Oct. 31, 1950 A. J. LOEPSINGER 2,528,063

AUTOMATIC SPRINKLER

Filed June 9, 1948 2 Sheets-Sheet 1

Fig. 1

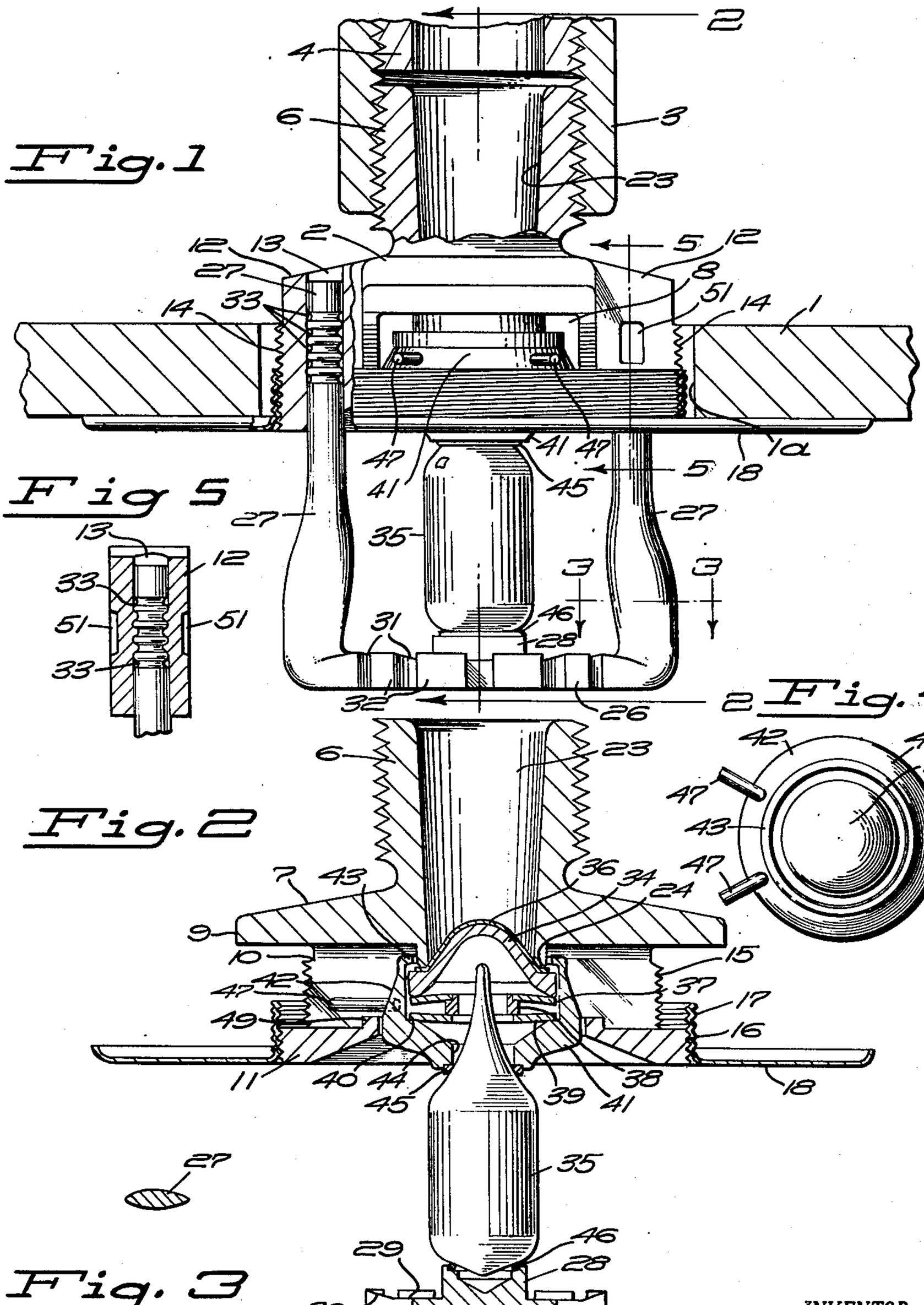

Fig. 5

Fig. 4

Fig. 2

Fig. 3

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Fig. 6

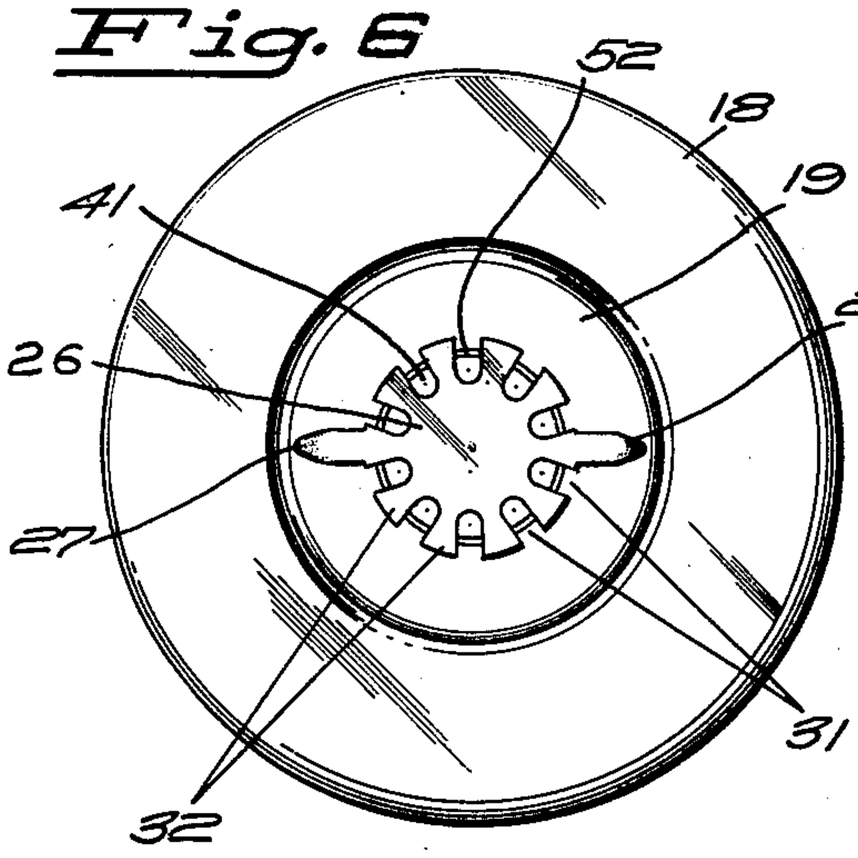


Fig. 7

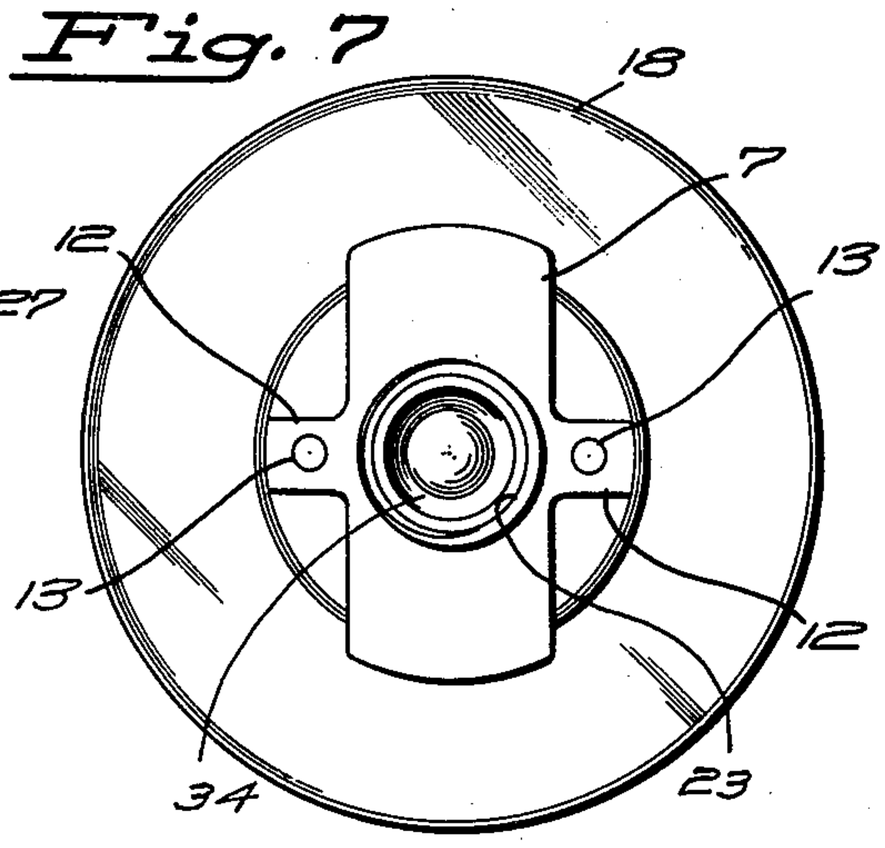


Fig. 8

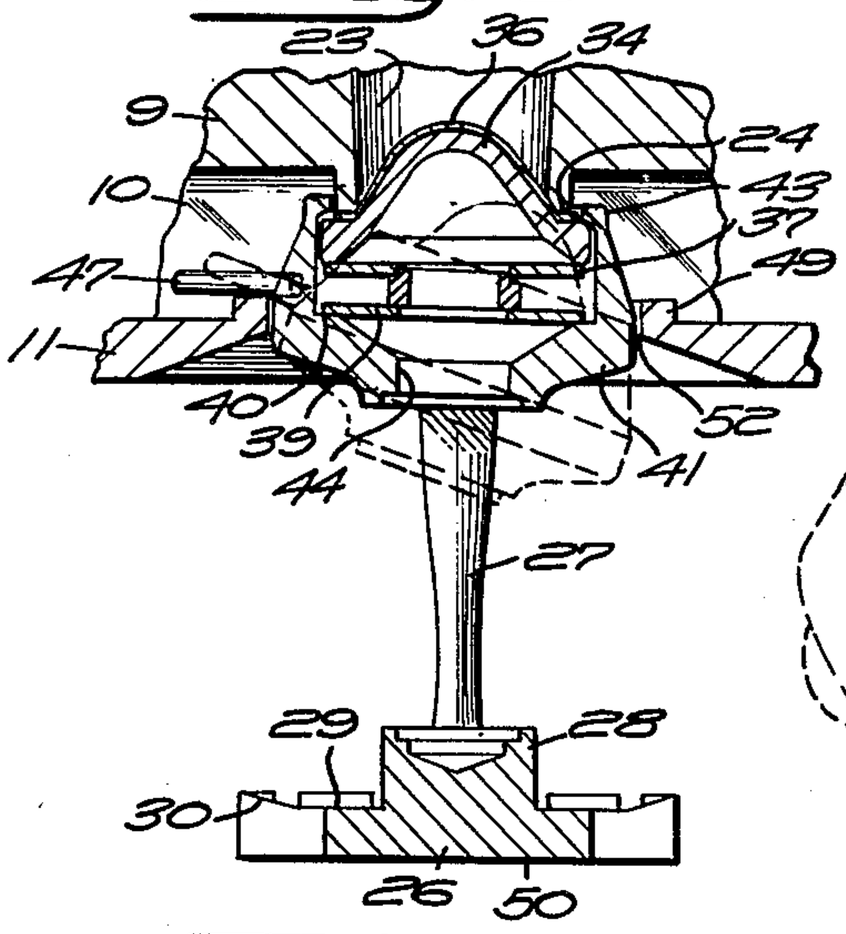


Fig. 9

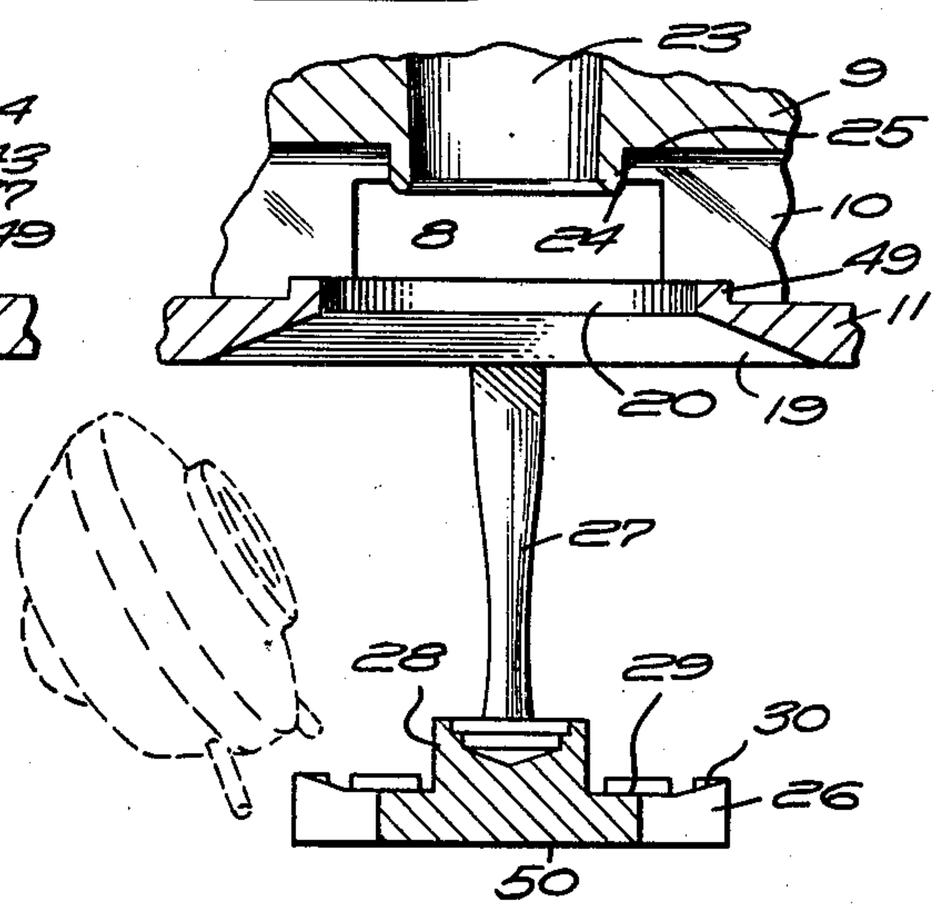


Fig. 10

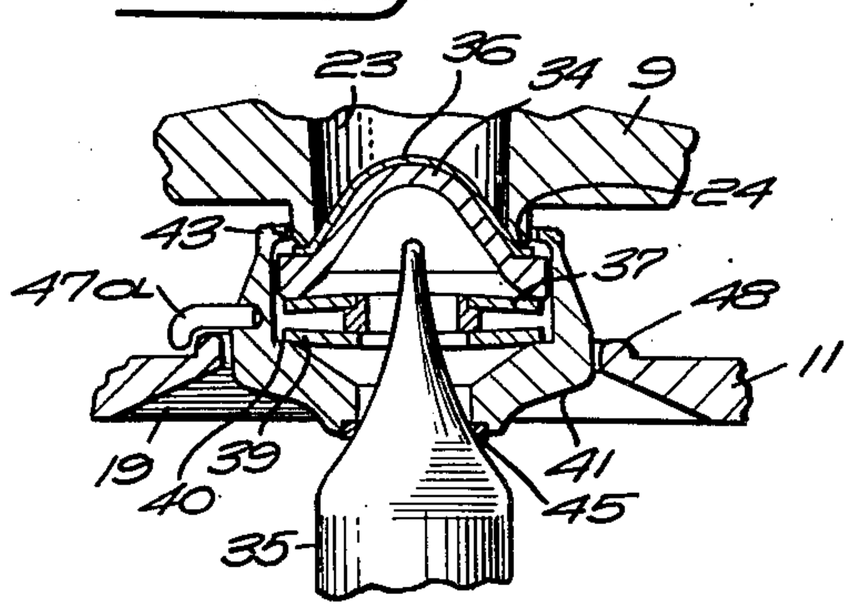
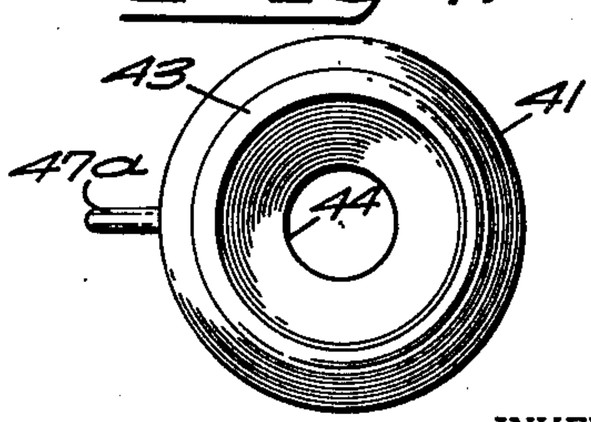


Fig. 11



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UNITED STATES PATENT OFFICE

2,528,063

AUTOMATIC SPRINKLER

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Application June 9, 1948, Serial No. 31,859

8 Claims. (Cl. 169—38)

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This invention relates to improvements in an automatic sprinkler. More especially it has to do with a sprinkler for a fire extinguishing system having distributing pipes located above the ceiling of an enclosure to be protected, the improved sprinkler being connected to such pipes through the ceiling with as little as possible of the sprinkler projecting below the surface.

The demand for such a so-called "ceiling sprinkler" has been prompted largely by the aesthetic desires of those who, while fully appreciating the protective value of a sprinkler system, wish to have it substantially hidden above the surface of a ceiling and with the necessarily exposed parts as inconspicuous as possible. This is especially desirable where any depending detail, such as the usual sprinkler, would be likely to cast unsightly shadows under some conditions of artificial lighting.

The usual form of automatic sprinkler has a yoke consisting of a pair of arms cast integral with the body which curve outward from its sides and then inward to meet in a sort of hub located along the axis of the sprinkler at some distance from the valve seat on the body. A deflector is customarily attached to the outer end of this hub and between the inner end of the hub and the valve seat is a strut which normally holds the valve of the sprinkler closed. This strut comprises some form of thermally responsive means which at a predetermined temperature is rendered incapable of holding the valve seated against the force of fluid standing under pressure in the distributing pipes of the system. The distance between the body and the hub of the yoke in the usual sprinkler is such that there is ample room for the strut and valve to be "washed away," as it were, by the fluid issuing from the throat of the sprinkler.

This distance must be greatly reduced in the case of a "ceiling sprinkler" if the desire of having the depending parts as few and as near the ceiling as possible is to be satisfied. And with this reduction in space arises the problems of insuring the complete removal of the valve and strut before any of their parts can lodge against the outer end of the yoke or deflector. Should any such lodgment occur the desired uniform distribution of the discharge and the required coverage of the area protected by the sprinkler would not be attained. Accordingly, it is most important, when a sprinkler opens that its removable parts be promptly and completely removed from the fixed parts leaving a clear unobstructed course for flow from the valve seat to the deflector.

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It is, therefore, an object of the present invention to provide a sprinkler, the greater portion of which is above the surface of a ceiling and has only its heat responsive element and a short unitary yoke embodying a deflector projecting below that surface. Another object is to provide directing means which, upon the response of the sprinkler for fire extinguishing discharge, will insure the prompt and complete removal of the parts normally interposed between the valve seat and the deflector. A feature of the particular form of sprinkler herein disclosed is that one member of the strut is engageable with the valve and the latter is caused to travel with the parts moving under the influence of the directing means. Other objects regarding details of construction will be pointed out in the description which follows. In general, it is the purpose of the present invention to provide an improved sprinkler which will not only satisfy the aesthetic desires of the discriminating user but will meet the requirements of the insurance authorities as to reliability and performance.

The best mode in which it has been contemplated to apply the principles of the present invention is shown in the accompanying drawings, but these are to be deemed merely illustrative because it is intended that the patent shall cover by suitable expression in the appended claims whatever features of patentable novelty exist in the invention disclosed.

In the accompanying drawings:

Fig. 1 is an elevation, partly in section, showing a sprinkler embodying the present improvements, as it may be installed in relation to a ceiling;

Fig. 2 is another elevation of the sprinkler, in section as on line 2—2 of Fig. 1;

Fig. 3 is a cross section of an arm, taken as on line 3—3 of Fig. 1;

Fig. 4 is a plan view of the valve and cap assembly shown in Figs. 1 to 9;

Fig. 5 is a partial section taken as on line 5—5 of Fig. 1;

Fig. 6 is an axial view, reduced in size, looking upward at the sprinkler shown in Fig. 2;

Fig. 7 is another axial view, also reduced in size, looking downward in Fig. 2;

Fig. 8 is a partial elevation, in section like Fig. 2, but showing in full lines the positions of the valve and certain parts of the strut just after the thermally responsive element has reacted to a predetermined temperature, and also showing in dotted outline the positions of these parts and the valve a moment or so later;

Fig. 9 is another partial elevation, in section,

showing the sprinkler fully open for discharge and indicating the course of travel of the valve and the certain parts of the strut seen in Fig. 8;

Fig. 10 is still another partial elevation like Fig. 2 but showing certain modifications; and

Fig. 11 is a plan view of the modified cap of Fig. 10.

Referring now more particularly to the drawings, there is indicated in Fig. 1 a ceiling 1 having an opening 1*a* through which the improved sprinkler 2 may be inserted and connected with a distributing system represented by a coupling 3 and a portion of a nipple 4. Although herein referred to and described as a "ceiling sprinkler" it is to be understood that the improved sprinkler can also be installed in like manner with respect to a wall or other surface where minimum exposure of the sprinkler parts is desirable.

The improved sprinkler has a body comprising an exteriorly threaded stem 6 which is screwed into the nipple 4 of the distributing system normally filled with a fire extinguishing medium, such as water, under pressure. Although designed for and intended to be used with a "wet pipe system," in which the water, for example, fills the system and stands at the sprinkler ready for immediate fire extinguishing discharge, the improved sprinkler is nevertheless capable of being used with a "dry pipe system" wherein the distributing pipes beyond a suitable valve are filled with a gas, such as air, under pressure.

At the inner end of the stem 6 the body has a diametrically extending portion 7 which for the most part is hollow, there being an open space 8 between its top plate 9, its side walls 10 and its bottom plate 11. Midway on the outer sides of the side walls 10 are lugs 12 which are solid except for holes 13 extending through them parallel to the axis of the sprinkler. The outstanding surfaces 14 of these lugs, as well as the edges 15 of the side walls and the circular edge 16 of the bottom plate 11 are provided with threads on which a hub flange 17 of a ceiling plate 18 may be screwed to cover over the otherwise open portion of the opening 1*a* in the ceiling.

The face 19 of the bottom plate is tapered inward and terminates in a relatively large central opening 20 coaxially arranged with the throat 23 of the sprinkler which is preferably tapered as shown and extends through the stem 6 and top plate 9 and has at its inner edge a seat 24 formed on a flange ring 25 depending from the plane of the top plate 9.

When the sprinkler is open for discharge, as shown in Fig. 9, the fire extinguishing medium passes from the throat 23 as a jet through the opening 20 into contact with a deflector 26 set crosswise of the stream. It is a feature of the design herein shown that this deflector is itself part of the yoke of the sprinkler, the remaining parts being two arms 27 arranged diametrically of the deflector and extending from the edge of the latter into the holes 13 of the lugs 12 on the body.

At its center the deflector has an upstanding hub 28 from which a flat annular surface 29 extends outward and merges into an inclined annular surface 30. The latter surface and to some extent the inner flat surface are interrupted by notches 31 which extend inward from the periphery of the deflector, thus providing a series of tongues 32 around the edge. Two of these tongues, diametrically opposed, merge into the arms 27 as clearly seen in Fig. 6. Near the deflector, in the zone through which the fire extinguishing medium is deflected outward and upward, these arms are of somewhat streamlined cross section, as shown in Fig. 3, beyond which the arms are round for insertion in the holes 13. Near the end of each arm is a series of grooves 33 for a purpose presently to be described.

When the sprinkler is closed a valve 34 rests on the seat 24 and between the valve and the hub 28 of the deflector is a strut having a thermally responsive element adopted to react at some predetermined temperature and permit the valve to open. I prefer to use the form of strut disclosed in my Patent No. 1,996,077 of April 2, 1935, not merely because it lends itself to the symmetry of the entire design but also because the greater portion of the strut is instantly removed when the predetermined temperature is reached at which the sprinkler is to go into discharging action. This "greater portion" just mentioned is a frangible bulb 35 containing a charge which expands upon rise of temperature and at a predetermined degree acts with explosive force to completely shatter the bulb and remove it from the sprinkler. Another reason for using this form of strut is that by another feature of the present invention what remains of the strut after the disappearance of the bulb is utilized to engage the valve and, in conjunction with novel directing means, to cause the valve to travel in a course which prevents lodgment of the valve or the remaining parts of the strut on the deflector 26 or arms 27.

The valve 34 is preferably cup-shaped having a soft metal gasket 36 formed to fit snugly the convex outer surface of the valve with a flanged edge for contact with the seat 24 on the body. Against the edge of the convex side of the valve is placed the rim of a spring disc 37 having a central hole. In the latter is the flanged edge of a spacer ring 38 which separates the center portion of the spring disc 37 from the corresponding portion of another like spring disc 39. The outer rim of this latter spring disc rests against an annular seat 40 of a cap member 41.

This cap member has a skirt 42 which extends past the outer edges of the discs and valve and when these several parts are assembled in the cap, with the spring discs flat and not exerting any force, the edge 43 of the skirt is spun over to retain these several parts together as a sub-assembly unit. The head of the cap has a central opening 44 and around its outer edge is a seat for a ring gasket 45. On the latter rests the frangible bulb 35 with its sealed neck extending through the central openings in the cap, spring discs and spacer and into the hollow of the valve. The other end of the bulb rests against another gasket ring 46 provided on the central hub 28 of the deflector.

Mounted on the cap 41 shown in Figs. 1 to 9 are a pair of straight cylindrical pins 47 located in one quadrant of the periphery and standing radially outward from the cap. In the modification shown in Figs. 10 and 11 only one such pin 47*a* is employed and this is bent at its outer end to form a sort of hook. When this single pin 47*a* is used a rounded-over flange 48 on the bottom plate 11 is provided to coact with the pin and constitute the directing means hereinbefore mentioned. When the two pins 47 of Figs. 1 to 9 are employed the edge of the hole 20 in the bottom plate 11 is preferably surrounded by a flange 49 to reinforce the edge, but it can be left square as shown. This flange 49 also coacts with the pins 47, but if it were not present the pins would

nevertheless coact with the edge of the opening **20** as will presently appear.

With the valve, cap and enclosed parts assembled together as previously described, the unit is placed on the valve seat **24**, the body of the sprinkler then being in reversed position from that shown in the drawings. The pins **47** (or the pin **47***a*) are positioned in the open space **8** of the body on one side or the other of a plane passing through the axes of the arms **27**. The neck of the bulb **35** is inserted in the unit and the yoke is applied by inserting the arms **27** in the holes **13** thus bringing the gasket ring **46** to bear on the bulb. With the outer flat surface **50** of the deflector held fixed in position, pressure is applied to the stem **6** of the body to impose a predetermined load on the strut. This is made possible by the yielding of the spring discs **37** and **39** thus permitting the body and valve to be moved toward the bulb. When the proper loading, somewhere in the range of from 100 to 125 pounds per square inch has thus been imposed, a pair of compression jaws (not shown) are applied to opposit sides of the lugs **12** according to the method set forth in my Patent No. 2,085,987, of July 6, 1937. The resulting depressions in the surface of a lug are indicated at **51** in Figs. 1 and 5. The purpose of the series of grooves **33** is now appreciated because if the position of the body should vary slightly with respect to the location of the compression jaws (these being at a fixed distance from the stop against which the flat surface **50** of the deflector is placed) there will nevertheless be one or more grooves opposite the jaws into which the metal of the lugs can be pressed without causing any shifting of the body. Thus a predetermined load is placed on the strut and the relative position of the various parts will then be as seen in Fig. 2. It is to be noted that in its thus finally assembled condition, the pins **47** are slightly separated from the flange **49** and the spun-over edge **43** of the cap's skirt is slightly removed from the valve.

When a fire occurs in the vicinity of a sprinkler and the heat therefrom raises the temperature of the bulb to a predetermined degree, (usually 135° F.) the bulb will explode and disintegrate, thus instantly releasing all holding pressure on the cap **41**. It is believed that the first action which takes place thereafter is the flattening out of the spring discs. This appears to occur while the valve and its gasket are still tight against the valve seat **24**. The straightening out of the discs tends to move the cap **41** directly away from the valve but a very slight movement of the cap in this manner brings the pins **47** against the flange **49**. This engagement causes the cap to tilt slightly as shown in full lines in Fig. 8. When this occurs the spun-over edge **43** of the cap engages the valve and, if there is any tendency for the gasket to stick to the valve seat, aids in the separation of the valve from its seat.

All this just described action of the spring discs, cap and pins takes place with extreme rapidity but only precedes momentarily the complete dislodgment of the valve and what remains of the strut after the bulb has disappeared. The force imposed upon the valve by the fluid standing under pressure in the sprinkler is always tending to push the valve from its seat and as soon as the force holding the valve to its seat is released, the valve and the remaining parts of the strut are forced downward. Were it not for the directing means these movable parts might lodge against

the deflector and prevent the desired uniform distribution from the sprinkler.

As the valve and associated parts of the strut begin their downward movement under the force of the fluid, they first move with a sort of swinging action as the pins **47** on one side of the cap continue to engage the flange **49**. This causes the valve to tip and be so disposed in the path of the stream which issues from the throat that as the pins slide off the bottom plate a component of the fluid force becomes effective to push the valve and the parts of the strut to one side in a course of travel which carries them clear of the deflector. The course of these moving parts is indicated by the dotted outline of them shown in Fig. 9. The same course of travel is followed when the cap has only the single hooked pin of Figs. 10 and 11. The engagement of the hooked end as it slides over the rounded surface of the flange **48** likewise causes the valve and associated parts of the strut to tip and be acted upon by a component of the fluid force. With either the two plain pins **47** or the single modified pin **47***a* the valve and movable parts are thrown clear of the sprinkler and thus the latter is fully opened for effective discharge.

Some of the fire extinguishing medium strikes the nearby deflector with considerable force while other portions of the stream pass through the notches **31** around the edge of the deflector. These latter portions spread outward as they continue downward and take care of the outer regions of the area below served by the sprinkler. The fluid striking the hub and the upper flat and inclined surfaces of the deflector is broken up and directed upward and outward at various angles of inclination toward the ceiling. Thus the desired area of the latter is well covered by the fire extinguishing medium which then promptly falls downward and completes the coverage of the area below. The streamline like shape of the arms offers substantially no obstruction to the fluid moving toward the ceiling and if shaped as shown in Fig. 3, the distribution beyond these arms is substantially as uniform as throughout the rest of the ceiling area wetted.

The ceiling plate **18** can be removed if the ceiling is to be painted and the paint, if applied with ordinary care, can be brushed on to the edge of the hole **1***a* without any of it touching the sprinkler. Frequently it is desired to paint this ceiling plate **18** and this can be done without fear of damaging the sprinkler even if the paint should pass beyond the cap **18** and get into the little annular groove or space **52** between the bottom plate **11** and the cap **41**. Tests have established that even if paint is sprayed all over the exposed parts of the sprinkler, and into the space **52**, the bulb nevertheless responds at the predetermined temperature and the valve and other parts of the strut are immediately wholly dislodged, thus opening the sprinkler for effective discharge.

Most of the sprinkler is hidden above the surface of the ceiling and the appearance of the necessarily exposed elements is not objectionable even where appearance is deemed most important. The sprinkler nevertheless fully satisfies its required performance. All the parts of the strut and the valve are promptly and entirely removed from the sprinkler when the need arises, leaving a straight unobstructed waterway direct to the deflector. The latter is rigid and strong being a part of the yoke as a whole. The latter

is so close to the ceiling and so firmly supported on the body by the short rugged arms, that it successfully resists any blows which may happen to strike it, as from a brush, ladder or other such thing. Thus the improved sprinkler provides the inconspicuous appearance demanded by a discriminating user, without in any wise sacrificing its reliability to stand by and, when called upon, to produce the desired effective fire extinguishing discharge.

I claim:

1. An automatic sprinkler having a body with a passageway for fluid, a frame extending from said body having a deflector opposite said passageway; a valve for closing said passageway; and means interposed between said valve and said frame for holding said valve closed comprising a thermally responsive element adapted to react at a predetermined temperature and release said valve; the last said means having a member in position for temporarily engaging a portion of said body upon release of the valve to tip the valve with respect to the axis of the fluid stream issuing from said passageway whereby a component of the force exerted by the stream is effective to push the valve to one side and avoid lodgment of the valve against the deflector.

2. An automatic sprinkler having a body with a passageway for fluid terminating in a valve seat at its discharge end; a frame secured to said body and comprising a deflector across the path of flow from said passageway; and removable means interposed between said deflector and said seat comprising valve means and a thermally responsive element adapted to react at a predetermined temperature and release said removable means; the said valve means having a member in position to be temporarily and slidably engageable with the body following the release of said removable means for directing the removable means clear of said body and frame as said removable means are subjected to the force of the fluid issuing from said passageway.

3. An automatic sprinkler having a body with a passageway for fluid, a frame extending from said body having a deflector opposite said passageway, a valve for closing said passageway; and a strut interposed between said valve and said frame for holding said valve closed; said strut comprising a thermally responsive element adapted to react at a predetermined temperature to release said strut and having a member in position to be temporarily and slidably engageable with said body after said strut is released; the said element during its sliding engagement with the body causing said valve to tip with respect to the fluid issuing from the passageway whereby the fluid acts upon said valve at such an angle as to move it clear of said frame.

4. An automatic sprinkler having a body with a passageway for fluid; a fixed frame extending from said body with a deflector positioned across the path of flow from said passageway; a valve for closing said passageway; and a strut interposed between said valve and said deflector for holding said valve closed; the strut having a thermally responsive element capable of being dislodged upon attaining a predetermined temperature, and the remainder of the strut having means for engaging the valve and other means for temporarily engaging a portion of the said body upon the dislodgment of the thermally responsive element; the last said means during its temporary engagement with the body causing the valve to tilt with respect to the said path of flow so that the fluid flowing from said passageway forces the valve and said remainder of the strut clear of said frame and deflector.

5. An automatic sprinkler having a body with a passageway for fluid; a deflector secured to said body and arranged in the path of flow from said passageway; an assembled unit comprising a valve for closing said passageway and a cap member overlying said valve having an arm extending sidewise for slidably engaging a portion of the body; and a thermally responsive element interposed between said cap member and said deflector being adapted to react at a predetermined temperature and release said assembled unit; the said arm moving into engagement with the body upon release of said assembled unit, and causing the valve unit to tip in the path of flow whereby a component of the force of the fluid issuing from the passageway acts on said unit to move it clear of the deflector.

6. An automatic sprinkler having a body with a passageway for fluid, valve means for closing said passageway, a deflector secured to said body and positioned across the path of flow from the passageway, and a strut interposed between said deflector and said valve means comprising a thermally responsive element capable of reacting at a predetermined temperature to release said strut; said valve means comprising a member outstanding therefrom and temporarily engageable with the said body following the initial displacement of said valve means upon release of said strut for tipping the valve means in the path of flow so that the fluid issuing from the passageway will move the valve and strut clear of the deflector.

7. An automatic sprinkler having a body with a passageway for fluid, a frame extending from said body having a deflector opposite said passageway, a valve for closing said passageway and means interposed between said valve and said frame for holding said valve closed; said means comprising resilient discs resting against said valve, a cap member overlying said discs, and a charged frangible bulb held between said cap member and said frame and adapted upon being heated to a predetermined temperature to explode and remove itself from the sprinkler; the said cap member having an arm outstanding from the side thereof for engaging a portion of the body as the cap member moves under the force of said fluid following the removal of said bulb; the said engagement of the arm and body causing the cap member and valve to tip with respect to the axes of the stream of fluid issuing from said passageway whereby a component of the force of the fluid is effective to push the valve and cap member clear of said frame.

8. An automatic sprinkler having a body with a passageway for fluid; a frame extending from said body having a deflector opposite said passageway, and means interposed between the discharge end of said passageway and said deflector for preventing flow of said fluid; said means comprising a charged frangible bulb capable upon being heated to a predetermined temperature of exploding and removing itself from the sprinkler, and a unit assembly interposed between said bulb and the end of the passageway; the said unit assembly comprising a cup-shaped valve seated on the edge of said passageway, a pair of spring discs with the rim of one resting on said valve, a spacer sleeve between the discs at their inner portions to enable the

rims of said discs to flex, and a cap member resting on the rim of the other of said discs and providing a seat for the bulb; said cap member having a skirt extending beside the rim of said discs and valve with its edge turned inward to overlie an annular portion of the valve, and an arm extending sidewise from the cap member for slidable engagement with a portion of the body; the said engagement taking place following the removal of said bulb as the unit assembly is displaced by the force of the fluid in said passageway, and causing said unit assembly to tip at such an angle to the axis of the fluid stream issuing from the passageway that upon the arm

sliding off the said portion of the body the unit assembly is pushed sidewise by a component of the force of the fluid to avoid lodgment of the unit assembly against the deflector.

ALBERT J. LOEPSINGER.

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