

Sept. 7, 1965

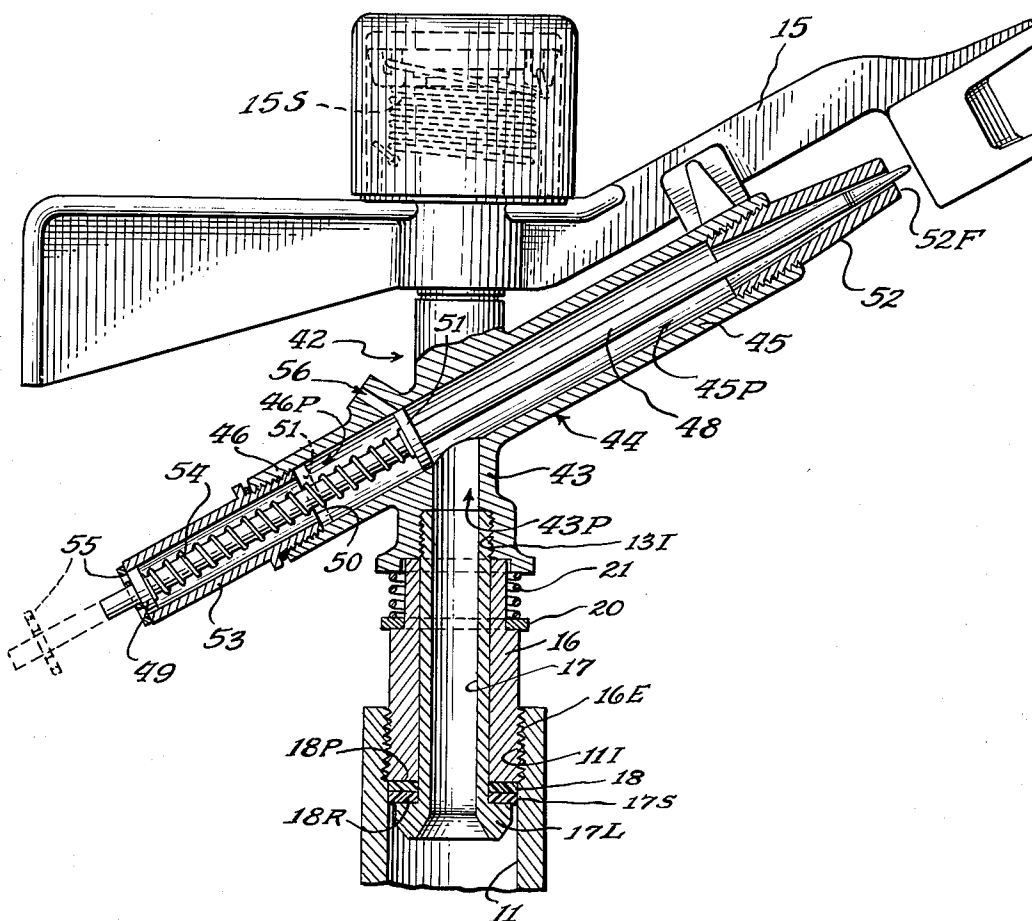
E. J. SENNINGER
ROTARY IMPULSE SPRINKLER HAVING AN
INTERNAL SHAFT CLEARING MEMBER

3,204,873

Filed Oct. 1, 1964

2 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

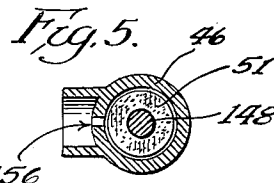
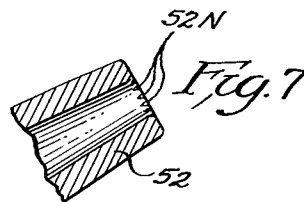
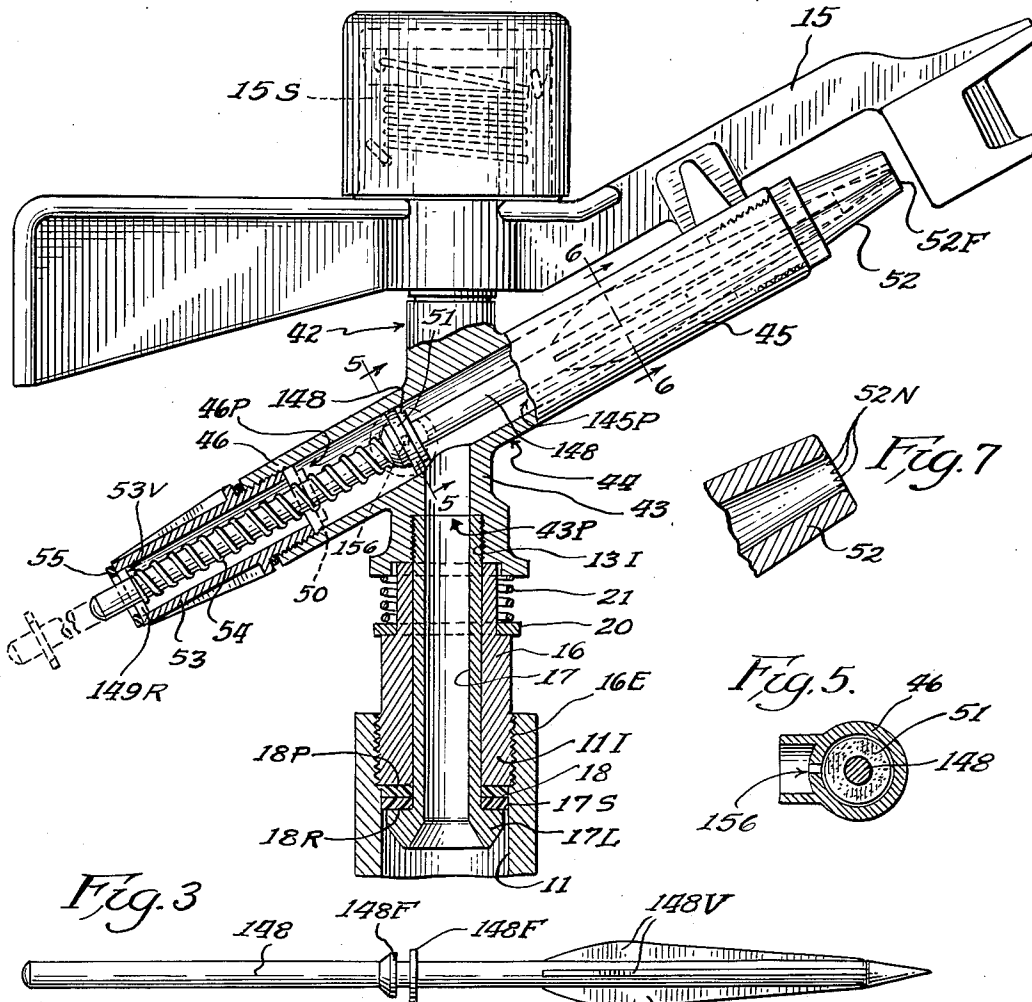


Fig. 3

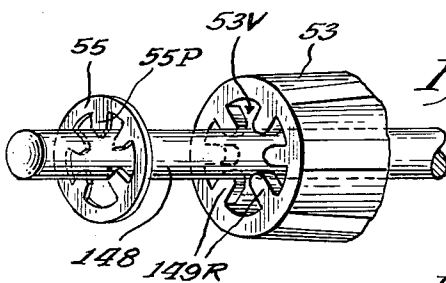
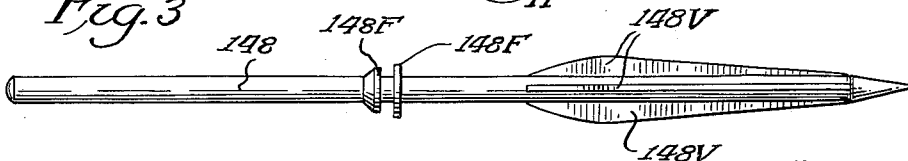


Fig. 4.

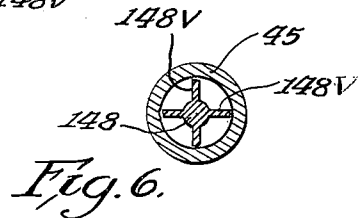


Fig. 6.

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ROTARY IMPULSE SPRINKLER HAVING AN INTERNAL SHAFT CLEARING MEMBER

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9 Claims. (Cl. 239—230)

This application is filed as a continuation-in-part of pending application Serial No. 313,974, filed October 4, 1963.

This invention relates to an automatic closure for blocking external access to the discharge opening of a spray nozzle device, and more particularly is concerned with an automatic closure that normally blocks the nozzle discharge opening and is shiftable in response to pressure of liquid within the nozzle to unblock the opening and permit normal discharge therethrough.

One important application of this invention exists in the hammer or impulse type of rotary sprinkler such as is now being used extensively for citrus irrigation. Commonly, these rotary sprinklers are spaced from 50 to 100 feet apart and employ nozzles with a discharge opening having a diameter in the range of $\frac{1}{8}$ to $\frac{5}{16}$ inch.

A common trouble with sprinklers employed for citrus irrigation is created by "mud daubers" and other wasps and bees who find the nozzle discharge opening a convenient place to build their nests. Where the sprinkler is not used for several days, the nozzle can actually become completely blocked by these nests. In citrus groves the spray nozzle head is carried atop a fixed riser and may be located as much as 20 or 30 feet in the air. Thus, blockage of the nozzle presents a difficult maintenance problem due to the difficulty of providing access to the actual nozzle opening. Where hundreds and even thousands of sprinklers are used in a single system, the maintenance problem is very serious.

The principal object of the present invention is to provide an automatic closure for blocking external access to the nozzle discharge opening when the device is not in use.

Another object of the invention is to provide such an automatic closure controlled by pressure of liquid therein.

Still another object of the invention is to provide an automatic closure responsive to liquid pressure and spring biased to normally maintain the discharge opening blocked only when pressure is not acting within the device.

In the preferred form the invention provides such an automatic closure in which a shaft is slidable within a through passage which defines a discharge section at one end and a vent section at the other end, with the shaft being resiliently biased to a blocking position preventing entry of insects at either end and with the shaft carrying a piston valve responsive to a predetermined pressure within the device to shift the shaft to an unblocking position.

An important feature of the invention is the provision of a loose fitting piston valve to allow flushing flow through the vent section each time the device is turned on.

Another important feature of the invention is the provision of a small auxiliary nozzle arranged in angular relation to the main flow stream to avoid clogging and located at a position to be blocked by the piston valve until the device is turned on.

Still another important feature of the invention is the provision of a shaft equipped with lengthwise directed radial vanes that divide and channel the main flow stream to avoid turbulence and loss of efficiency.

Other objects and advantages of the invention will become apparent during the course of the following description.

In the accompanying drawings forming a part of this

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specification and in which like numerals are employed to designate like parts throughout the same:

FIGURE 1 is an elevational view of an impulse hammer type sprinkler head equipped with an automatic closure in accordance with this invention, with parts thereof broken away and sectioned to facilitate the disclosure;

FIGURE 2 is a side elevational view partly in section of a similar type sprinkler head and automatic closure with certain features of construction shown in modified form;

FIGURE 3 is a side elevational view of a shaft employed in the embodiment of FIGURE 2;

FIGURE 4 is a fragmentary perspective view of the shaft end region of the sprinkler head of FIGURE 2;

FIGURES 5 and 6 are fragmentary sectional views taken on the lines 5—5 and 6—6 of FIGURE 2; and

FIGURE 7 is a fragmentary lengthwise section of the nozzle end.

Referring now to FIGURES 1 to 3 of the drawings, a sprinkler device of the impulse hammer operated type is shown generally at 10 and is rotatably mounted atop a riser 11. In the case of citrus groves, it will be understood that these risers may be spaced at 50 or 100 foot intervals over the area to be sprayed and may project 20 to 30 feet above ground with a common source of water under pressure being connected to a plurality of risers through an underground conduit system (not shown).

The sprinkler device as illustrated in FIGURE 1 includes a spray nozzle head 42 that includes a vertical stem 43 and a discharge tube 44 directed obliquely upwardly from the stem at a location intermediately therealong. The head 42 has an inertially operated impulse hammer mechanism 15 swingably mounted thereon at the upper end of the stem 13 for oscillation about a vertical axis coincident with the axis of the riser 11. The head 42 is mounted for rotation on the upper end of the riser 11 and for this purpose a tubular bearing 16 has external threading 16E on its lower end for fixed engagement with internal threading 11I within the upper end of the riser 11.

A tubular spindle 17 projects through and is arranged in rotatably journaled relation with the bearing 16. The spindle 17 has external threading 17E on its upper end fixedly engaged with internal threading 13I within the enlarged lower end of the nozzle head stem 13. The spindle 17 has a lower end enlargement 17L providing an annular seat 17S that receives a laminar annular gasket 18 having a rubber face 18R in stationary sealing engagement with the seat 17S and having a lubric plastic face 18P in rotary sliding engagement with the axial end face of the bearing 16. The bearing 16 has a reduced upper end receiving a washer-like seat ring 20 and a helical coil spring 21 that reacts between the bearing 16 and an axial end face on the lower end of the nozzle head while accommodating relative rotation therebetween.

The discharge tube 44 is obliquely inclined to the stem 43 and has a nozzle tube portion 45 providing an upwardly inclined forwardly directed spray discharge flow passage 45P and a vent tube portion 46 providing a downwardly inclined rearwardly directed vent tube passage 46P axially aligned in direct end to end communication therewith. The stem 43 provides a liquid flow inlet passage 43P intersecting obliquely with and intermediately into the discharge tube 44 to define the passages 45P and 46P.

A separate nozzle tip 52 may be threadedly fixed in the nozzle tube portion to form an endwise extension thereof and of the flow passage with the tip 52 terminating in nozzle face portions 52F that border and define a discharge opening for the passage 45P that is of substantially smaller transverse cross sectional dimension than the discharge flow passage 45P.

A separate vent system 53 may be threaded in the vent tube portion 46 to provide a rear extension thereof that terminates in a vent opening 53V.

During normal use of the device, the riser 11 (which is connected to an underground conduit system equipped with a suitable shut-off valve) serves to supply liquid under pressure into the head 12 to flow through the stem passage 43P and the nozzle tube 44P for discharge through the discharge opening along a line such as is generally indicated at L in FIGURE 3. The spray discharge acts upon the hammer element 15 in the usual way and in conjunction with the return spring 15S for the hammer element, intermittent or step-by-step unidirectional movement of the sprinkler head results so that each sprinkler ultimately covers a circular area. When the sprinklers are turned off by closing the shut-off valves of the main distribution system, it usually results that the nozzle tube 44 and tip 52 are free of liquid and they have been found to offer attractive nesting facilities to mud daubers and other wasps and bees.

In accordance with this invention, the blockage problem resulting from the nesting tendency of these insects is eliminated by providing an automatic closure for blocking external access to the discharge opening. An automatic closure element for blocking external access to the discharge opening is provided in the form of a shaft 48 that is movable within the discharge tube 44.

The passages 45P and 46P are axially aligned end to end and collectively comprise a through passage that serves as a slide chamber for the shaft 48 which extends end-to-end through the vent passage and discharge passage. The shaft 48 is substantially smaller in transverse cross section than either of these passages to allow desired flow.

A spring seat and shaft guide 49 is fixed within the rear of the vent stem 53 to define the vent opening and the forward end face of the vent stem 53 provides a valve seat 50 located intermediately along the vent passage 46P to face towards the discharge passage 45P.

A piston valve 51 preferably in the form of a rubber washer is fast upon the shaft 48 and is freely slideable therewith along a region of the slide chamber extending between the valve seat 50 and the discharge flow passage 45P. The piston valve 51 is arranged in slight clearance relation within the vent tube portion 46 to insure free sliding movement of the valve 51 with the shaft 48 and to enable limited water flow through the vent passage while the valve 51 is moving towards passage seating engagement on the seat 50, following turn on of the device. This periodic momentary flow of water is desirable in preventing faulty operation as it flushes sand, dirt or other foreign materials that may have entered the head around the piston valve and out the vent opening 53V.

Resiliently yieldable means normally urge the shaft 48 outwardly along the discharge flow passage 45P to project an end portion of the shaft into loose fitting blocking relation in the discharge opening and to space the piston valve 51 from the valve seat 50 a distance great enough to allow sufficient retraction of the shaft to clear the tip 52 and allow free liquid discharge therethrough. As illustrated in FIG. 1, the resiliently yieldable means preferably comprise an elongated coil spring 54 encircling the shaft 58 and reacting between the spring seat 49 and the piston valve 51.

Thus, when the device is not in use, the spring 54 urges the shaft 48 forwardly to project the outer end of the shaft through the tip 52 sufficiently to block external access to the discharge opening. The maximum forward position for the shaft may be determined by direct engagement of the shaft with the nozzle tip but to prevent the possibility of sticking of the shaft, a free sliding action is achieved by maintaining loose fitting clearance between these parts and a stop in the form of a shield 55 is provided fast on the exposed rear end of the shaft 48 to

engage the spring seat 49 to determine the blocking position of the shaft.

In order to enable a proper flow of flushing water, the effective area through the vent opening 53V which is determined by the elements 48 and 49 must be substantially greater than the flow around the piston valve. Satisfying this requirement leads to a vent passage discharge opening 53V of a size which is itself subject to blockage by nesting insects but the external stop shield 55 is arranged to span the vent opening and effectively close it against ingress of insects.

It will be noted that the tube 44 may be provided with a side wall passage 56 constituting an ancillary nozzle discharge passage the inner end of which is spanned by the piston valve 51 when the device is not-in-use, and the shaft is in its blocking position. The passage 56 may be small enough to be free of the nesting problem, but the piston valve 51 will block insects from entering the main head passages.

It may also be seen that when the shaft 48 is in its blocking position, the piston valve has its lower extremity immediately adjacent the water inlet passage 43P. Therefore, in the event that sand, dirt, or other foreign material of a size too large to pass around the piston valve 51 is trapped in the through passage, the forward movement of the piston valve following turn-off of the sprinkler serves to physically move such foreign particles to a position where they can fall by gravity down the riser 11.

Another embodiment of the invention is illustrated in FIGURE 2, and many of its main elements are similar in construction and bear identical reference characters to the corresponding elements already described with reference to FIGURE 1. A number of modifications and improvements are incorporated in the rotary sprinkler illustrated in FIGURE 2, and these include the use of a vaned shaft 148 (FIGURE 3), the provision of a modified side wall passage 156 (FIGURE 5), and the formation of the spring seat and shaft guide as integral ribs 149R (FIGURE 4) at the rear of the vent stem 53 and projecting radially inwardly to terminate adjacent the shaft portion which is movable therethrough.

The improved shaft 148 is equipped with integrally formed lengthwise directed radial vanes 148V that divide the discharge flow passage 145P and channel the main flow stream moving therethrough to avoid turbulence and loss of efficiency. The vanes 148V serve the additional function of tending to center the shaft within the nozzle 52, particularly during operation of the sprinkler when the shaft might develop a lateral vibration if the vanes were not present. It should be noted, however, that the vanes 148V have a slight clearance in the tube 44 and thus do not act as a forward limit stop for the shaft, this function again being accomplished by the shield 55 fastened at the rear of the shaft. The shield 55 is a metal stamping having prongs 55P which bite into the shaft 148 to locate the shield in a fixed relation.

Since the vanes 148V are effective to stop nearly all turbulence, the range of the spray discharge produced by the sprinkler increases significantly and to insure that more discharge will drop off at regions near the sprinkler and insure a full coverage distribution pattern, rifling of the nozzle discharge opening is provided by forming notches 52N (FIGURE 7) in the nozzle tip. The effect of the rifling is to enable the main flow stream to discharge without substantial change except for peripheral regions which are rotated enough to be caused to break away and form small droplets that fall near the sprinkler.

A further modification apparent on shaft 148 is the provision of integral flanges 148F in closely spaced relation to define a socket for receiving the piston valve 51 in mechanically interlocked fixed position. The rear-most of these flanges also serves as a seat for the front end of the coil spring 54.

The side wall passage 156 projects laterally from the vent passage and as such may be made quite small with-

out creating serious problems of clogging due to foreign matter carried in the water passing through the sprinkler. As water moves upwardly through the inlet passage 43P the water which is to be discharged through the side wall passage 156 must move away from the main flow stream pattern and flow rearwardly and then laterally outwardly with the result that centrifugal force effects cause foreign objects that may be with this water to move on into the vent passage rather than to pass through the side wall passage 156. There is, therefore, no tendency for such foreign matter to enter and clog this passage 156.

For purposes of specific disclosure, certain clearance relationships are now given. Assuming the through passage to have a 1/2 inch diameter, the piston valve 51 is sized to provide a clearance with respect to the through passage of about .030 of an inch on the diameter. Practical constructions can advantageously employ clearances ranging from .010 to .060 of the diameter and even smaller clearances can be used, for example .002 of an inch where the head body material is not subject to warpage, swelling and similar problems.

Once the clearance around the piston valve 51 is established, the clearance through the vent passage discharge opening 53V should be arranged to be greater in effective area than that around the piston valve 51. Finally, the vanes 148V on the shaft should operate in the through passage with a peripheral clearance ranging from .010 to .020 of an inch, and the point of the stem should fit very loosely in the nozzle just sufficiently to block ingress of insects.

The principal parts of the sprinkler head, namely the vertical stem 43 and the discharge tube 44, are preferably formed of a molded plastic such as Delrin and the shaft 48 or 148 may be of nylon, while the piston valve 41 may be of rubber, neoprene, Buna-N, or any other similar material.

While specific embodiments of the invention have been illustrated herein, it is to be understood that changes and variations may be made by those skilled in the art without departing from the spirit and scope of the appended claims.

What is claimed is:

1. In a rotary sprinkler of the impulse type which includes a sprinkler head adapted to be rotatably mounted on a vertical riser, and intermittently rotated through a selected angle by an impulse hammer operated by water passing through the riser and issuing from the head, said sprinkler head having means defining a vertical passage communicating with an oblique passage, the latter passage having at its forward end a nozzle having an orifice opening of at least about 1/8", and having at its rearward end, and in axial alignment therewith, a vent orifice through a wall of the head, a shaft extending substantially the full length of the oblique passage, with the forward end of the shaft, when the sprinkler is not operating, projecting loosely into said nozzle orifice to block said orifice against ingress by insects, a piston mounted on the shaft rearwardly of said vertical passage and having radial clearance of at least about 10/1000 of an inch with the wall of said oblique passage, the rear end of the shaft projecting through said vent orifice and providing a water discharge opening around the shaft at least as large in area as the area of the annular clearance space between the piston and the adjacent wall of the oblique passage, a forwardly facing seat rearwardly of the piston for limiting rearward movement of the shaft within the oblique passage, resilient means urging the shaft forwardly, and a stop shield mounted on the rear end of the shaft exteriorly of the head for limiting forward movement of the shaft in response to said resilient means, said shield substantially closing the vent orifice to ingress by insects while the sprinkler is inoperative and while the shaft is in its forward position in response to said resilient means.

2. A sprinkler as set forth in claim 1 in which said seat cooperates with said piston when the shaft is in its rear-

most position to seal the vent orifice from the portion of the oblique passage which is forward of the piston.

3. A sprinkler as set forth in claim 1 in which the forward end of the shaft is provided with radial vanes having loose fitting engagement with the walls of said oblique passage.

4. A sprinkler as set forth in claim 1 in which a side orifice is provided in the side wall of the sprinkler head, said side orifice being positioned so that it is closed by said piston when the shaft is in its forward position but provides communication between the oblique passage and the exterior of the head when the shaft is moved rearwardly in response to water pressure in said oblique passage.

5. A sprinkler as set forth in claim 1 in which said seat and piston cooperate to form a water seal when the shaft is moved rearwardly in response to water pressure in said oblique passage, and in which said radial clearance between the piston and the wall of the oblique passage permits foreign material to be flushed rearwardly through said vent passage while the shaft is being moved rearwardly and the piston is moved toward its seat.

6. A sprinkler as set forth in claim 1 in which the shaft is made of plastic material and is of unitary construction, and in which the stop shield is frictionally secured to the rear end of the shaft.

7. A sprinkler as set forth in claim 1 in which the sprinkler head has a vent tube interiorly threaded into the rearward end of the oblique passage, the forward end of the vent tube constituting said forwardly facing seat and the rear end of the vent tube having inwardly directed spaced radial ribs serving to guide longitudinal movement of the shaft, with the spaces between the ribs collectively constituting said water discharge opening.

8. A sprinkler as set forth in claim 1 in which the discharge nozzle is provided with rifling notches to thereby impart rotary swirl to peripheral portions of the water flowing through the nozzle to cause formation of droplets that fall close to the sprinkler.

9. In a rotary sprinkler of the impulse type which includes a sprinkler head adapted to be rotatably mounted on a vertical riser, and intermittently rotated through a selected angle by an impulse hammer operated by water passing through the riser and issuing from the head, said sprinkler head having means defining a vertical passage communicating with an oblique passage, the latter passage having at its forward end a nozzle having an orifice opening of at least about 1/8", and having at its lower end, and in alignment therewith a vent orifice through a wall of the head, said sprinkler head also having a side orifice in communication with said oblique passage, a shaft extending substantially the full length of the oblique passage, with the forward end of the shaft, when the sprinkler is not operating, projecting loosely into said nozzle orifice to block said orifice against ingress by insects, and with the rear end of the shaft projecting through said vent orifice, resilient means urging the shaft forwardly, means including a piston on the shaft, loosely fitted within the oblique passage and located rearwardly of said vertical passage means for moving the shaft rearwardly in response to fluid pressure in said oblique passage, and means carried by the shaft for substantially closing the side orifice and the vent orifice when the shaft is in its forward position, said last named means including said piston and a stop shield affixed to the rear end of the shaft.

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