

Feb. 6, 1962

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3,019,991

GYRATORY STEM SPRINKLERS WITH UPPER CHAMBER

Filed June 20, 1960

FIG. 1.

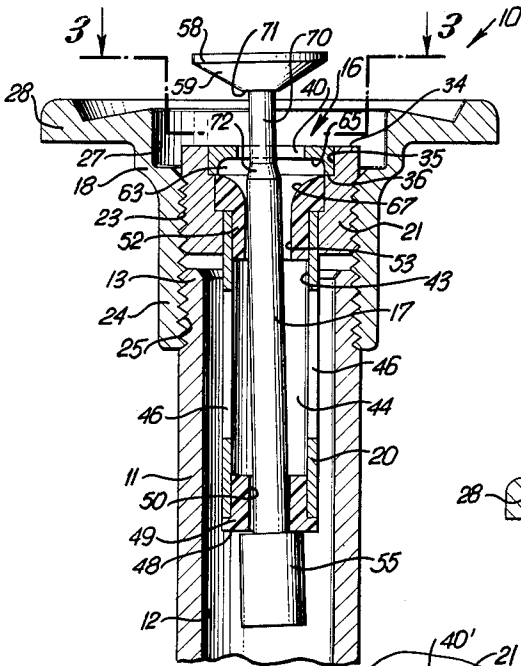


FIG. 4.

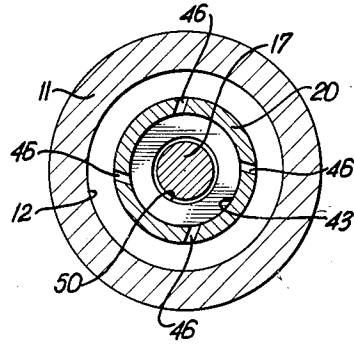


FIG. 2.

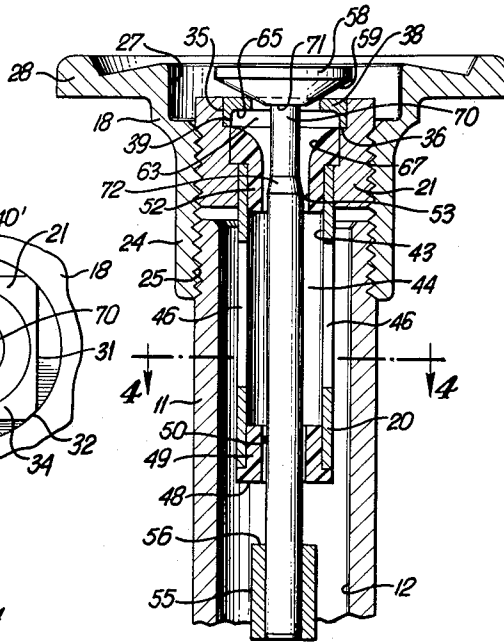


FIG. 5.

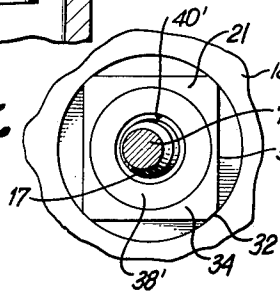
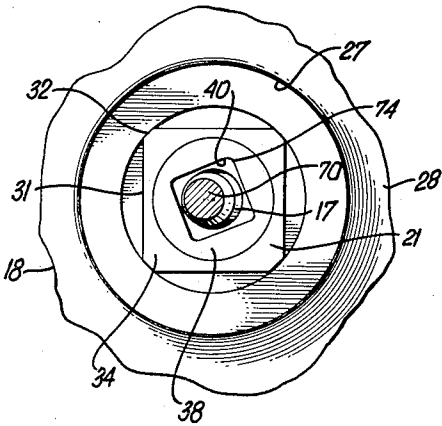


FIG. 3.



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1

2

3,019,991
GYRATORY STEM SPRINKLERS WITH
UPPER CHAMBER

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Filed June 20, 1960, Ser. No. 37,496
4 Claims. (Cl. 239-206)

This invention relates to improvements in sprinklers of the general type described in United States Patents Nos. 2,589,942 and 2,639,191, issued on March 18, 1952, and May 19, 1953, respectively.

The sprinklers of said patents are characterized by a stem extending into an open cavity formed in a sprinkler body, the body having water deflecting surfaces for causing swirl of water around in the body cavity, thereby to gyrate the stem around in the body cavity with the stem being inclined with respect to the axis of the body cavity, and with the result that the water is deflected outwardly by a head on the outer end of the stem and at constantly varying degrees of elevation around the sprinkler. For sprinklers of Patent No. 2,589,942, the stem is solid or otherwise closed against passage of water through the stem, whereas in the sprinklers of Patent No. 2,639,191 water passes through and outwardly from the stem.

A structural feature of the sprinklers of this invention is that the walls which define the water discharge opening extend radially inwardly from the inside surface of the sprinkler body, and as far as I can determine, this structure causes a radially inwardly directed force to be imparted to the water immediately prior to its being discharged from the body. Preferably, the new structure is such as to define a chamber proximate the discharge opening.

Comparing sprinklers of this invention with others of the solid stem gyratory type, those of this invention produce a spray pattern of much larger diameter and have a relatively low gallonage rating (gals./min./sq. ft.), thus permitting spraying over a large area for a long period of time without surface water run-off.

I have found further, that sprinklers of this invention may be constructed to produce spray patterns of non-circular outline, e.g. square, and the spray pattern produced is one of uniform density of water droplets throughout the area being sprayed.

General objects of this invention are to provide sprinklers of the above mentioned character which form spray patterns of evenly distributed water droplets over the area being sprayed, are simple and rugged in construction, efficient and reliable in operation, and are adapted to be manufactured at low cost.

Further objects and advantages of the invention will appear during the course of the following part of this specification wherein the details of construction and mode of operation of two preferred embodiments are described with reference to the accompanying drawing, in which:

FIG. 1 is a central vertical section through a lawn sprinkler of this invention, with the centrally disposed stem thereof appearing in side elevation and disposed in water-discharging position;

FIG. 2 is a central vertical section similar to that of FIG. 1 but showing the sprinkler in its shut-down position;

FIG. 3 is a cross section on an enlarged scale through the sprinkler and taken on line 3-3 of FIG. 1;

FIG. 4 is a cross section on an enlarged scale taken along line 4-4 of FIG. 2; and

FIG. 5 is a cross section similar to that of FIG. 3 but taken through a sprinkler in which the water discharge opening thereof is circular instead of square as in the embodiment of FIGS. 1-4.

Referring to FIGS. 1 to 4 in detail, there is shown a sprinkler head embodying this invention, the head being designated generally by reference numeral 10, and being mounted atop a riser pipe 11 of a lawn sprinkler installation which supplies water to the sprinkler head. The inside surface of the riser pipe is designated by reference numeral 12, and the upper end of the pipe by numeral 13.

Sprinkler head 10 comprises a hollow body 16 extending axially into the upper end of the riser pipe, a gyratory stem 17 in the body, and a casting 18 for mounting the body upon the upper end of the pipe. The body 16 comprises a rigid tube 20 and a collar 21 around the tube, the tube being force-fitted or otherwise suitably secured in the collar. The collar is externally screw threaded at 23 for securing the body 16 in the casting 18. The casting has a skirt portion 24 which is internally screw threaded at 25 for mounting the sprinkler head on the riser pipe. There is a recess 27 formed in the casting for positioning the collar below the upper surface of a radially outwardly extending flange portion 28 of the casting.

Sprinkler head 10 is formed, according to this invention, to produce a spray pattern of water droplets which is square in outline. For simplicity in orienting the sprinkler so that its square spray pattern will be aligned with the square area to be sprayed, the upper end portion of the collar 21 is formed to a square perimeter 31, as appears best in FIG. 3 of the drawing, whereby, when installing the sprinkler head, the same may be oriented to a position such that the corners 32 of the square 31 are aligned with the corners respectively of the square area to be sprayed. The square structure 31 of the upper end of the collar also provides for convenience in gripping the body 16 with a wrench, as a square socket wrench (not shown), for turning the body into the casting.

The upper end surface of the body 16 is designated by reference numeral 34. Collar 21 extends upwardly to such upper end surface 34 and thereby defines the outer marginal portion of the upper end surface 34. The collar has a centrally disposed annular recess 35 formed therein extending inwardly or downwardly from the upper end surface 34 and providing an upwardly facing annular shoulder 36. The recess receives a plate member 38 having a downwardly extending peripheral flange portion 39 which abuts against the annular shoulder 36 and is secured within the collar 21 as by being force-fitted in the recess 35. The plate member 38 has a water discharge opening 40 extending therethrough.

The inside surface of tubular portion 20 of the body 16 is cylindrical and is designated by numeral 43. It defines a cavity 44 in the body 16. Formed in the walls of the tubular portion 20 is a plurality of apertures 46 for admitting water into the body cavity from the riser 11. In the illustrated embodiment these apertures are formed as slits extending longitudinally of the body tube. As best shown in FIG. 4, the slits 46 extend through the body tube 20 at an angle with respect to the radii of the body cavity 44, to cause the water entering the body cavity through the inlet apertures to impart rotation and upward spiral motion to water in the body cavity.

The lower end surface of the body 16 is designated by numeral 48, it being defined by an annular bushing 49 which is secured in the lower end of the tubular portion 20 as by being force-fitted therein. Bushing 49 has a centrally disposed opening 50 extending therethrough in axial alignment with the water discharge opening 40 in the upper end of the body 16. The body has another annular bushing 52 positioned proximate the water discharge opening 40, the bushing 52 having an opening 53 extending therethrough and in axial alignment with bushing opening 50 and water discharge opening 40.

Stem 17 is arranged longitudinally in the body cavity 44, the stem extending upwardly through and beyond

the water discharge opening 40 and downwardly through the lower end opening 50 of the body. The stem is substantially smaller in diameter than the discharge opening 40. The lower end opening 50 of the body is only slightly larger in diameter than the stem, enough so that the lower end opening will preferably accommodate sufficient inclination of the stem with respect to the vertical axis of the body cavity to permit engagement of the stem with the inside walls of upper bushing 52.

There is a stop means in the form of a collar 55 secured on the lower end of the stem for preventing removal of the stem upwardly through the discharge opening 40. The stem is movable longitudinally in the body cavity whereby the illustrated embodiment is of the "pop-up" type, i.e. when water is turned on to the sprinkler, the stem moves upwardly to the position thereof shown in FIG. 1 by the force of water flowing through the sprinkler head. The extent of upward movement of the stem in the body is limited by engagement of upper end face or shoulder 56 of the collar 55 against the lower annular end surface 48 of the body. The stem may be a solid rod or otherwise suitably closed against passage of water axially through the stem.

At its upper end the stem has a head 58 which is larger in diameter than the discharge opening 40 whereby when water to the sprinkler is turned off, the sprinkler will drop down in the body to a position in which the head covers the discharge opening 40, as appears in FIG. 2. Undersurface 59 of the stem head is inclined upwardly around the stem so as to deflect water from the discharge opening radially outward around the sprinkler.

As thus far described, the mode of operation of the sprinkler head 10 is similar to the sprinkler head of FIG. 6 of the aforementioned Patent No. 2,589,942. A review of the explanation of the mode of operation of the sprinkler head of said patent and of the sprinkler heads of U.S. Patent No. 2,639,191, will make it clear that for the sprinkler head 10, the swirl of water around and upwardly in the body cavity 44 causes the stem 17 to gyrate around in the body with the axis of the stem being inclined with respect to the axis of the body cavity 44. In being so gyrated, the stem pivots adjacent or at the upper end shoulder 56 of the stop collar 55. The spray produced by outward deflection of water by the undersurface 59 of the stem head is one in which the water is deflected to a higher elevation from one side of the stem than at its opposite side because of the degree of inclination of the stem. The spray pattern thus produced is of wide area, measured radially with respect to the sprinkler, because of the continuously varying degrees of elevation of water deflection around the sprinkler as the stem gyrates around the sprinkler body. Although the stem 17 of the sprinkler 10 is rotatable on its longitudinal axis, and does so rotate in operation, for the purposes of this invention, the stem need not rotate on its axis, and may be made non-rotatable as by forming the opening 50 of the lower bushing 49 and the lower end portion of the stem of out-of-round configuration. The bushings 49 and 52 are preferably formed of wear resistant laminated phenolic composition to increase the life of the sprinkler.

Sprinklers of the instant invention differ from those of the aforementioned patents in that the plate member 38, in which the water discharge opening 40 is formed, extends radially inward from the inside walls of the sprinkler body, thereby making the discharge opening smaller in circumference than that portion of the body passage adjacent the discharge opening. Also, the upper bushing 52 forms an annular restriction in the body 16, dividing the passage of the body into an upper chamber 63 and the lower swirl cavity 44. The body passage is therefore constituted of the swirl cavity 44, opening 53 of the restriction bushing 52, and the upper chamber 63.

The upper chamber 63 is circular in cross section and larger in diameter than the water discharge opening 40 and is larger in diameter than the circular opening 53. The chamber 63 is defined at its upper end by inside concave or dished surface 65 of plate member 38, and at its lower end by the upwardly and radially outwardly flaring annular surface 67 of the upper bushing 52. The surfaces 65 and 67 are preferably curved as shown for streamlining purposes to minimize turbulence.

Stem 17 has a neck portion 70 of reduced diameter. The axial dimension of the neck portion, i.e. between the lower extent 71 of the stem head and an annular frusto-conical shoulder 72 on the stem where the stem enlarges in diameter from the neck portion 70 to the remaining portion of the stem, is great enough that the annular shoulder 72 will be disposed inwardly or below the discharge opening 40 when the stem is in its pop-up position.

Inasmuch as the stem pivots in its gyratory movement in the proximity of the lower bushing 49, the circular path travelled by a point on the stem axis within the discharge opening 40 is larger in diameter than that travelled by a point on the stem axis within the upper bushing 52, whereby, but for the reduced neck portion 70, the discharge opening 40 would necessarily have to be larger in size than the opening 53 of the upper bushing. Were the discharge opening 40 of sufficient size to accommodate gyration of a stem not having a reduced neck portion, the spray pattern would be of small size. Accordingly, it is the reduced neck portion of the stem which makes it possible to reduce the size of the discharge opening, thus to restrict the flow of water from the sprinkler body to produce a spray pattern of large area.

In the embodiment of FIG. 5, the discharge opening 40' is a circular opening for producing a circular spray pattern. In FIG. 3, however, the discharge opening 40 is square for producing a square spray pattern. It will be noted further in FIG. 3 that the sides of the square discharge opening 40 are not parallel to sides of the square 31, but instead the corners 74 of the square 40 are on a radial line which is spaced at an angle in the neighborhood of about 30° from the radial line for the corners 32 of square 31. I have found that the sides of the square spray pattern produced by sprinklers of this invention are not parallel with the sides respectively of the square water discharge opening 40, but instead bear the illustrated orientation relationship of squares 31 and 40.

With the several parts being of the relative sizes shown in the drawing, a spray pattern of practically perfect square outline will be produced, and because of the gyration of the stem around in the body, the spray of water droplets from the sprinkler will extend from adjacent the sprinkler out to the square periphery of the area being sprayed.

While the instant invention has been shown and described herein in what are conceived to be the most practical and preferred embodiments, it is recognized that the departures may be made therefrom within the scope of the invention which is therefore not to be limited to the details disclosed herein but is to be accorded the full scope of the appended claims.

Having described the invention, what is claimed as new in support of Letters Patent is:

1. A sprinkler comprising a vertically extending water supply pipe, a body mounted in the upper end of said pipe and having an upper end and lower end and an inside surface defining a flow passage for water in the body, the body having an inlet opening formed therein for admitting water from the pipe to said passage, the body having a discharge opening formed in the upper end of the body for discharging water from said passage, an elongate stem having an upper end, the stem being disposed in the body passage with the upper end of the

5

stem extending upwardly beyond said discharge opening, the stem being of a diameter which is substantially smaller than that of said discharge opening, stop means on the stem engageable with the body for maintaining the stem against being removed upwardly through said discharge opening, a head fixed on the upper end of the stem and having an undersurface encircling the stem, said undersurface being inclined upwardly for deflecting water from said discharge opening radially outward around the stem, the walls which define said inlet opening being inclined with respect to radii of the body for imparting rotary motion to water in said passage thereby to gyrate the stem around in the body with the axis of the stem being inclined with respect to the axis of said passage, the body having an annular and radially inward extending wall spaced between said discharge and inlet openings and forming a restriction in said passage, said discharge opening being smaller in circumference than that portion of said passage next adjacent the discharge opening.

2. A sprinkler according to claim 1 in which said discharge opening is square.

3. A sprinkler according to claim 2 in which the upper end of said body has a square diagram around said square discharge opening for orientating the sprinkler in alignment with the square area to be sprayed, said square opening being deflected with respect to said square diagram.

4. A sprinkler comprising a hollow body having an upper end and a lower end and an inside surface defining a passage in the body, the body having a square discharge opening in its upper end and open to said passage, an elongate stem having an upper end and a lower end, the stem being closed against flow of water

6

longitudinally therethrough and being disposed longitudinally in the body passage and extending upwardly through said discharge opening, the stem being of an outside diameter which is substantially smaller than that of said discharge opening, stop means on the stem engageable with the body for maintaining the stem against being removed upwardly through said discharge opening, the body having walls defining an inlet opening for admitting water to the passage from outside the body, said inlet opening walls being inclined with respect to the radii of the body for imparting rotary motion to water in the body passage thereby to gyrate the stem around in the body with the stem being inclined with respect to the vertical axis of the body, a head fixed on the upper end of the stem and having an undersurface encircling the stem, said undersurface being inclined upwardly for deflecting water from said discharge opening radially outward around the sprinkler, and said inside walls of the body which define said passage forming an annular passage-restriction spaced around the stem and located between said discharge opening and said inlet opening thereby dividing said passage into a lower cavity and an upper chamber, said upper chamber being larger in its dimensions taken transversely of the body than each of said discharge opening and the passage portion through said restriction.

References Cited in the file of this patent

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