# United States Patent

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[33] **Israel**
[31] **28,397**


[54] **ROTARY SPRINKLER**
**9 Claims, 4 Drawing Figs.**


[52] **U.S. Cl.** ..... **239/222.15,** 239/233, 239/236
[51] **Int. Cl.** ..... **B05b 3/02**
[50] **Field of Search** ..... 239/97, 222.15, 223, 224, 232, 233, 236, 237



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**ABSTRACT:** A rotary sprinkler comprises a housing, a rotatable nozzle through which the water exits in the form of a jet, and a rotor having an outer group of widely-spaced vanes and an inner group of closely-spaced vanes. The rotor "floats" on a shaft fixed to the nozzle obliquely to the path of the jet and is normally urged toward the nozzle. The inner group of vanes are impinged by the water jet during starting conditions to rotate the rotor which is then forced by the jet outwardly along the shaft to cause the outer group of vanes to be impinged by the jet, effecting rotation of the rotor and also of the nozzle during normal running conditions.

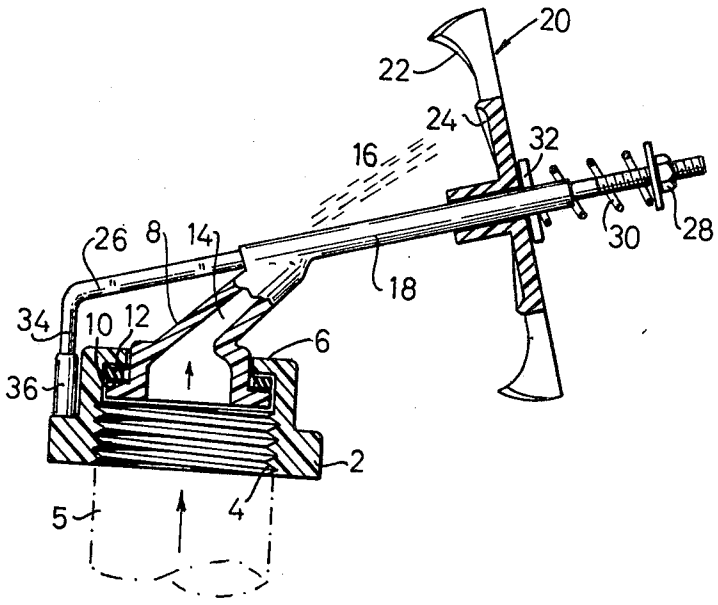



FIG. 1

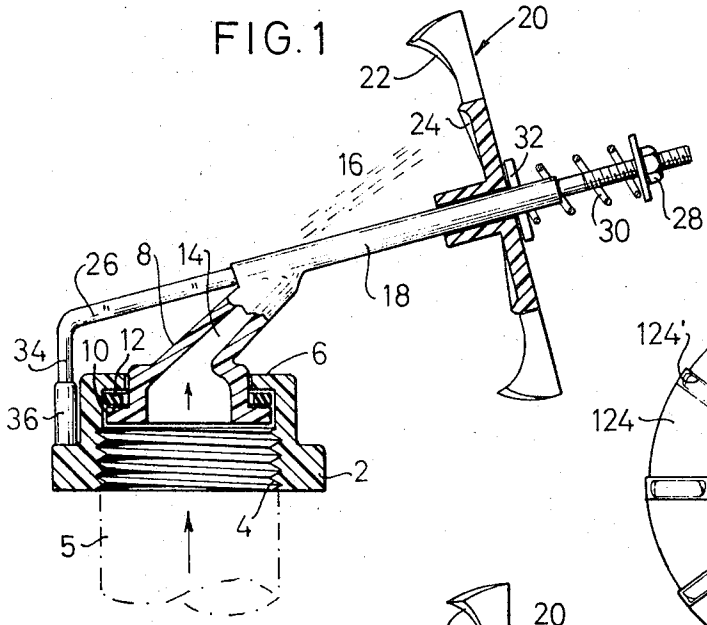



FIG. 3

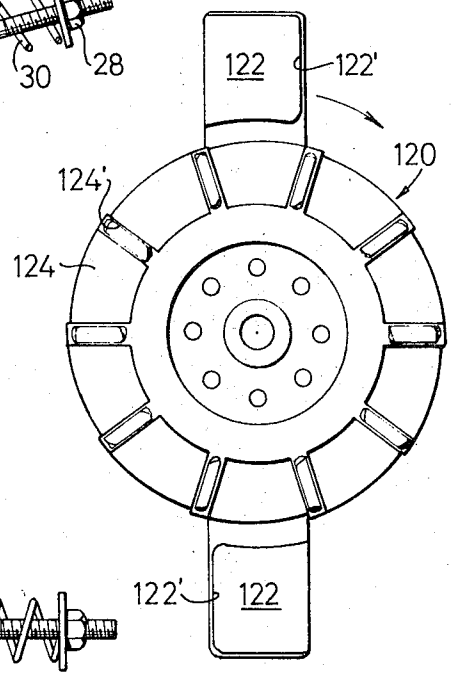



FIG. 2

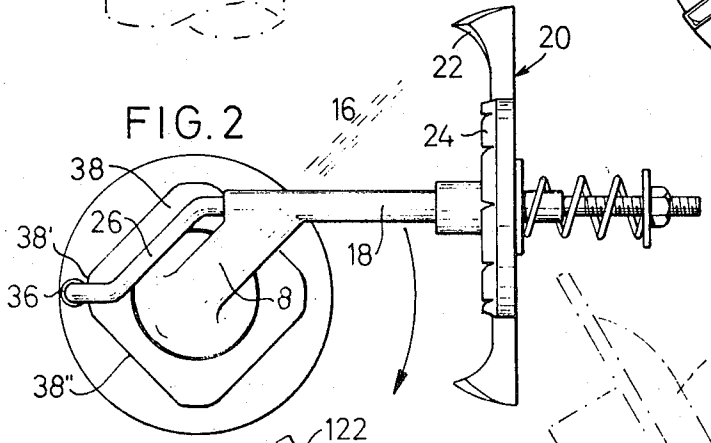
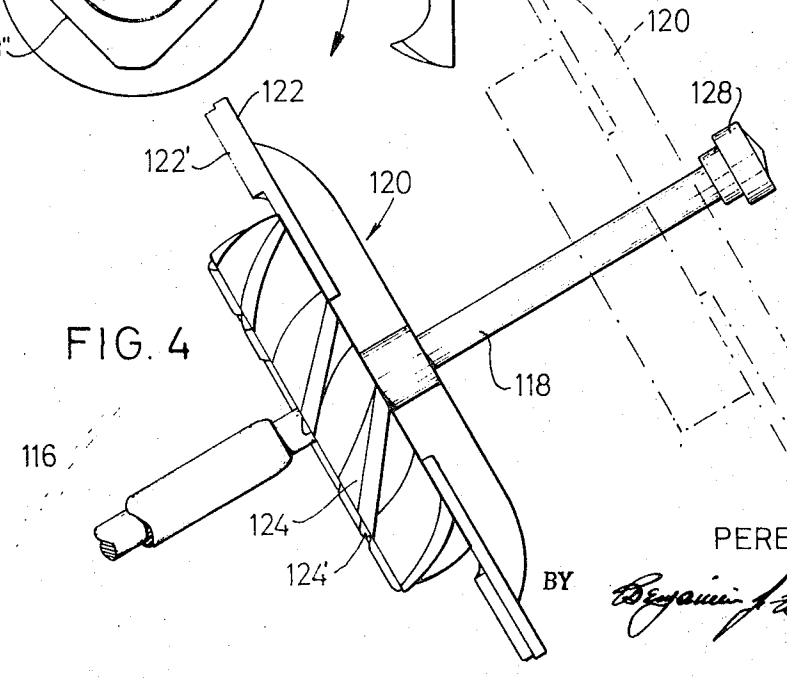



FIG. 4




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# ROTARY SPRINKLER

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to water sprinklers or other forms of liquid dispersing devices, and particularly to water sprinklers for use in irrigation systems.

2. Description of the Prior Art

Many different types of rotary sprinklers are now in use, but all those known to me have at least one, and usually more, of the following disadvantages: difficulty of inspecting the packing to determine extent of wear; presence of small openings or narrow necks which easily become blocked by dirt or other foreign particles in the water; improper or complete failure of operation under low or high water pressure; inability to produce irregular water distribution patterns, *e.g.* square or rectangular patterns; and high cost of manufacture and maintenance because of the use of many complicated parts requiring close tolerances.

An object of the present invention is to provide a novel rotary sprinkler having improved characteristics in the above respects.

## SUMMARY OF THE INVENTION

The present invention provides a rotary sprinkler comprising a housing having a water inlet and a nozzle rotatably mounted to the housing. The nozzle is formed with a water outlet through which the water exits in the form of a jet, and a shaft is fixed to the nozzle at an oblique angle laterally of the direction of the water jet. A rotor is rotatably and slidably mounted on the shaft. The rotor includes a complete circle of inner, closely-spaced vanes, and a separate group of outer widely-spaced vanes.

In operation, the rotor "floats" on the shaft fixed to the nozzle such that, during starting conditions, the inner group of vanes are impinged by the water jet to effect rotation of the rotor. The rotor is then forced by the jet to move outwardly along the shaft to cause the outer group of vanes to be impinged by the water jet, effecting the rotation of the rotor and also of the nozzle during the normal running conditions.

According to a further feature of the invention, a cam and follower arrangement may be provided acting on the rotor to produce an irregular distribution pattern of the water exiting from the sprinkler.

Further features and advantages of the invention will be apparent from the description below.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention is herein described, by way of example only, with reference to the accompanying drawings, wherein:

FIG. **1** is a longitudinal sectional view of a rotary sprinkler constructed in accordance with the invention;

FIG. **2** is a top plan view of the sprinkler of FIG. **1**;

FIG. **3** is a front plan view of the details of a rotor that may be used in the sprinkler of FIG. **1**; and

FIG. **4** is a side elevational view of a sprinkler with the rotor of FIG. **3**, showing the rotor in full lines in its starting position, and in broken lines in its running position.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

The sprinkler illustrated in the drawings comprises a housing **2** (*e.g.*, of molded plastic) internally threaded at its lower end **4** and formed with an apertured top wall **6**. The lower end of the housing serves as the water inlet and is adapted to be coupled by threads **4** to a source of water, such as a water supply pipe **5**. The sprinkler includes a nozzle **8** (*e.g.*, of molded plastic) formed with an outwardly-extending annular flange **10** adapted to limit against top wall **6** of housing **2**. A gasket **12** (*e.g.* of plastic) is interposed between the two and serves as a rotary bearing for the nozzle **8**, the latter being mounted for rotation about the vertical axis of housing **2**. Nozzle **8** is formed with a conical bore **14** extending obliquely to the vertical axis of the housing. The water introduced into housing **2** exits through bore **14** in the form of a jet **16**.



Fixed to nozzle **8** is a shaft on which a rotor **20** (*e.g.*, of molded plastic) is rotatably and slidably (*i.e.*, "floatingly") mounted. Shaft **18** is fixed to the nozzle **14** at an oblique angle laterally of the water jet **16** such that rotor **20** is impinged by the water jet. The shaft is also inclined with respect to the horizontal axis so that rotor **20** is biased downwardly by gravity toward the water jet.

Rotor **20** is formed with two separate and distinct groups of blades or vanes, namely an outer group of widely-spaced vanes **22**, and a complete circle of inner closely-spaced vanes **24**. The outer vanes **22** are spaced from each other many times the thickness of the water jet, whereas the inner vanes **24** are spaced sufficiently close to each other that the water jet cannot freely pass between them.

The operation of the sprinkler, insofar as described above, is as follows: During starting conditions, *i.e.*, before the water is turned on, rotor **20** moves downwardly by gravity to a position close to the exit end of nozzle bore **14**. As soon as the water is turned on, the water jet impinges on the inner, closely-spaced vanes **24**. This starts the rotor to rotate on shaft **18**, and at the same time causes nozzle **8** to begin to rotate about the vertical axis of the sprinkler. In addition, the force of the water jet moves rotor **20** upwardly along shaft **18** so that the water jet now impinges on the outer, widely-spaced vanes **22**, effecting the rotation of the nozzle (in the direction of the arrow in FIG. **2**), and also of the rotor, during normal running conditions of the sprinkler.

If the water pressure falls, the rotor will slide downwardly toward the nozzle so that the inner vanes **24** will be impinged by the water jet, thus assuring operation of the sprinkler even under low water pressure conditions. On the other hand, if the water pressure rises, the rotor will slide away from the nozzle, decreasing the impact forces on the rotor. The rotor thus "floats" along shaft **18** providing self-regulation of the rotational speed of the sprinkler by the energy derived from the water jet.

It will be appreciated that gasket **12** may be easily inspected in the field and replaced if necessary. In addition, the water flows straight from the housing and out through the nozzle bore without passing through any narrow neck or small openings which may easily become blocked by foreign particles. The self-regulation feature obtained by the "floating" rotor assures operation even under a drop or rise in the water pressure. Further, the sprinkler is made of but few simple parts which can be easily manufactured and assembled at low cost.

The described embodiment of the invention also includes an additional feature, namely the ability to effect special or irregular water distribution patterns (*e.g.*, a square or a rectangular one) as may be required in special applications, such as lawns or hothouses. For this purpose the sprinkler includes a rod **26** passing coaxially through shaft **18** and carrying at its outer end an adjustable stop in the form of a nut **28**. A spring **30** is interposed between nut **28** and rotor **20**, washer **32** being provided, if desired, to reduce friction. The opposite end **34** of rod **26** is bent inwardly and then downwardly, and carries a cam follower in the form of a roller **36** adapted to follow the profile of a cam **38** fixed on housing **2**. For purposes of illustration, there is shown a square-shaped cam **38** for effecting a square-shaped water distribution pattern.

As nozzle **8** rotates about the vertical axis, during the operation of the sprinkler as described above, cam follower **36** will move along cam surface **38** and will cause rotor **20** to "float" along shaft **18** in accordance with the profile of the cam. Thus, when the follower moves along the corners of the square (*i.e.*, along the high surfaces **38'**), the rotor is forced by spring **30** to move inwardly closer to the water jet **16**, thus decreasing the trajectory of the jet. When the follower moves along the sides of the square (*i.e.*, along the low surfaces **38''**), the rotor tends to move further away from the jet, thereby increasing the trajectory of the jet.

It will also be seen that when the rotor moves inwardly, decreasing the trajectory of the jet, the rotational velocity of the nozzle is increased by the increased number and force of the jet impacts on the inner group of closely-spaced vanes **24**; and that when the rotor moves outwardly, increasing the trajectory of the jet, the rotational velocity of the nozzle is decreased. Thus a square water distribution pattern is effected not by changing the force of the jet, but rather by decreasing its trajectory and increasing its velocity at the sides of the square, and increasing its trajectory and decreasing its velocity at the corners. A fairly uniform distribution of the water is thus effected during this sprinkling of the irregular pattern, which could be achieved in previously known sprinklers, if at all, only by complicated arrangements.

The irregular distribution pattern feature, namely elements **26—38**, may of course be omitted, in which case the rotor is freely and unobstructively slidable on the shaft from its starting position, where the water jet impinges only on the inner vanes, to its normal running position where the water jet impinges only on the outer vanes.

FIGS. **3** and **4** illustrate such an arrangement and the details of a rotor that may be used. As shown, there are but two outer widely-spaced, diametrically-opposed, vanes **122**, the front face of each being wedge-shaped, thickened at the leading edge **122'** in the direction of rotation of the rotor **120** so as to form a small angle to the plane of rotation of the rotor. The inner, closely-spaced vanes **124** lie at a greater angle to the plane of rotation of the rotor and are slightly curved, the front face of each being wedge-shaped, thickened at the leading edge **124'**. The vanes will thus move clockwise in FIG. **3**, during rotation of the rotor. Upon starting, the rotor will be in the full-line position of FIG. **4**, where the jet impinges only on the inner vanes **124**, the rotor being slid by jet **116** along shaft **118** to the broken-line position where only the outer vanes **122** are impinged by the jet during normal running conditions. Cap **128** serves as the end stop but is not essential assuming shaft **118** is long enough to accommodate the floating movement of the rotor during normal running conditions.

It will be appreciated that certain of the above-described features may be used without others, and that many other variations, modifications and applications of the illustrated embodiment may be made.

I claim:

**1**. A rotary sprinkler comprising a housing having a water inlet and a nozzle rotatably mounted to the housing, said nozzle being formed with a water outlet through which the water exits in the form of a jet, a shaft fixed to the nozzle at an oblique angle laterally of the direction of the water jet, and a rotor rotatably mounted on said shaft, said rotor including a complete circle of inner, closely-spaced vanes and a group of outer, widely-spaced vanes each separate and distinct from said inner vanes, said rotor being slidably mounted on said shaft and biased in the direction of said nozzle such that during starting conditions the water jet impinges only on the inner vanes to start the rotor to rotate and to slide it outwardly along the shaft until the water jet impinges only on the outer vanes during normal running conditions to rotate the rotor on the shaft and to rotate the nozzle on the housing.

**2**. A sprinkler as defined in claim **1**, wherein said nozzle is rotatably mounted to the housing about a vertical axis of rotation, and wherein said shaft is fixed to the nozzle at an incline to the horizontal, whereby said rotor is biased in the direction of said nozzle by gravity.

**3**. A sprinkler as defined in claim **1**, wherein said group of outer wide-spaced vanes comprises two diametrically-opposed vanes.

**4**. A rotary sprinkler comprising a housing having a water inlet and a nozzle rotatably mounted to the housing about a vertical axis of rotation, said nozzle being formed with a water outlet through which the water exits in the form of a jet, a shaft fixed to the nozzle at an incline to the horizontal and at an oblique angle laterally of the direction of the water jet, and a rotor rotatably mounted on said shaft, said rotor including a complete circle of inner, closely-spaced vanes, and a group of outer, widely-spaced vanes each separate and distinct from said inner vanes, said rotor being floatingly mounted on said shaft such that during starting conditions the water jet impinges only on the inner vanes to start the rotor to rotate and to slide outwardly along the inclined shaft until the water jet impinges only on the outer vanes during normal running conditions to rotate the rotor on the shaft and to rotate the nozzle on the housing.

**5**. A sprinkler as defined in claim **4**, wherein the inner vanes lie at a greater angle to the plane of rotation of the rotor than the outer vanes.

**6**. A sprinkler as defined in claim **4**, wherein the rotor is freely and unobstructively slidable on the shaft from its starting position where the water jet impinges only on the inner vanes, to its normal running position where the water jet impinges only on the outer vanes.

**7**. A sprinkler as defined in claim **4**, further including means for producing an irregular water distribution pattern, comprising, a rod passing coaxially through said shaft, the outer end of said rod carrying a stop, and a spring interposed between the rotor and the stop, the opposite end of said rod carrying a cam follower, and a cam fixed to the sprinkler housing cooperable with said follower, said cam having a shape in accordance with the water distribution pattern desired.

**8**. A sprinkler as defined in claim **4**, wherein said housing is formed with an apertured top wall, said nozzle being rotatably mounted in said apertured top wall and having an outwardly extending annular flange adapted to limit against the inner surface of said top wall.

**9**. A sprinkler as defined in claim **8**, wherein a gasket is interposed between said housing top wall and said nozzle annular flange.