Feb. 18, 1958 J. O. HRUBY, JR 2,823,952

SPRINKLER HEAD AND NOZZLE

Filed Nov. 4, 1955

fig. 1.

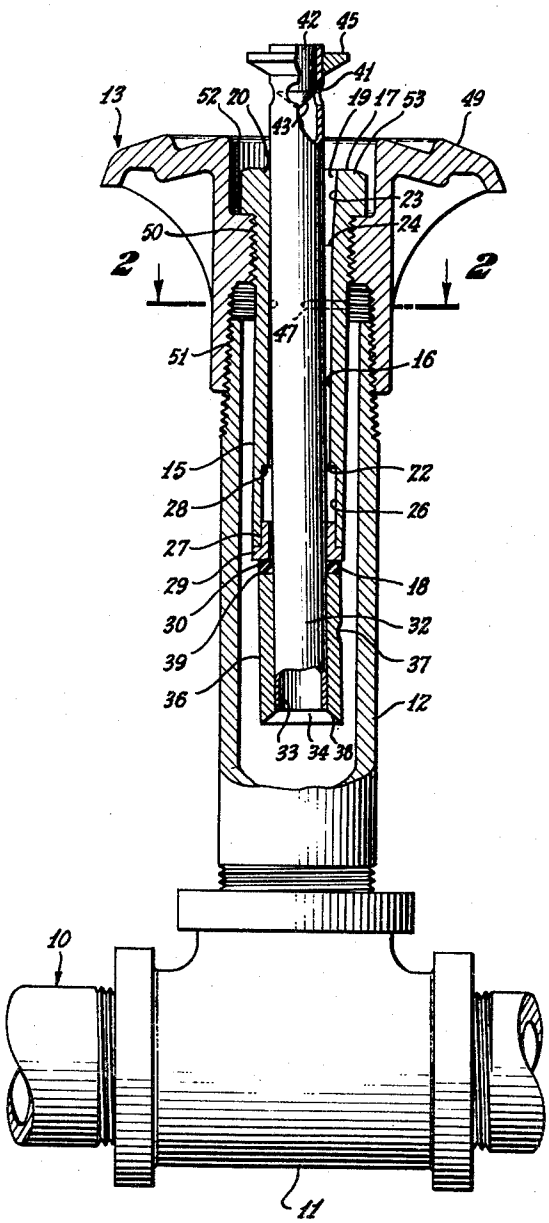
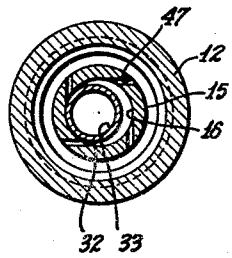


fig. 2.



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United States Patent Office 2,823,952 Patented Feb. 18, 1958

2,823,952

SPRINKLER HEAD AND NOZZLE

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Application November 4, 1955, Serial No. 544,976

7 Claims. (Cl. 299—64)

This invention relates to fluid discharging and distributing devices and relates more particularly to sprinkler heads and nozzles.

It is a general object of this invention to provide improved sprinklers and nozzles of the type illustrated and described in letters patent of the United States, Nos. 2,589,942 and 2,639,191, issued to me on March 18, 1952 and May 19, 1953, respectively.

Sprinkler heads and nozzles of the above referred to type are characterized by a stem disposed longitudinally in a sprinkler or nozzle body and arranged to be both rotated on the stem axis and gyrated in the body, the axis of the stem being inclined with respect to the axis of the body. It sometimes occurs in nozzles and sprinklers of a design which duplicates that of the embodiments shown in the drawings of the above-mentioned patents, that particles of sand or dirt carried in the fluid stream passing through the nozzle or sprinkler become imbedded between the outside wall of the stem and that part of the body which retains the stem in the body, and hinders gyration of the stem in the body.

It is an object of this invention to provide an improved fluid discharging and distributing device of the above-mentioned character having structure such that sand and dirt particles carried in the fluid stream do not become trapped in the device at a location where they may affect the gyration and rotation of the stem in the body.

Another object of the invention is to provide an improved device of the above-mentioned character having increased rolling contact of the stem with the fluid outlet end of the body, thereby to secure improved rotating and gyrating characteristics of the stem.

A further object of the invention is to provide an improved device of the above-mentioned character which is so designed and constructed that it may be manufactured easily and simply according to mass-production methods for economical assembly with the view to reducing the cost thereof.

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 an embodiment of the invention are described with reference to the accompanying drawing, in which:

Fig. 1 is a side elevation of a sprinkler head embodying the invention, the same being mounted on a portion of a conduit of a lawn sprinkler system, the sprinkler head being shown in central vertical section; and

Fig. 2 is a cross-section through the sprinkler, taken on line 2—2 of Fig. 1.

Referring to the drawing in greater detail and with the use of reference numerals, a conduit of a lawn sprinkler system is shown and designated by reference numeral **10**. Such conduit includes a pipe-T **11** which threadably receives a vertically extending riser **12**. A sprinkler head, embodying the invention, is mounted in the riser, the sprinkler head being designated generally by reference numeral **13**.

Sprinkler head **13** comprises a tubular body **15**, which in the illustrated embodiment is cylindrical and circular in cross-section. It has an axially extending passage **16**, preferably of circular cross-section. An annular end face **17** defines the upper end of the body while the opposite or lower end of the body is defined by an annular end face **18**. As will be more fully explained hereinafter, only part of the water which enters the body is discharged directly from the body for distribution over the lawn. Such direct discharge of water from the body occurs through a top opening **19** defined by the inner periphery of the end face **17**, the same constituting a rim **20**.

The passage **16** comprises a cylindrical lower portion **22** and an upper portion **23** of frusto-conical configuration. The smaller end of the frusto-conical portion **23** appears in the drawing as a line **24** extending in a horizontal plane around the internal wall of the body and along which the adjacent ends of the passage portions are contiguous. In axial length, the upper portion **23** may be from about 10 to 50% of the over-all length of the passage.

Formed in the internal wall of the body and proximate the lower end of the body is a recess **26** spaced above the lower end face **18** of the body. In the illustrated embodiment, the recess **26** is formed by a counter-bore **27** terminating at **28** as an annular shoulder which faces in the direction of end face **18**. The lower boundary for the recess is defined by an upwardly facing end face of an annular bearing sleeve **29**, the bearing sleeve being force fitted into the counter-bore and thereby made an integral part of the body. Preferably the bearing sleeve **29** is formed of oil-impregnated sintered bronze. Although the bearing sleeve **29** is shown in the drawing as having an axially extending bore which is cylindrical in configuration and is herein referred to for purposes of convenience in its description as constituting the lower end portion of the passage **16**, I desire to have it understood that the axially extending passage in the bearing sleeve need not be cylindrical, but may flare outwardly and upwardly, for example, or be otherwise suitably shaped, so long as it provides an upwardly directed annular shoulder for defining the lower end of the recess **26**. Also, the bearing sleeve provides an edge **30** for the body, which in the illustrated embodiment is defined by the inner periphery of the lower annular end face **18**.

Arranged longitudinally in the body passage **16** is a tubular stem **32** of greater length than the passage whereby the stem extends above and below the passage. The stem is smaller in outside diameter than the body passage and is preferably circular in cross section. Reference numeral **33** designates the axially extending passage or bore of the stem, the same being open at its lower end to provide a water inlet opening **34**.

The stem is movable longitudinally in the body passage **16** and is moved upwardly by the force of water flowing through the riser **12**. Thus the sprinkler **13** is of the "pop-up" type. To limit the extent to which the stem may be moved upwardly in the body, there is a collar **36** around the lower end of the stem and fixed thereto as by means of a detent **37** pressed tight against the outside surface of the stem. The lower end of the collar is preferably bevelled or countersunk as shown at **38**. A washer **39**, preferably formed of non-metallic material, e. g. hard rubber or plastics material, is positioned on the stem between the collar and the bushing or bearing sleeve **29**, the washer being freely rotatable on the stem.

Adjacent the upper end of the stem is a circumferentially arranged series of orifices **41** through which streams of water flow radially and upwardly from the stem. The upper end of the stem passage **33** is closed by a plug **42** which in the illustrated embodiment extends downwardly in the stem beyond the circumference of each

of the orifices 41, thereby restricting the size of the orifices. For the purpose of simplifying the manufacture of the stem, the orifices 41 are formed to extend radially inwardly of the stem wall, and such construction tends to cause the streams flowing from the orifices to be directed in a horizontal plane from the stem; however, in order to insure upward inclination of the streams, the lower end of the plug is pointed downwardly as shown at 43 to deflect the water in the stem to flow out through the orifices not only outwardly, but also upwardly.

Above the orifices 41 is a head 45 arranged as a collar around the upper end of the stem. Its underside slopes upwardly and outwardly at an angle of inclination depending upon the degree desired for deflection of water from the body passage, as will be described more fully hereinafter. The head 45 is larger in diameter than opening 19 whereby the head serves as a valve to close the body passage 16 when the water to the sprinkler is turned off and the stem drops down in the body.

Intermediate the upper end of the body and the recess 26, and preferably below the frusto-conical portion 23 of the body passage as shown, is a plurality of apertures 47, each of which extends through the body wall at an angle with respect to the radii of the bore passage, for causing streams of water to enter the body passage and spiral or rotate around and upwardly in the body passage. As best shown in Fig. 2 of the drawing, the apertures 47 of the illustrated embodiment are substantially tangential with respect to the body passage 16 and are four in number. The swirl of water in the body passage resulting from the slant of the apertures 47 causes stem 32 to revolve within the body passage with the axis of the stem being inclined with respect to the axis of the body passage. Thus the stem contacts the edge 30 of the bearing sleeve and rolls within and around the edge 30.

The above described structure provides a lawn sprinkler in which the streams of water flowing from the orifices 41 move not only angularly, with respect to the horizontal, around the sprinkler as a result of rotation of the stem on its axis; but also upwardly and downwardly in vertical planes, thereby distributing the water from the orifices in a wide area around the sprinkler. Also, the water flowing upwardly in the body passage around the stem is deflected by the stem revolving around in the body passage and is furthermore deflected by the under side of the head 45 as well as by the streams of water from the orifices 41 to provide for distribution of water over the inside area around and adjacent the sprinkler. Such distribution of water over the lawn is by way of discrete drops of water as contrasted with the sprays of fine mist or the heavy streams produced by numerous types of other well-known sprinklers. For a fuller description of the characteristics of the water distribution developed by sprinklers of the herein described type, I refer to the above mentioned patents and particularly to Patent No. 2,639,191 which illustrates diagrammatically typical patterns of water distribution produced by these sprinklers.

I have found that sprinklers of the type described in my above referenced prior patents wear excessively around the inside of the lower end or edge 30 of the body passage. Although some wear also occurs around the rim 20 of the passage opening 19, I have found, too, that I may maintain the stem out of contact with the rim 20 and still obtain rotation of the stem on its axis and revolution of the stem around the inside of the body with the axis of the stem being inclined with respect to the axis of the body. Thus by making the upper portion 23 of body passage frusto-conical in configuration as above described, and with the inclination of the walls defining the frusto-conical portion being such that the stem will lie flush against the walls of the frusto-conical portion throughout the full height of the frusto-conical portion when the stem is in contact with the edge 30, the sprinkler 13 provides substantially increased surface on which the stem may roll, thereby substantially improving the wear resistance of the sprinkler, providing increased rolling contact of stem and body walls to insure constant revolution of the stem in body, and increasing the amount of change in elevation and depression of the streams of water from the orifices 41.

Also I have found that by forming the bearing sleeve of oil impregnated sintered metal, less wearing away of the edge 30 occurs, and in addition the stem revolves at a more constant speed within the body. However, notwithstanding these improvements, I find that sand and other foreign particles carried in the water and perhaps dropping into the body as through opening 19, become lodged between the stem and the bearing sleeve and thereby restrict free rolling of the stem along the edge 30 at least until a sufficient force of water is developed within the body to dislodge such particles. When the sprinkler is in full operation, water from the riser 12 seeps into the body from around the washer 39 and such seepage is sufficient to prevent particles from dropping down between the stem and bearing edge 30, but when the water is turned off, any foreign particles remaining in the body will drop down upon the washer and when next the sprinkler is operated such particles will rub against the lower end face 18 and within the edge 30 and thus impede revolution of the stem. To correct these disadvantages, I have provided the recess 26 which serves as a reservoir into which foreign particles are deposited due to the centrifugal force developed by the spiralling of water in the body passage.

The water distribution device of this invention is designed as a conventional lawn sprinkler by providing a head 49 into which the body 15 is screw threaded at threads 50, the head also serving to close the upper end of the riser 12 and to secure the sprinkler body in the riser. The head 49 is screw threaded as at 51 to the riser and provides a void for flow of water upwardly around the body 15 to the tangential apertures 47. A central recess 52 is formed in the head 49 for receiving a flanged portion 53 around the upper end of the sprinkler body. This recess also serves to receive the upper end of the stem including the stem head 45 when the stem drops down in the body passage to its stand-by position. Thus the stem is protected by the sprinkler head 49 from being damaged as a result of traffic over the lawn.

While I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein, but is to be accorded the full scope of the claims so as to embrace any and all equivalent structures.

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

1. A fluid discharge device comprising a body having an inside wall defining an open-ended passage extending through the body, one end of the passage defining a fluid discharge opening, an elongate stem arranged longitudinally in the passage, means spaced from said discharge opening defining a bearing face extending around the passage and facing in a direction away from said discharge opening, said bearing face having an inside edge, means on the stem engageable with the bearing face preventing removal of the stem out from the passage and permitting free gyration of the stem in the passage in rolling contact with said inside edge, said inside wall of the body having a recess formed therein and located between said discharge opening and said bearing face and proximate said bearing face, there being a recess shoulder defining that end of the recess proximate the discharge opening, the recess shoulder facing toward said bearing face and serving to trap foreign particles carried in the fluid passing through the discharge device, and fluid passage means for imparting rotary motion to the fluid flowing in the body passage so as to gyrate the stem to roll

around said inside edge with the stem being inclined with respect to the axis of the body passage.

2. A fluid discharge device comprising a body having an inside wall defining an open-ended passage extending through the body, one end of the passage defining a fluid discharge opening in the body, a tubular stem arranged longitudinally in the passage, the stem having an orifice in one end portion thereof constituting a fluid discharge end, the other end of the stem being open and constituting a fluid inlet end, means spaced from said discharge opening defining a bearing face in the body around the passage and facing in a direction away from said discharge opening, said bearing face having an inside edge, means on the stem engageable with the bearing face preventing removal of the stem out from the passage and permitting free gyration of the stem in the passage in rolling contact with said inside edge, said inside wall of the body having a recess formed therein and located between said discharge opening and said bearing face and proximate said bearing face, there being a recess shoulder defining that end of the recess proximate the discharge opening, the recess shoulder facing toward said bearing face and serving to trap foreign particles carried in the fluid passing through the discharge device, and fluid passage means formed in said body for imparting rotary motion to the fluid flowing in the body passage so as to gyrate the stem to roll around said inside edge with the stem being inclined with respect to the axis of the body passage.

3. A fluid discharge device comprising a body having an internal wall defining a substantially straight, elongate, open-ended passage extending through the body, said passage being arcuate in cross-section throughout the length thereof, one end of the passage defining a fluid discharge opening in the body, a tubular stem of arcuate configuration in cross-section arranged longitudinally in the passage, the stem having one end thereof extending outwardly beyond said discharge opening, said one end of the stem being open and constituting a fluid discharge end, the other end of the stem being open and constituting a fluid inlet end, means spaced from said discharge opening defining a bearing face in the body around said passage facing in a direction opposite to said discharge opening, said bearing face having an inside edge of arcuate configuration, means on the stem engageable with the bearing face preventing removal of the stem out from the discharge opening of the passage and permitting free gyration of the stem in the passage with the outside surface of the stem in rolling contact with said inside edge, said inside wall of the body having an annular recess formed therein and located between said discharge opening and said bearing face and proximate said bearing face, there being a recess shoulder defining that end of the recess proximate the discharge opening, the recess shoulder facing toward said bearing face and serving to trap foreign particles carried in the fluid passing through the discharge device, and fluid passage means formed in the body for imparting rotary motion to the stream of fluid flowing in the body passage so as to gyrate the stem to roll around said inside edge with the stem being inclined with respect to the axis of the body passage.

4. A fluid discharge device according to claim 3 wherein said body passage and said stem and said inside edge are circular in cross-section.

5. A fluid discharge device comprising a body having an inside wall defining a substantially straight and open-ended passage of circular cross-section extending through the body, one end of the passage defining a fluid discharge opening, a straight elongate stem of circular cross-section arranged longitudinally in the passage, means spaced from said discharge opening defining an annular bearing edge around said passage, the stem being of

smaller diameter than the passage whereby the stem is freely rotatable on its axis and may revolve around in the passage with the axis of the stem being inclined with respect to the axis of the passage, a portion of the passage adjacent the discharge opening being of frusto-conical configuration, the remaining portion of the passage being substantially cylindrical, the inside wall of the body defining said frusto-conical portion being inclined to an extent such that the stem when in inclined position in contact with said bearing edge will lie flush against said frusto-conical portion throughout the full height of the frusto-conical portion, and fluid passage means formed in the body for imparting rotary motion to the fluid flowing in the body passage so as to rotate the stem on its axis and cause the stem to gyrate in the passage with the stem being in rolling contact with said bearing edge and said frusto-conical portion.

6. A fluid discharge device according to claim 5 wherein the axial length of said frusto-conical portion is about 10 to 50% of the axial length of the body passage.

7. A lawn sprinkler comprising a body having an inside wall defining a vertical, straight, elongate, and open-ended passage extending through the body, said passage being circular in cross-section throughout the full length thereof, the upper end of the passage wall and the outside surface of the body forming a rim defining a water discharge opening, said passage being of frusto-conical configuration in that portion thereof adjacent said rim with the base of said frusto-conical portion being coincident with said rim and the smaller end of the frusto-conical portion being spaced inwardly from said rim, the passage being substantially cylindrical in that portion thereof extending from said smaller end, said cylindrical portion of the passage being substantially equal in cross-sectional area to the area defined by said smaller end, the body having a counterbore formed in the lower end of the body and extending upwardly to define an annular shoulder facing in a direction opposite to said discharge opening, a bearing sleeve having an internal cross-sectional area substantially the same as that of the cylindrical portion of the passage, said sleeve being formed of oil impregnated sintered metal and being force-fitted coaxially in said counterbore, the upper end of the sleeve being spaced from said shoulder to define an annular pocket for trapping sand and foreign particles carried in the water passing through the sprinkler, the lower end of the sleeve defining a bearing face facing in the direction of said recess shoulder, said bearing face having an inner annular edge, a cylindrical tubular stem of circular cross-section arranged longitudinally in the passage, the stem being of greater length than the passage and having the upper end of the stem projecting upwardly beyond said discharge opening and the lower end of the stem projecting downwardly beyond said bearing face, the stem being of lesser outside diameter than the diameter of the cylindrical portion of the passage, a collar fixed around the outside surface of the stem at the lower end of the stem limiting upward movement of the stem in the passage and permitting free gyration of the stem in the passage with the outside surface of the stem in rolling contact with said inner edge, a washer disposed around the stem and between said collar and said bearing sleeve, and a plurality of apertures formed in the body tangent to the body passage for admitting water to the body passage and for imparting rotary movement to the water in the passage to cause rotation of the stem on its axis and gyration of the stem in the body passage.

References Cited in the file of this patent

UNITED STATES PATENTS

2,639,191 Hruby ---------- May 19, 1953