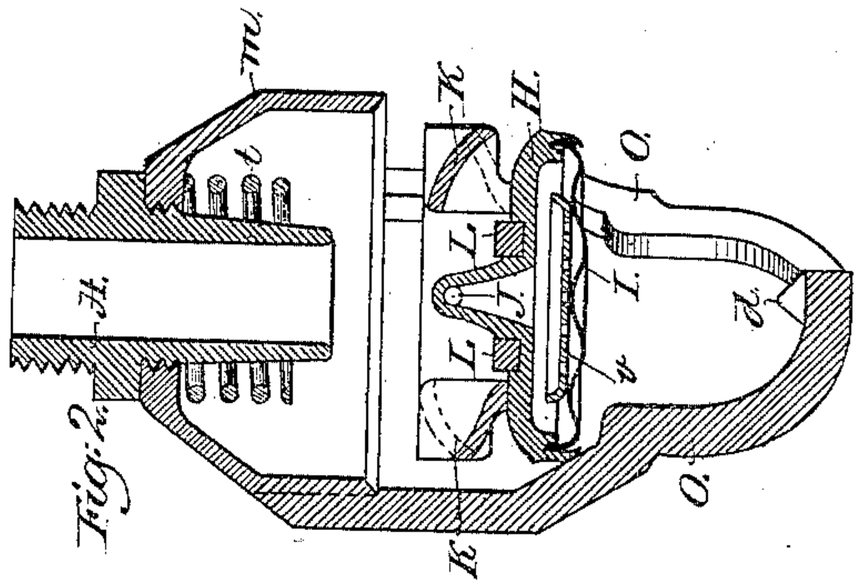


Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9

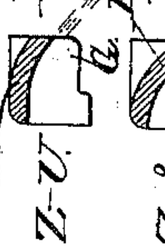


Fig. 10.

Fig. 1.

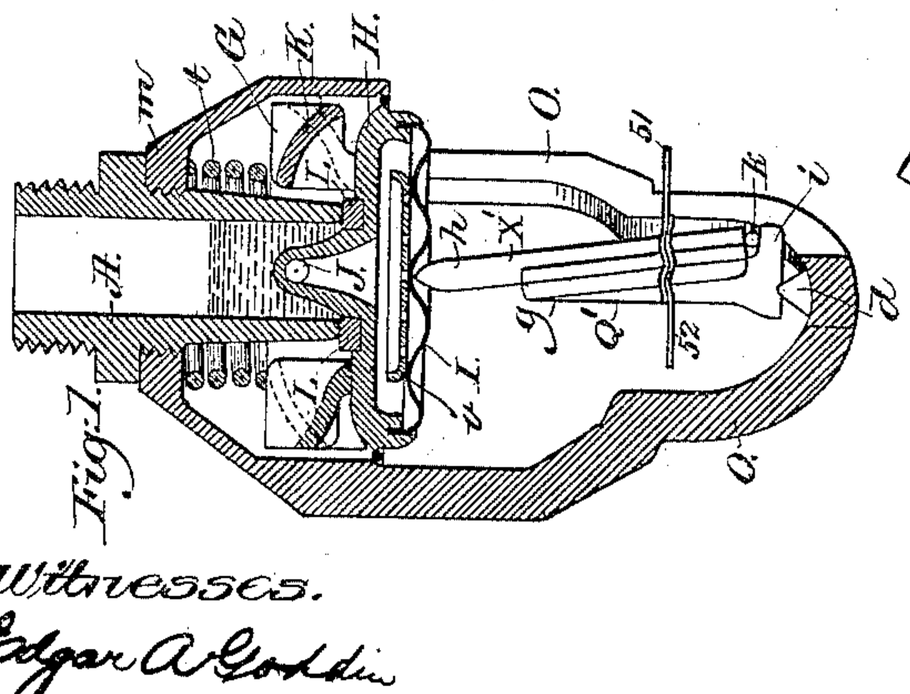


Fig. 3.

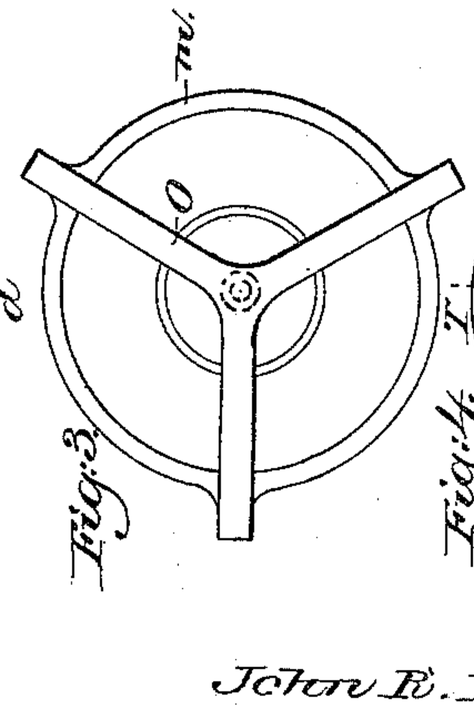
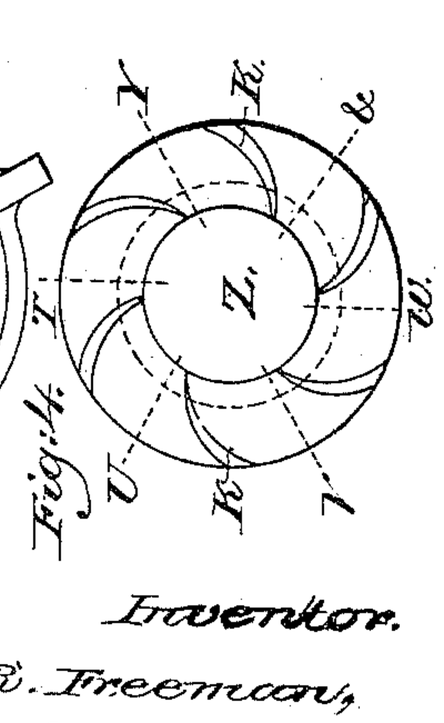


Fig. 4.



Witnesses.
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Frederick L. Emery

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John R. Freeman,
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

J. R. FREEMAN.

AUTOMATIC FIRE EXTINGUISHER.

No. 440,704. Patented Nov. 18, 1890.

Fig: 18.

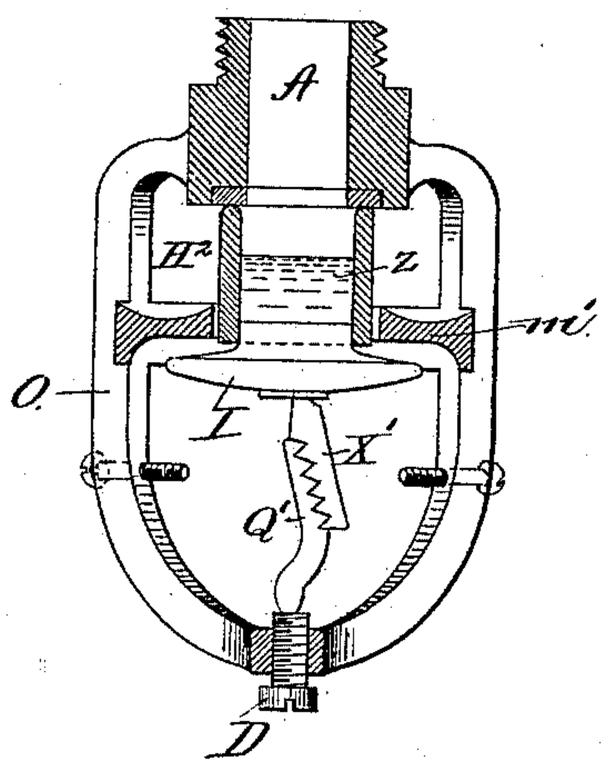

Fig: 19

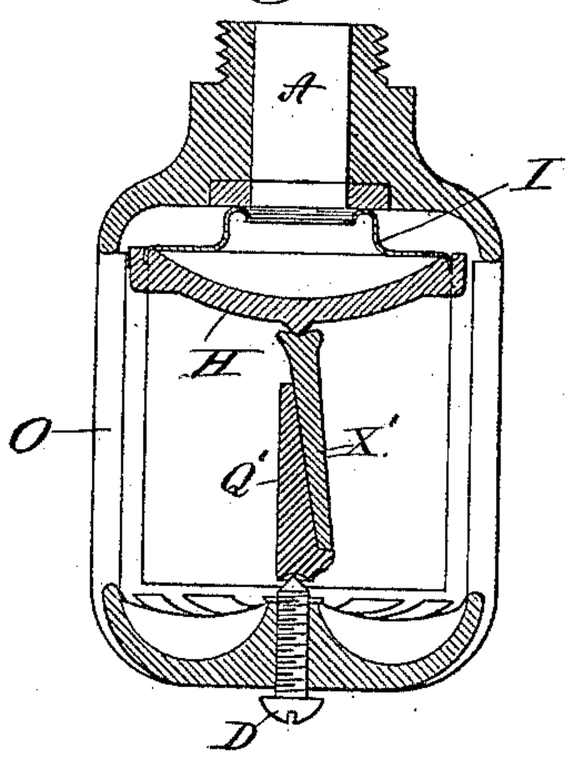

Fig: 20

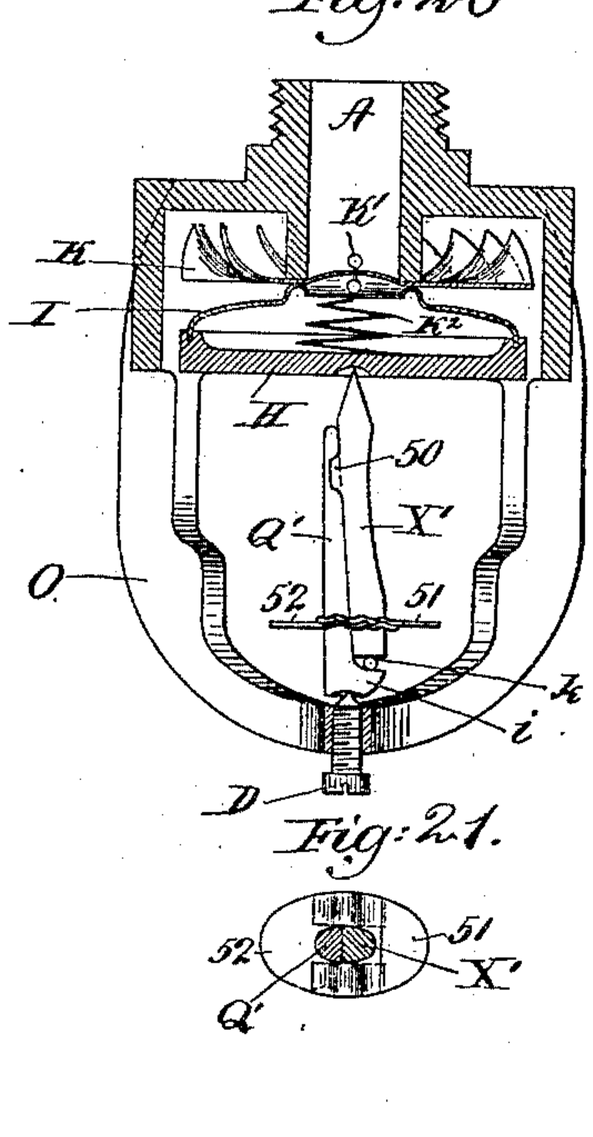

Fig: 21.

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Inventor:
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by Crosby Gregory & Dodge
Attys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN R. FREEMAN, OF BOSTON, MASSACHUSETTS.

AUTOMATIC FIRE-EXTINGUISHER.

SPECIFICATION forming part of Letters Patent No. 440,704, dated November 18, 1890.

Application filed February 5, 1890. Serial No. 339,225. (No model.)

To all whom it may concern:

Be it known that I, JOHN R. FREEMAN, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Automatic Fire-Extinguishers, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

This invention, embodying the invention shown and described in my application, Serial No. 243,332, filed July 5, 1887, and which has been formally abandoned in favor of this application, relates to automatic fire-extinguishers of the kind in which a fire-extinguishing fluid is retained within appropriate conduits or reservoirs and prevented from flowing out prior to the occurrence of fire or dangerous rise in temperature by means of a valve, which is kept closed by connections or supports formed wholly or in part of easily-fusible solder or other material, which will on the occurrence of fire or dangerous rise in temperature yield and thus cause or permit the said valve to open and the said fire-extinguishing fluid to flow out.

The objects of my invention are, first, to provide a valve for restraining the fire-extinguishing fluid which shall not be liable to leak, but which shall yet open easily; second, to provide a fusible connection or support which, until acted upon by heat, shall retain the valve closed tightly, and which shall be sensitive to heat, yet shall be strong, durable, and without liability of its solder joint to "crawl" under long-continued pressure, and not liable to have its action interfered with by corrosion; third, to provide means by which when one of these connecting-pieces has become broken another similar piece can be readily substituted and the extinguisher be thus made ready for further service; fourth, to provide a distributer for the issuing fluid which shall scatter it uniformly in nearly all directions, yet delivering it in suitable body to be effective.

Figure 1 is a vertical section of an automatic sprinkler embodying my invention, the valve being closed; Fig. 2, a vertical section of the sprinkler shown in Fig. 1 with the valve open; Fig. 3, an under side view of the sprinkler shown in Fig. 1 to show the form of stirrup or support for sustaining the valve-supporting bar. Fig. 4 is a plan view of the distributer shown in Fig. 1. Figs. 5, 6, 7, 8, 9, and 10 are sectional details of the distributer to more clearly show its mode of operation; Fig. 11, an elevation of the valve-support detached from the sprinkler; Fig. 12, a front elevation of the bar shown in Fig. 11; Fig. 13, a section of the bar shown in Fig. 12. Figs. 14 and 15 are modifications to be referred to. Figs. 16 and 17 are modifications of valves to be referred to; Figs. 18, 19, and 20, sectional elevations of modifications to be referred to, and Fig. 21 a detail to be referred to.

Referring to Fig. 1, the pipe or nozzle A, herein shown as screw-threaded on its outer side, is adapted to be connected with a pipe or receiver containing a fire-extinguishing liquid. The pipe or nozzle A has its outlet end closed by a valve, preferably made in two parts H I, united at their edges by solder or in other suitable manner to form between them a chamber or cell. The disk I, forming one of the parts of the valve, is preferably corrugated in order to increase its range of motion, for a purpose that will be described, and the disk H, forming the other part of the valve, is provided, as herein shown, with a conical portion, which in practice is fitted into the nozzle A, the said conical portion being provided with a port or opening J, through which the water or fluid contained in the nozzle may pass and enter the chamber or cell of the valve and assist in firmly seating the same. This valve as a whole is thus cellular and is so constructed that the thickness of the cell or the distance of the portion of valve which bears against the nozzle A from the portion of valve which bears against the valve-support is capable of variation in accordance with expansive internal pressure exerted on the walls of the cell formed between the two disks H and I or capable of variation in accordance with compressive force exerted on exterior of said cell between the nozzle A and the valve-support.

The chief purpose of the cell in valve is to enable the pressure of the fluid within the pipe to which the sprinkler is attached to cause a pressure of the valve against the nozzle A, for since I make the area of the mov-

able part of disk greater than the outlet of nozzle, or greater than the area within the seating-joint of the valve, fluid-pressure within valve-cell, when constructed as above described, will tend to expand it, and thus force the disk H against the nozzle A, and the greater the pressure of the fluid tending to escape from the nozzle the greater will be the force by which the valve will be pressed against the nozzle so long as the valve-support remains to support it.

The disk H of the valve supports, as herein shown, a rotary distributer K, made as a casting or piece of stamped metal provided with vanes, faces, or lips G of irregular form or curvature, or arranged at different angles one with relation to another and shaped substantially as is shown in the detail, Figs. 5 to 10, inclusive, to distribute in various directions the water or other fluid discharged from the nozzle A when the valve is open. To better effect this result, the bottoms or directing-surfaces of the channels between the vanes are also arranged at different angles one with relation to another.

The nozzle A above the rotary disk K is surrounded, as herein shown, by a spiral spring *t*, fastened at its upper end, preferably, to a hood or cap *m*, placed over and protecting the valve, the said hood being herein shown as screwed upon the nozzle. The spring *t* is normally compressed, as shown in Fig 1, when the valve is closed and acts to force the valve and the rotary distributer down away from the nozzle A into the position shown in Fig. 2 when the valve is opened, as will be described.

As the valve is herein made, I rely mainly upon gravity and the restrained fluid to move the distributer and valve, and so I lay no particular stress upon the spring.

The valve is held against its seat in accordance with my invention by a valve-support formed in two parts X′ Q′, united by fusible solder or other fusible material capable of melting at a low temperature. The part Q′, which is made somewhat shorter than the part X′, is provided with a horizontal or laterally-extended arm, as *i*′, upon which the lower end of a part X′ rests, and the contacting faces or sides of said parts are united by the fusible solder to constitute the valve-support. The valve-support rests upon a conical stud *d*, formed upon or attached to a depending bracket or stirrup O, secured in any suitable manner to the hood *m*, the said stud serving as a fulcrum for the bar Q′. The two-part valve-support resting, as described, on the conical stud occupies a position beneath the diaphragm or disk I and thereby supports the valve.

In the operation of the sprinkler shown in Fig. 1 the valve remains seated until the temperature of the locality in which the sprinkler is located becomes sufficiently high to change the condition of the fusible solder joining the parts X′ Q′. As the solder changes, the valve forced by the liquid exerts a pressure upon the part X′ of the valve-support, the force of which pressure is received upon the arm *i* at or near its outer end. As the lower end of the part X′ presses against the outer end of the arm *i*, the upper end of the said part exerts substantially a lateral pressure upon the end *g* of the part Q′, (see Fig. 11,) and the end *h* of the part X′ being meanwhile held from lateral motion by its contact with the under side of the valve the said end *h* becomes a fulcrum for the part X′, and the resistance offered by the part Q′ at the point *g* tends to separate the part X′ from the part Q′ at the point *j*. (See Fig. 11.) By this form of valve-support it will be seen that the direction of the thrust or pressure is at one side of the support for the part Q′, and the said part Q′ is extended vertically to present at its extreme end a fixed point as a resistant for the part X′ when the latter is moved, so that the two parts X′ Q′ will act as compound levers and separate. It is also obvious that by this construction the strain upon the solder may be made very small in proportion to the compression strain in the bar X′ Q′. Thus, if distance from point of bearing of X′ on *i* to bearing of Q′ on fulcrum be one-fifth the distance of *g* from fulcrum, and if distance of *g* from *h* be one-fourth the distance of center of resistance *j* of solder joint from *h*, then the tension on the said solder joint will be only one-twentieth of the direct pressure exerted by the valve against the said bar X′ Q′, and by varying the ratios of lengths of the lever-arms the tension on solder joint may be made still smaller. It is essential, however, that the point where the end of X′ bears on Q′ be not directly in line with the fulcrum in order that when the solder melts there shall be a reliable leverage tending to separate the parts X′ and Q′. It will also be seen that by constructing the valve-support as above described a sliding movement of one part on another is obviated, so that no danger can arise of the valve being but partially opened by the melting of the solder and a sudden cooling of the same immediately thereafter.

To reduce the friction between the end of the part X′ and the arm *i*, a small roller *k*, preferably of a short piece of round wire, may be interposed between the end of the part X′ and the said arm, as shown in Fig. 1, the said roller being secured by solder or in other suitable manner, and for cases where great sensitiveness is desired it may be best, while retaining the same principle of action as already described, to form the levers, as shown in Fig. 20, with lugs 50, or their equivalent, to prevent dislocation, and apply the fusible metal or solder to unite a clamp-collar composed of thin corrugated metal plates 51 52, which until a dangerous rise of temperature will firmly clamp the two parts of support together. This collar is thin and of large area that it may quickly yield to heat.

When the valve is opened by the melting of the fusible solder between the parts X′ Q′, the valve and the rotatable distributer supported thereby are forced downward into substantially the position shown in Fig. 2, they being supported by the stirrup or bracket, the valve-support at such time being out of the said stirrup.

The fire-extinguishing fluid discharged from the nozzle A falls upon the inclined portion of the valve, and being directed outward strikes against the inclined or turbine-like vanes G of the distributer and imparts a rotation to the same. As the water passes out laterally between the vanes of the distributer, it is shot in a variety of directions by the inclination or form of the recesses between the said vanes, as clearly shown in the detail, Figs. 5 to 10, inclusive, and also by the varying angles of the vanes themselves, thereby very effectually wetting a considerable area in the vicinity of the sprinkler and maintaining a distribution of the water in a solid body. The rotary distributer is retained in position upon the upper portion of the valve, as herein shown, by a ring L. The valve may be returned to its normal position to close the nozzle A by applying a new valve-support.

The valve and rotary distributer are shown in Figs. 1 and 2 as independent; but, if desired, they may be made in one piece, as shown in Fig. 14, the said distributer having a flange H′, adapted to engage or rest upon an outwardly-turned flange R on the nozzle A when the valve is open. So, also, the rotary distributer may be supported in its lower position upon a spindle d' below the valve, as shown in Fig. 15; or, if desired, the independently-formed rotary distributer lying between valve-face and end of nozzle may be supported by a small pivot K′, attached to a spring K^2 and rising when valve is released, so as to then support distributer in such position that it may revolve with a minimum of friction out of direct contact with either valve or nozzle, as shown in Fig. 20.

The port or orifice in the valve shown in Fig. 1 is small; but, if desired, a larger port, as shown in Figs. 15 to 20, may be used.

Instead of the particular form of valve-support shown in Figs. 1 and 11 I may employ a support such as shown in Figs. 16 and 18, the parts X′ Q′ of the support shown in Fig. 18 being provided with serrations or projections. Moreover, it is within the spirit of my invention to make use of rigid disks united by a corrugated or extensile wall, as shown in Fig. 18. Likewise the use of a hollow washer to make tight the joint between nozzle and plate covering or closing the same, as illustrated in Fig. 16, is also within the scope of my invention of an expansible removable valve. Furthermore, I do not desire to limit myself to the particular shape of valve-support, herein shown, as other shapes embodying the essence of my invention may be used.

In the chamber formed within the valve a re-enforcing or check plate v is placed, it resting on the diaphragm I and having an upwardly-extended flange, which, when the plate is lifted, strikes the under side of the plate H, thereby preventing puncturing or otherwise injuring the diaphragm by pressure from beneath.

It will be seen that that portion of disk on section Z Y shown in Fig. 5 deflects the fluid back upward at a high angle, while the portion of disk lying between two vanes G (shown by section Z in Fig. 10) deflects the fluid downward at a low angle, and the intermediate sections, Figs. 6, 7, 8, and 9, show portions of disk deflecting the fluid at intermediate angles, and thus as the distributer revolves these differently-inclined jets will revolve, each describing an approximate cone, and all jets together distribute the issuing fluid in almost every direction, radiating out from the apparatus and in comparatively solid streams.

In disposing the differently-inclined portions of disk K it is preferable to arrange them about as indicated by Fig. 4 in connection with Figs. 5, 6, 7, 8, 9, and 10, in order that pressure may be evenly distributed on bearings of revolving distributer, and thus allow it to revolve more easily.

In Fig. 18 the distributer-disk m' is stationary, and the valve, when opened, falls into an opening in said disk.

z is a mobile gelatinous substance, against which the extinguishing-fluid acts instead of directly against the disk.

I would state, further, that I do not desire to limit my invention to the arrangement having the rigid disk next the end of nozzle, for it is obvious that the flexible disk may rest directly in contact with nozzle, as shown in Figs. 19 and 20, while the rigid disk bears against the valve-support, this being in one sense a mere reversal of the arrangement of the parts shown in Figs. 1 and 2. Moreover, my invention includes the arrangement of valve shown in Fig. 18, in which the expansible cell proper is separated from contact with the nozzle by the intervening tube H^2, as shown. Instead of stud d the fulcrum may be a screw D, as shown in Figs. 11, 16, 18, 19, and 20.

I claim—

1. In an automatic fire-extinguisher, a cellular valve tending to expand under the pressure of the restrained fluid, composed of a rigid saucer-like disk H, bearing against the end of discharge-nozzle and perforated by a hole J interior to its line of contact with said nozzle, to which disk at its outer rim is attached a flexible disk I, constructed substantially as described and shown, against which the valve-supporting bar bears.

2. In an automatic fire-extinguisher, a composite fusibly-yielding bar for maintaining valve closed, which bar consists, essentially, of a thrust-post fusibly soldered to a bent lever or "bell-crank" whose short arm receives the thrust of the said post and the long arm

of which bears transversely against that side of the said post which is toward the main fulcrum, said long arm of bell-crank or bent lever lying wholly or in part along that side of said post nearest to said fulcrum, substantially as specified and shown.

3. In an automatic fire-extinguisher, the valve formed with an internal chamber, one of the side walls of which is yielding or movable, combined with a re-enforcing or check plate *v*, placed in said internal chamber or cell to prevent injuring the yielding or movable side wall by compression, substantially as described.

4. In an automatic fire-extinguisher, a valve, combined with a separable valve-support consisting of the posts X′ Q′, joined by fusible material, the post Q′ being formed as a bent lever and contacting with a support at or near the junction of the arms of said bent lever, and the post X′ bearing at one end against the valve and at the other end against one arm of the said bent lever at or near its outer end through the medium of an interposed anti-friction device, substantially as described.

5. In an automatic fire-extinguisher, a rotary distributer having vanes rising from its surface in planes between a tangent and a radius and forming ways or channels for the escape of the extinguishing-fluid, some of the said channels directing upwardly from the horizontal plane of the distributer, others being in such horizontal plane, and still others directing downwardly from said plane, substantially as described.

6. In an automatic fire-extinguisher, the valve and its support, combined with a distributer constructed independently of the valve and arranged in the plane of the seat of said valve and freely revoluble upon and movable with the said valve, substantially as described.

7. In an automatic fire-extinguisher, the valve and valve-support, combined with the distributer supported upon the valve and adapted to lie in the path of the issuing fluid when the valve is open, said distributer being provided with channels the side walls of which are in planes inclined to the radii and the bottoms or directing portions of some of which are in a horizontal plane, while others are curved upward and downward relatively to said plane, substantially as described.

8. In an automatic fire-extinguisher, a removable expansible valve or cover formed by uniting two disks H I at their outer edges, so as to form a cell or chamber between them communicating with the valve-closed nozzle, one of the said disks being elastic or capable of yielding to pressure, the said expansible valve or cover when operated moving away from or out of contact with the discharge-nozzle, substantially as described.

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

JOHN R. FREEMAN.

Witnesses:
BERNICE J. NOYES,
EMMA J. BENNETT.