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H. M. CROW
FLUID SPRINKLER

2,918,220

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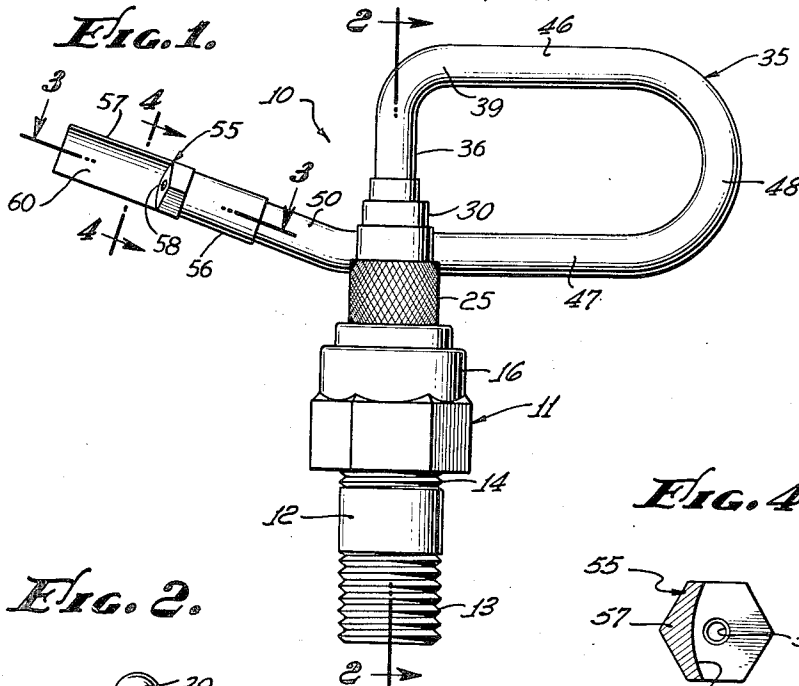


Fig. 2.

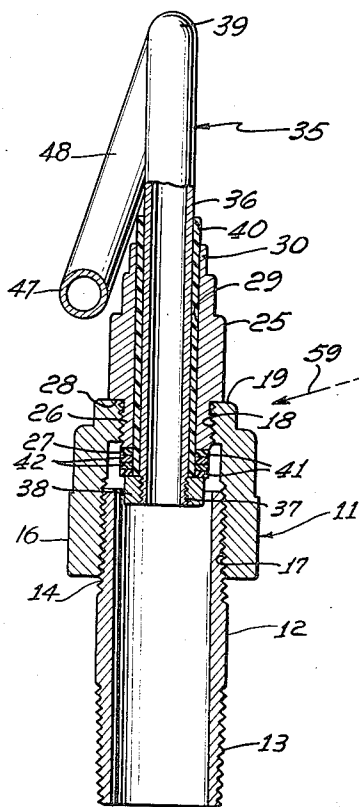


Fig. 4.

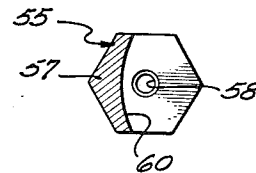
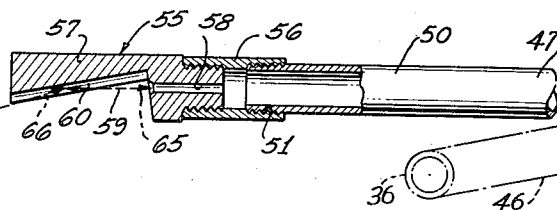


Fig. 3.



HOWARD M. CROW
INVENTOR.

Huebner, Beehler, Worrel & Herzig
BY

Richard M. Worrel
ATTORNEYS.

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FLUID SPRINKLER

Howard M. Crow, Lindsay, Calif.

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The present invention relates to a fluid sprinkler and more particularly to improvements in a rotary fluid sprinkler having special advantages in agricultural irrigation systems.

In heavy soils and on hillsides, it is necessary to sprinkle water at a very slow rate in order to obtain sufficient penetration without undue run-off. For example, it has been found that the rate of application should be from 0.08 to 0.012 inch of precipitation per hour. It is further found that this rate of application requires a sprinkler having a capacity of from 0.35 to 1.0 gallon per minute and with a range sufficient to cover an area from two-hundred fifty to nine hundred square feet.

Although there are many well-known rotary sprinklers, few are available which will meet these requirements and they have been unable to provide uniform water distribution. Only one such sprinkler is known to the applicant to give any substantial measure of satisfaction under conditions requiring slow water application. This sprinkler includes an upwardly extended tube rotatably mounted in the base, a fluid discharge conduit in fluid communication with the tube and laterally outwardly and upwardly extended therefrom, a nozzle on the end of the conduit, and an arm extended outwardly from the tube in the opposite direction from the conduit mounting a counterweight thereon. Further, a deflecting wheel is coaxially mounted on a rod for rotation therearound and the rod is mounted on the conduit adjacent to the nozzle for adjustable pivotal movement about a substantially horizontal axis so as adjustably to position the wheel in fluid intercepting relation to a stream of water issuing from the nozzle. The water strikes the wheel and is deflected for dispersion over the area to be irrigated. Further, the nozzle is positioned in such relation to the wheel as to cause rotation of the wheel when the water impinges thereon. This impingement sets up a reactive force which causes the conduit, weight and tube to rotate. This type of sprinkler has not been fully satisfactory, however, because adjustments of the wheel to vary the speed of rotation of the sprinkler have in many cases destroyed the distribution pattern and in addition, it is found that the wheel causes excessive distribution of water in the area proximate to the sprinkler. More generally, this sprinkler is of relatively complex and expensive construction; it has several moving parts requiring frequent repair, replacement and/or attention; and, like so many of the rotary sprinklers of the prior art, it provides for application of rotary thrust at a considerable distance from the axis of rotation and at such a position that excessive binding of the bearing results.

Accordingly, it is an object of the present invention to provide an improved rotary sprinkler.

Another object is to simplify the construction of rotary sprinklers.

Another object is to minimize the friction impeding movement in rotary sprinklers and thus the driving power required.

Another object is to minimize binding of the bearings in rotary sprinklers incident to rotary thrust.

Another object is to provide a rotary sprinkler in which the rotary thrust is applied at an advantageous position minimizing bearing friction and wear.

Another object is to provide a rotary sprinkler which is balanced about its axis of rotation.

Another object is to provide a sprinkler adapted to rotate dependably at a slow rate of speed.

Another object is to provide a sprinkler which produces a substantially uniform distribution of fluid over a wide area.

Another object is to provide an improved nozzle for use in a rotary sprinkler.

Another object is to provide a nozzle which is adjustable to vary the range of projection without impairing the distribution pattern.

Another object is to provide a rotary fluid sprinkler of sufficient resilience to accommodate limited vibration.

Another object is to provide improvements in the bearing of a rotary sprinkler.

Other objects and advantages will become apparent upon reference to the following description and accompanying drawing.

In the drawing:

Fig. 1 is a side elevation of a sprinkler constructed in accordance with the principles of the present invention.

Fig. 2 is an elevational section taken on line 2—2 of Fig. 1.

Fig. 3 is a fragmentary section taken on line 3—3 of Fig. 1.

Fig. 4 is a transverse section taken on line 4—4 of Fig. 1.

Referring more particularly to the drawing, the rotary fluid sprinkler of the present invention is generally indicated by the numeral 10. The sprinkler includes an upwardly disposed, substantially cylindrical, fluid coupling shank 11 having a nipple 12 providing a lower threaded male end 13 adapted to be connected to a source of fluid under pressure, not shown, and an upper threaded male end 14.

The shank 11 also has a nut 16 providing a lower threaded female bore 17 screw-threaded on the upper male end 14 of the nipple 12. The nut preferably has an outer hex-shaped surface for convenience in threading manipulation thereof. Further, the nut provides an upper threaded female bore 18 and an upper annular ledge 19.

The shank 11 also includes an elongated bearing member 25 having a lower male end 26 screw-threaded into the bore 18 of the nut 16 and a downwardly disposed annular end face 27. The bearing member provides an annular shoulder 28 adapted to rest on the ledge 19 of the nut when the bearing is fully threaded into the nut. Still further, the bearing member provides an internal substantially cylindrical bearing surface 29 and an upper end 30.

The sprinkler 10 also has a generally strophoidally shaped fluid conducting tube 35 of substantially rigid although of somewhat resilient material, such as aluminum. The tube provides a substantially straight lower mounting end portion 36 having a threaded tip or lower end 37. A nut 38 is screw-threaded on the tip of the tube. It is to be noted that the mounting portion also has an upper end 39. A bearing sleeve 40, preferably of a plastic material such as tetrafluoroethyl polymer, more commonly known in the trade by the trademark "Teflon," is snugly fitted, as by shrinking, on the mounting portion of the tube and has an outer diameter slightly less than the diameter of the bearing surface 29 of the bearing member 25. It is to be understood that the bearing sleeve does not rotate on the mounting portion

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and terminates adjacent to the nut 38. The mounting portion of the tube with the bearing sleeve thereon is rotatably journaled in the bearing member 25 with the bearing sleeve rotatably engaging the bearing surface 29 and with the nut 38 positioned below the end face 27. A pair of outer, preferably rubber, gaskets 41 and a pair of inner, preferably "Teflon," gaskets 42 circumscribe the bearing sleeve between the nut 38 and the end face of the bearing member.

The tube 35 further provides an upper, substantially horizontal balancing portion 46 laterally outwardly extended in substantially perpendicular relation from the mounting portion 36 and lying in a substantially common plane with the mounting portion. A lower balancing portion 47 in substantially parallel spaced relation to the upper balancing portion is extended alongside of the bearing member 25 in laterally adjacent spaced relation to such bearing member and between the upper and lower ends thereof. An intermediate, outwardly convexed, balancing portion 48 interconnects the upper and lower balancing portions along smooth curves and is in acute angular relation to the plane of the mounting portion 36 and the upper bearing portion 46 of the tube, as best seen in Fig. 2. It will be evident that the balancing portions of the tube form a substantially U-shaped loop laterally extended from the shank a predetermined distance.

The tube 35 also has a discharge end portion 50 integrally upwardly extended in obtusely angular relation from the lower balancing portion 47 and on the opposite side of the axis of rotation of the mounting portion 36 from the balancing portions 46, 47, and 48. The discharge end portion terminates in a threaded tip 51.

The sprinkler 10 provides a fluid discharge nozzle 55 including a mounting collar 56 screw-threadably connected to the tip 51 of the discharge end portion 50 of the tube 35. The nozzle also has a body 57 screw-threaded into the collar and providing a fluid passage 58 having an axis disposed substantially coaxially of the discharge end portion for directing a stream of fluid outwardly of the nozzle, as indicated at 59. The body also provides a fluid deflecting, transversely arcuate, surface 60 acutely angularly related to and outwardly extended from the passage in fluid intercepting relation to the water stream. As indicated in Fig. 3, the stream is deflected from the surface and projected outwardly in a fan-shaped spray.

Operation

The operation of the described embodiment of the subject invention is believed to be readily apparent and is briefly summarized at this point. With the parts of the sprinkler 10 connected as shown in the drawing, the nipple 12 is screw-threaded into a conduit, not shown, supplying a source of water under pressure.

Water flows upwardly through the nipple 12 and into the tube 35. At this point it is to be noted that the fluid pressure urges the tube upwardly in the bearing member 25 so that the gaskets 41 and 42 are lightly compressed between the nut 38 and the end face 27 of the bearing member.

Water travels upwardly through the mounting portion 36, into the upper balancing portion 46, around the intermediate portion 48, back through the lower balancing portion 47, upwardly along the discharge end portion 50, through the passage 58 and issues outwardly of the passage in the form of jet stream 59 where it impinges the deflecting surface 60 and is projected in a fan-shaped spray outwardly of the sprinkler. The jet issuing from the passage 58 creates a reactive force 65 in the opposite direction acting on the nozzle 55, discharge end portion 50, and lower balancing portion 47. Inasmuch as the discharge and balancing portions are laterally spaced from the axis of rotation of the tube, this reactive force imparts rotary movement to the tube. It is significant that this reactive force is applied intermediate the upper and

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lower ends of the bearing member 25. Thus, binding of the mounting portion 36 of the tube in the bearing 25 is minimized for the reasons that the force is applied close to the axis of rotation and intermediate the upper and lower ends of the bearing. The amount of rotary force due to this reaction can be varied by changing the lateral spacing between the mounting and discharge portions of the tube relative to the shank 11, as will be evident.

When the water stream 59 is deflected from the surface 60, another reactive force 66 is set up which also acts to turn the tube in the shank 11. This force, of course, acts on a radial lever arm a distance equal to the spacing between the axis of rotation and the point of deflection of the water stream. It is to be noted in this connection that when the water strikes the surface 60, it sets up a limited vibration in the tube which is transmitted to the bearing area between the mounting portion 36 and bearing sleeve 40 and bearing surface 29. If foreign particles enter between the bearing surfaces, they are soon dislodged by this vibratory action. The limited resilience of the tube facilitates such vibration.

It is of significance that the subject invention provides for a mechanical balance of the sprinkler around its axis of rotation without the use of conventional counterweights. Thus, when the tube 35 is full of water, it is balanced around the axis of rotation, the weight of the water in the balancing portions 46, 47, and 49 acting as a counterweight.

The employment of a "Teflon" bearing sleeve 40 and the combination of rubber and "Teflon" gaskets 41 and 42 provides a bearing structure having a minimum of friction. Thus the sprinkler requires a minimum of driving power which, as has been seen, is obtained through the development of reactive forces.

The nozzle 55 may be rotatably adjusted on the discharge end portion 50 for raising or lowering the trajectory of the water stream 59 thereby to increase or decrease the range of distribution of the sprinkler. In contrast with certain prior art sprinklers, this adjustment has no appreciable effect on the distribution pattern of the sprinkler. It is found that the surface 60 breaks up the stream issuing from the passage 58 into small droplets thereby assuring gentle rain-like precipitation and has an excellent distribution pattern through the range of the sprinkler.

From the foregoing it will be evident that improvements have been made in a rotary sprinkler in an effort to simplify and economize in the sprinkler construction. The sprinkler has the advantages of very little friction, requires little driving power, minimizes binding of the bearing, is balanced around its axis of rotation, provides a slow rate of rotation, has a substantially uniform distribution pattern, and is adjustable to meet the needs of various applications.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the 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 devices and apparatus.

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

1. In a rotary sprinkler; a fluid coupling adapted to be connected to a source of fluid under pressure; an up-standing bearing having upper and lower ends, said bearing being mounted in the coupling; and a generally strophoidally shaped fluid conducting tube having an up-standing mounting end portion journaled for rotation in the bearing about a predetermined axis and being in fluid communication with the coupling, a horizontal portion extended outwardly of the mounting portion, an intermediate loop having an upper portion connected to said horizontal portion and extended downwardly therefrom,

and a lower balancing portion below the horizontal portion and connected to said intermediate loop, said balancing portion being between the upper and lower ends of said bearing; and a discharge end portion connected to and extending outwardly from said balancing portion, said discharge end portion being provided with a discharge nozzle.

2. The sprinkler of claim 1 wherein said mounting end portion has a lower end adjacent to the lower end of the bearing, and wherein said lower balancing portion is located relatively close to the lower end of the mounting end portion.

3. In a rotary sprinkler; an upwardly disposed fluid coupling shank adapted to be connected to a source of fluid under pressure; a generally strophoidally shaped fluid conducting tube of limited flexibility having a lower upstanding mounting end portion rotatably journaled in the shank for rotation about a substantially erect axis, an upper substantially horizontal balancing portion laterally outwardly extended from the mounting portion and lying in a substantially common plane with the mounting portion, a lower balancing portion in substantially parallel spaced relation below the upper balancing portion extended alongside of the shank in laterally closely spaced adjacent relation to the shank and to the plane of the mounting portion and upper balancing portion, an outwardly convexed intermediate balancing portion interconnecting the upper and lower balancing portions along smooth curves, the upper, lower and intermediate balancing portions being in a common upstanding plane acutely angularly related to the plane of the upper balancing portion and mounting portion, and a substantially straight discharge end portion integrally extended from the lower balancing portion on the opposite side of the axis of rotation from the balancing portions; and a fluid discharge nozzle connected to the discharge portion of the tube having an elongated outlet passage providing an axis coaxial with said discharge end portion for directing a slender stream of fluid outwardly of the nozzle, and a deflecting surface outwardly extended from the discharge end portion in angular relation to the axis of said passage and in fluid intercepting relation to a stream of fluid issuing from the passage whereby such stream is deflected from said surface and sets up a reaction force acting on the surface to impart rotary movement to the tube around said axis of rotation, whereby fluid issuing from the nozzle creates a further reaction force acting along said discharge and lower balancing portions for imparting rotation to the tube around said axis of rotation, and whereby said tube is balanced around said axis when full of fluid.

4. In a rotary sprinkler; an upwardly disposed fluid coupling shank adapted to be connected to a source of fluid under pressure; a generally strophoidally shaped fluid conducting tube of limited flexibility having a lower upstanding mounting end portion rotatably journaled in the shank for rotation about a substantially erect axis, an upper substantially horizontal balancing portion laterally outwardly extended from the mounting portion and lying in a substantially common plane with the mounting portion, a lower balancing portion in substantially parallel spaced relation below the upper balancing portion extended alongside of the shank in laterally closely spaced adjacent relation to the shank and to the plane of the mounting portion and upper balancing portion, an outwardly convexed intermediate balancing portion interconnecting the upper and lower balancing portions along smooth curves, the upper, lower and intermediate balancing portions being in a common upstanding plane acutely angularly related to the plane of the upper balancing portion and mounting portion, and a substantially straight discharge end portion integrally extended from the lower balancing portion on the opposite side of the axis of rotation from the balancing portions;

tions, said discharge end portion being provided with a discharge nozzle.

5. In a rotary sprinkler; an upwardly disposed fluid coupling shank adapted to be connected to a source of fluid under pressure; a generally strophoidally shaped fluid conducting tube of limited flexibility having a lower upstanding mounting end portion rotatably journaled in the shank for rotation about a substantially erect axis, an upper substantially horizontal balancing portion laterally outwardly extended from the mounting portion and lying in a substantially common plane with the mounting portion, a lower balancing portion in substantially parallel spaced relation below the upper balancing portion extended alongside of the shank in a laterally closely spaced adjacent relation to the shank and to the plane of the mounting portion and upper balancing portion, an outwardly convexed intermediate balancing portion interconnecting the upper and lower balancing portions along smooth curves, the upper, lower and intermediate balancing portions being in a common upstanding plane acutely angularly related to the plane of the upper balancing portion and mounting portion, and a substantially straight discharge end portion integrally upwardly extended in obtusely angular relation from the lower balancing portion on the opposite side of the axis of rotation from the balancing portions; and a fluid discharge nozzle rotatably adjustably connected to the discharge portion of the tube having an elongated outlet passage having an axis coaxial with said discharge end portion for directing a slender stream of fluid outwardly of the nozzle, and a transversely arcuate deflecting surface outwardly extended from the discharge end portion in angular relation to the axis of said passage and in fluid intercepting relation to a stream of fluid issuing from the passage whereby such stream is deflected from said surface and sets up a reaction force acting on the surface to impart rotary movement to the tube around said axis of rotation, whereby fluid issuing from the nozzle creates a further reaction force acting along said discharge and lower balancing portions for imparting rotation to the tube around said axis of rotation, and whereby said tube is balanced around said axis when full of fluid.

6. In a rotary fluid sprinkler; an upwardly disposed substantially cylindrical fluid coupling shank having a nipple adapted to be connected to a source of fluid under pressure, a nut screw-threaded on the nipple, and a bearing member screw-threaded into the nut in coaxial relation to the nipple providing an internal bearing surface and an endwardly disposed annular end face; a fluid conducting tube of limited resiliently flexible material having a substantially straight lower mounting end portion rotatably journaled in the bearing surface of the shank for rotation about an upwardly disposed axis and having a lower end extended below the bearing member, an upper substantially horizontal balancing portion laterally outwardly extended from the mounting portion and lying in a substantially common plane with the mounting portion, a lower balancing portion in substantially parallel spaced relation below the upper balancing portion extended alongside of the shank in laterally spaced adjacent relation to the shank and to the plane of the mounting portion and upper balancing portion, an outwardly convexed intermediate balancing portion interconnecting the upper and lower balancing portions along smooth curves and acutely angularly related to the plane of the upper balancing portion and mounting portion, and a substantially straight discharge end portion integrally upwardly extended in obtusely angular relation from the lower balancing portion on the opposite side of the axis of rotation from the balancing portions; a plastic bearing sleeve interposed the mounting end portion of the tube and the bearing surface of the bearing member; a nut secured to the lower end of said mounting end portion; a pair of outer rubber gaskets circumscribing the bearing sleeve between said end face and the nut; a

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plastic gasket interposed the rubber gaskets whereby fluid passing upwardly through the shank into the tube compresses the gaskets between the nut and said end face; and a fluid discharge nozzle rotatably adjustably connected to the discharge portion of the tube providing an elongated outlet passage having an axis coaxial with said discharge end portion for directing a slender stream of fluid outwardly of the nozzle, and a transversely arcuate deflecting surface outwardly extended from the discharge end portion in angular relation to the axis of said passage and in fluid intercepting relation to a stream of fluid issuing from the passage whereby such stream is deflected from said surface and sets up a reaction force acting on the surface to impart rotary movement to the tube around said axis of rotation, whereby fluid issuing

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from the nozzle creates a further reaction force acting along said discharge and lower balancing portions for imparting rotation to the tube around said axis of rotation, and whereby said tube is balanced around said axis when full of fluid.

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