United States Patent

[11] **3,623,667**

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[73] Assignee **Rain Bird Sprinkler Mfg. Corp.**
Glendora, Calif.

[54] **MOTOR FOR ROTARY SPRINKLERS**
6 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **239/237,** 239/210, 239/240, 239/264, 415/122, 418/61
[51] **Int. Cl.** **B05b 3/04**
[50] **Field of Search** ..... 239/206, 210, 237, 240, 260, 264, DIG. 1; 415/122; 418/61

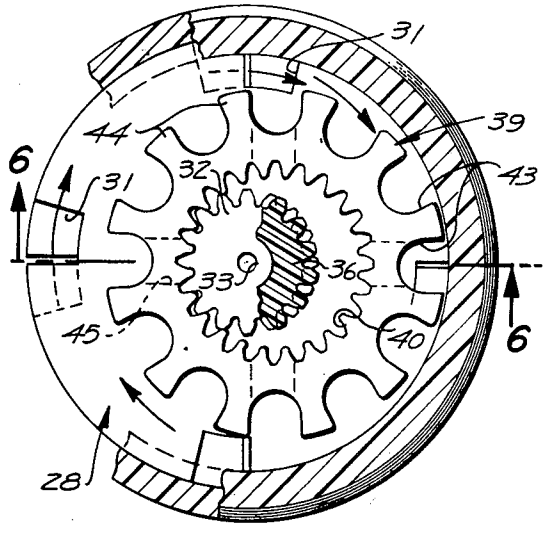
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ABSTRACT: A motor for rotary sprinklers in which a fixed member and a rotatable member are disposed coaxially and are surrounded by a drive ring; the external surfaces of the fixed and rotatable members and the internal surface of the drive ring having two sets of intermeshing teeth which differ in ratio so that, for each rotation of the drive ring, the rotatable member turns in the same or opposite direction with respect to the drive ring a predetermined small amount. The intermeshing members are contained in a chamber having inlets positioned to direct water circumferentially against the drive ring to cause rotation and an outlet through the rotatable member terminating in a sprinkler nozzle.



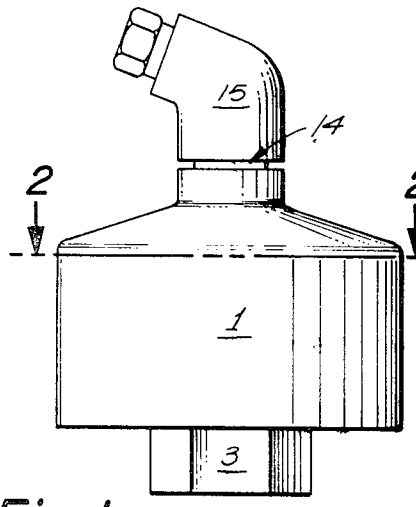


Fig. 1

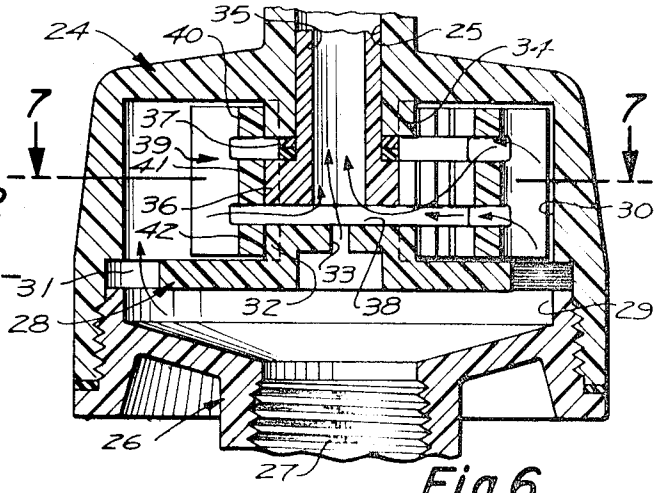


Fig. 6

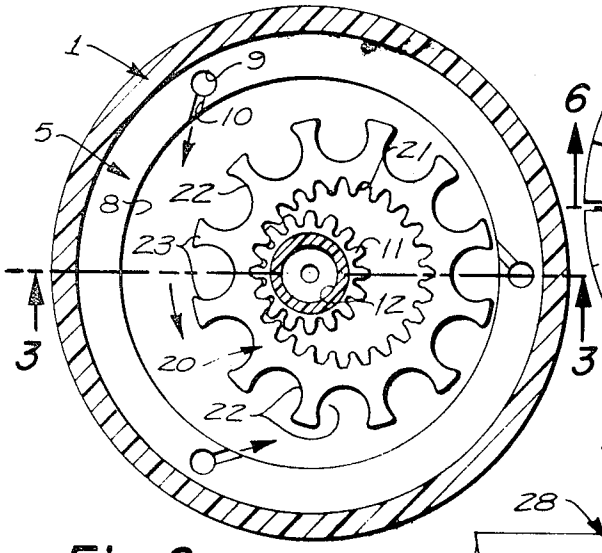


Fig. 2

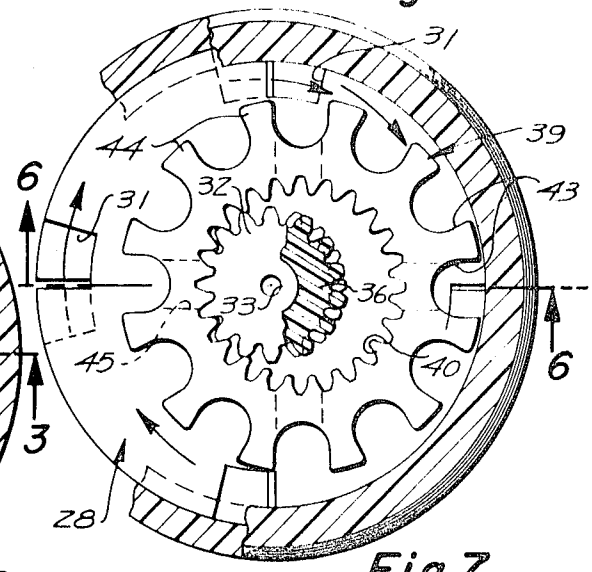


Fig. 7



Fig. 8

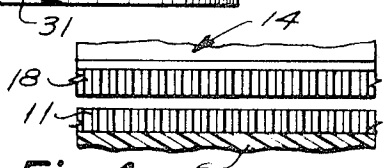


Fig. 4

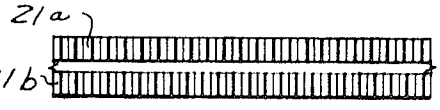


Fig. 5

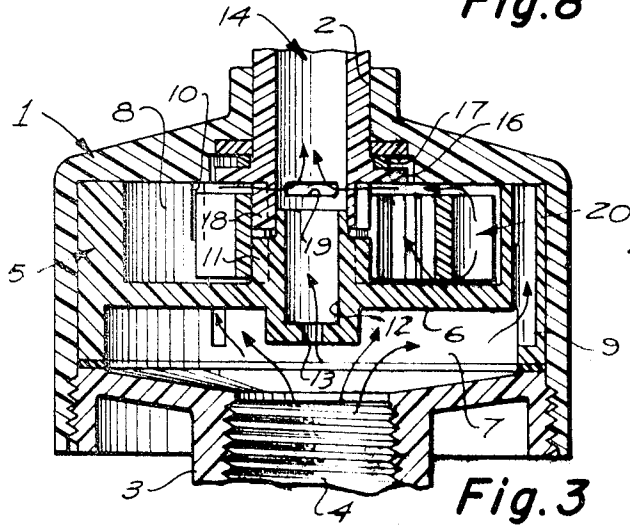


Fig. 3

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MOTOR FOR ROTARY SPRINKLERS

BACKGROUND OF THE INVENTION

Reference is made to U.S. Pat. No. 3,315,898 which discloses a rotary sprinkler motor utilizing a rotor having a polygonal impact-receiving surface and a surrounding water-driven polygonal drive ring having at least one more side than the rotor. The construction therein disclosed has proved to be quite successful and has been incorporated in the following copending applications:

Ser. No. 759,038,

filed Sept. 11, 1968, now Pat No. 3,323,647, entitled PART CIRCLE WATER MOTOR DRIVEN SPRINKLER; and Ser. No. 758,961 filed Sept. 11, 1968, now Pat. No. 3,515,351, entitled IMPACT DRIVEN POP-UP SRINKLER.

For some uses, it is desirable to rotate the sprinkler at a slower rate than is possible with the impact type of rotor. While this can be accomplished by appropriate gears, the cost is substantially increased. In some cases, it is desired to minimize the proportion of water bypassed through the motor or to miniaturize the sprinkler both of which have the effect of reducing the power output of the rotor. Also, if the sprinkler incorporates a variable distance selecting cam to produce other than a circular spray pattern, the load on the motor is increased.

SUMMARY OF THE INVENTION

The present invention is summarized in the following objects:

First, to provide a motor for rotary sprinklers which utilizes a fixed member and a coaxial rotatable member, both surrounded by a water-actuated drive ring, the external surfaces of the drive ring having two sets of intermeshing teeth, differing slightly in ratio so that on complete rotation of the drive ring, the rotating member moves in the same or opposite direction to the drive ring a small amount, thus causing slow rotation of a sprinkler nozzle carried by the rotating member.

Second, to provide a motor for rotary sprinklers, as indicated in the preceding object, wherein water impinging on the outer surface of the drive ring causes the drive ring to rotate, and upon rotation, tends to assume an eccentric path causing intermeshing of the teeth.

Third, to provide a motor for rotary sprinklers, of the type indicated in the preceding objects, which, in the event that particles carried in the water should lodge between the teeth, the rotor tends to disengage from the fixed and rotatable member to permit dislodgement of the particles, then reengages to continue the driving operation.

Fourth, to provide a motor for rotary sprinklers, of the type indicated in the preceding objects, wherein the teeth tend to disengage if the restraint on the rotary member is excessive, and which, in the course of reengagement, the drive ring teeth tend to impact the mating teeth thereby producing extra force to free the rotating member from the excessive restraint.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of the motor for rotary sprinklers, showing a typical sprinkler mounted thereon.

FIG. 2 is an enlarged transverse sectional view, taken through 2—2 of FIG. 1, with portions of the motor shown in plan.

FIG. 3 is a fragmentary sectional view, taken through 3—3 of FIG. 2.

FIG. 4 is a fragmentary developed view, at a reduced scale, showing the teeth of the fixed pinion gear and the rotatable pinion gear to illustrate one form of the motor drive wherein the number of teeth differ in order to effect rotation of the rotatable pinion gear when the two gears are driven by a common internal gear.

FIG. 5 is a similar developed view of the teeth of a modified internal gear in which the teeth are divided into two groups differing in the number of teeth for engagement with pinion gears having a like number of teeth.

FIG. 6 is a sectional view, similar to FIG. 3, showing a modified form of the motor, taken along 6—6 of FIG. 7.

FIG. 7 is a transverse sectional view, taken through7—7 of FIG. 6, with portions of the motor shown in plan.

FIG. 8 is a side view of the partition plate and fixed gear.

Reference is first directed in FIGS. 1 through 4. The motor for rotary sprinklers includes a housing 1 of generally cylindrical form, open at its lower end and constricted at its upper end to form a bearing 2. The lower open end is internally screw threaded and receives an inlet fitting 3 which closes the lower end of the housing except for an internally screw threaded inlet 4.

Secured within the housing 1 by the inlet fitting 3 is a cylindrical sleeve 5, having a partition 6 which forms with the inlet fitting 3 an inlet chamber 7, and with the housing 1 a motor chamber 8. The walls of the sleeve 5 have inlet passage 9 communicating with the inlet chamber 7 and terminating in essentially tangential inlet slits 10, communicating with the motor chamber 8.

Formed as an integral part of the partition 6 is an upwardly directed centrally located fixed pinion gear 11. The pinion gear is tubular and forms a central inlet passage 12, having at its lower end a constricted central inlet port 13.

Journaled in the bearing 2 is a rotatable stem 14 which extends above the housing 1 and receives an angularly directed sprinkler nozzle 15. The upper wall of the motor chamber is recessed and the stem 14 is provided with a flange 16, which fits into the recess and forms a part of a thrust bearing 17. The stem 14 extends below the flange 16 and is provided with an integral rotatable pinion gear 18, disposed in coaxial relation with the fixed pinion gear 11. Immediately below the thrust bearing 17, the stem 14 is provide with radially directed outlet slots 19 communicating with the motor chamber 8.

A rotor 20 is positioned in the motor chamber 8 and surrounds the pinion gears 11 and 18. The rotor forms an internal gear 21, which meshes with the fixed and rotatable pinion gears 11 and 18. The rotor 20 is also provided with external flutes 22, forming therebetween drive webs 23.

Operation of the motor for rotary sprinklers is as follows:

The two pinion gears do not have the same number of teeth; however, they have the same pitch diameter. Preferably, one pinion gear has one more tooth than the other. Water entering the inlet 4 is divided, a portion flowing directly through the inlet port 13 and a portion being diverted through the inlet passages 9 and inlet slits 10 to engage the rotor 20. The impinging water causes the rotor to rotate and in doing so the rotor tends to assume an eccentric position with its internal gear 21 meshing with the pinion gears 11 and 18. The rotor tends to float in the motor chamber as the water passes between the axial ends of the rotor and discharges through the slots 19. The teeth of the internal gear wedge between the teeth of the pinion gears with the result that for each rotation of the rotor, the rotatable pinion gear 18 moves one tooth, causing the position of the sprinkler nozzle to advance slowly in a circular path.

Should the resistance to rotation of the sprinkle nozzle be excessive, the internal gear 21 may disengage momentarily; however, continued rotation will cause the internal teeth to impact against the teeth of the pinion gear until reengagement occurs. This impact action tends to jar the stem 14 free. The rotor rotates rapidly so that the period of disengagement, should it occur, is brief.

Reference is directed to FIG. 5, which illustrates a pair of internal gears 21*a* and 21*b*, having the same pitch diameter but having a different number of teeth, preferably one gear having one more tooth the than the other. With this arrangement the pinion gears 11 and 18 may have the same number of teeth.

It should be noted that the pitch diameters of the two pinion gears and two mating internal gears may differ providing that the ratio of each mating pair of gears differs slightly so as to produce the desired slow rotation of the sprinkler nozzle.

Reference is now directed to FIGS. 6, 7 and 8. The motor construction here shown is similar in most respects to the first-described structure; that is, the modified motor includes a housing 24, generally similar to the housing 1, having a bearing 25 at its upper end, and provided with an internally screw threaded lower end which receives an inlet fitting 26, having an inlet 27. In place of the sleeve 5, a partition disk 28 is interposed between the inlet fitting 26 and the housing 24 to form an inlet chamber 29 and motor chamber 30. The periphery of the partition disk 28 is provided with angular or helically directed slots 31 so that water entering the inlet chamber 29 is caused to swirl or rotate.

Formed as an integral part of the parition disk 28 is a lower fixed pinion gear 32, through which is formed a central inlet port 33. The upper wall of the motor chamber 30 is provided with an upper depending fixed pinion gear 34. The two fixed gears are identical in pitch and number of teeth and are disposed in coaxial relation.

The housing 24 receives a rotatable stem 35, corresponding to the stem 14. The lower extremity of the stem 35 is provided with a rotatable pinion gear 36, which is interposed between the fixed gears 32 and 34. Interposed between the rotatable gear 36 and the upper fixed pinion gear 34 is a thrust gearing 37. The gear 36 is spaced from the lower fixed pinion gear 32 to form outlet ports 38 communicating with the tubular rotatable stem 35.

As in the first-described structure, the motor chamber 30 receives a rotor 39, having a set of internal gears 40, 41, and 42. The rotor 39 is provided with external flutes 43, forming therebetween drive webs 44. Slots 45 may be provided between the internal gears so that water may flow through the slots 45 as well as past the axial ends of the rotor.

Operation of the modified motor is essentially the same as the first-described structure. Also, similar to the first-described structure, either the number of teeth of the fixed and movable pinion gears may differ, or the internal gears 40 and 42 may differ with respect to the internal gear 41, the purpose being to cause slow rotation of the sprinkler nozzle.

The present embodiments of this invention are to be considered in all respects as illustrative and not restrictive.

I claim:

1. A fluid-operated motor, comprising:
   a. a housing structure having a motor chamber, and inlet means to cause rotary motion of water in the chamber;
   b. a tubular stem journaled in the body structure and having a sprinkler nozzle;
   c. a rotatable gear mounted on the end of the stem exposed to the chamber;
   d. a fixed gear secured in the chamber in coaxial relation to the rotatable gear;
   e. a floating drive ring surrounding the gears and rotatable in response to rotary motion of water in the chamber;
   f. the drive ring having internal gear elements engageable respectively with the fixed and rotatable gears, to form a first and a second gear drive, the ratios of the gear drives being different thereby to cause the rotatable gear to turn a predetermined partial circle with each complete rotation of the drive ring.

2. A motor, as defined in claim 1, wherein:
   a. the inlet means includes a sleeve fitted within the housing structure and tangentially disposed inlet openings formed in the walls of the sleeve.

3. A motor, as defined in claim 1, wherein:
   a. the inlet means is a disk defining the bottom of the chamber having helically directed inlet ports in the periphery thereof.

4. A motor, as defined in claim 1, wherein:
   a. a pair of fixed gears extend into the motor chamber from opposite ends thereof and the rotatable gear is interposed therebetween.

5. A motor, as defined in claim 1, wherein:
   a. the fixed and rotatable gears differ in the number of teeth.

6. A motor, as defined in claim 1, wherein:
   a. the internal gear elements of the drive ring differ in the number of teeth.

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