

[54] **ROTARY POP-UP SPRINKLER**
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[52] U.S. Cl. **239/205**
[51] Int. Cl. **B05b 15/10**
[58] Field of Search **239/203, 204, 205, 206**

[56] **References Cited**

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[57] **ABSTRACT**

A sprinkler is provided with a pop-up nozzle rotatably supported on a housing keyed to a casing for axial nonrotatable movement between positions in which the nozzle is retracted or extended. The housing contains a water actuated motor coupled by gearing to the nozzle for rotation thereof. A seal is fixed to one end of the casing and sealingly surrounds the nozzle when the nozzle is retracted and stationary. When the nozzle is extended and rotating, the seal is disengaged therefrom and sealingly surrounds a part of the housing in stationary relation. The gearing has an internal seal which is protected by the nozzle and is located above the casing in the extended position of the nozzle to obviate flooding of the internal seal. This minimizes drag on rotation of the nozzle and reduces wear on the seals. The gearing coupling the motor and nozzle is alterable to obtain a predetermined arc of rotation of the nozzle.

10 Claims, 7 Drawing Figures

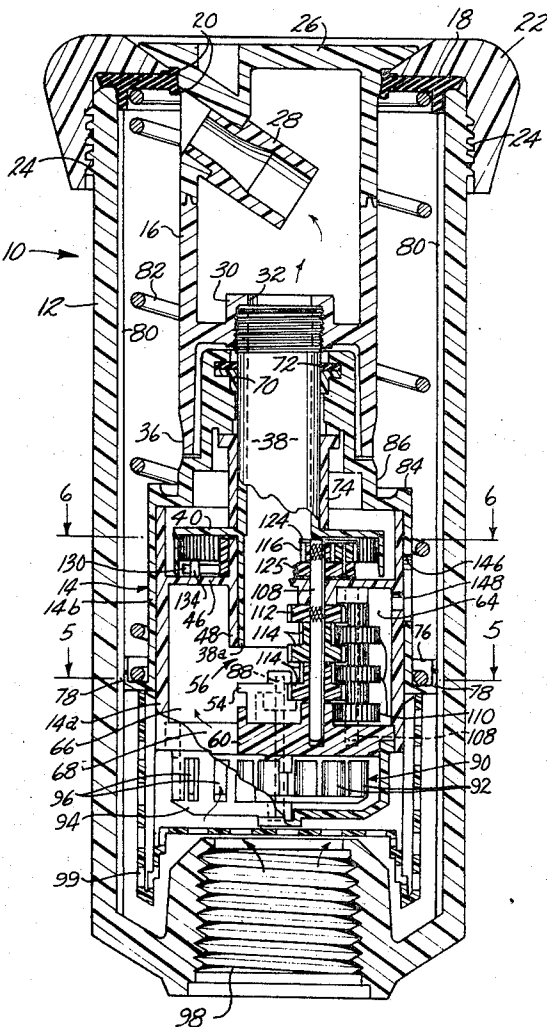


FIG. 1.

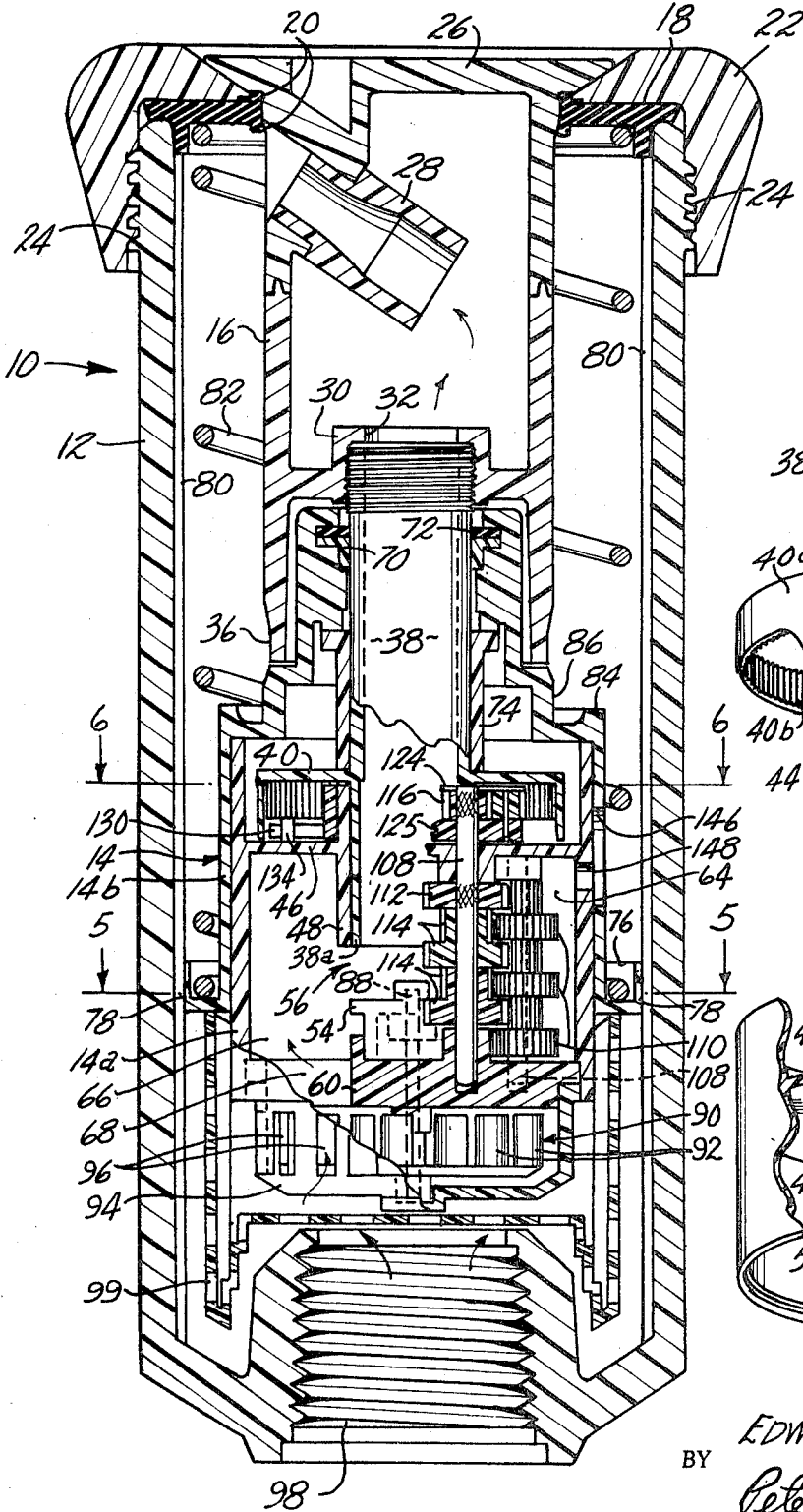


FIG. 3

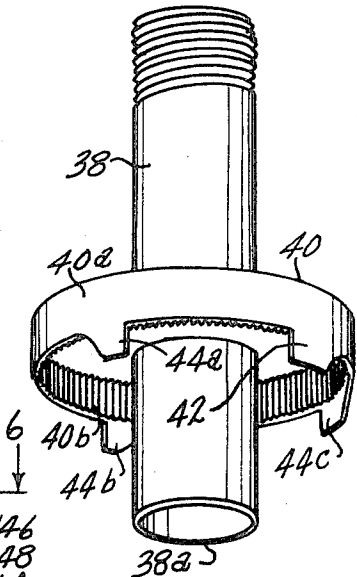
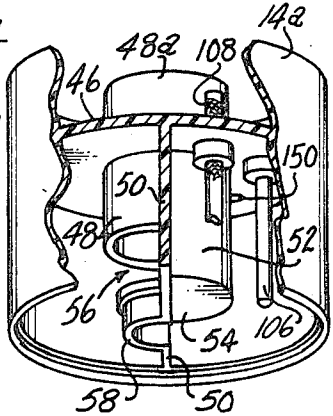


FIG. 4.



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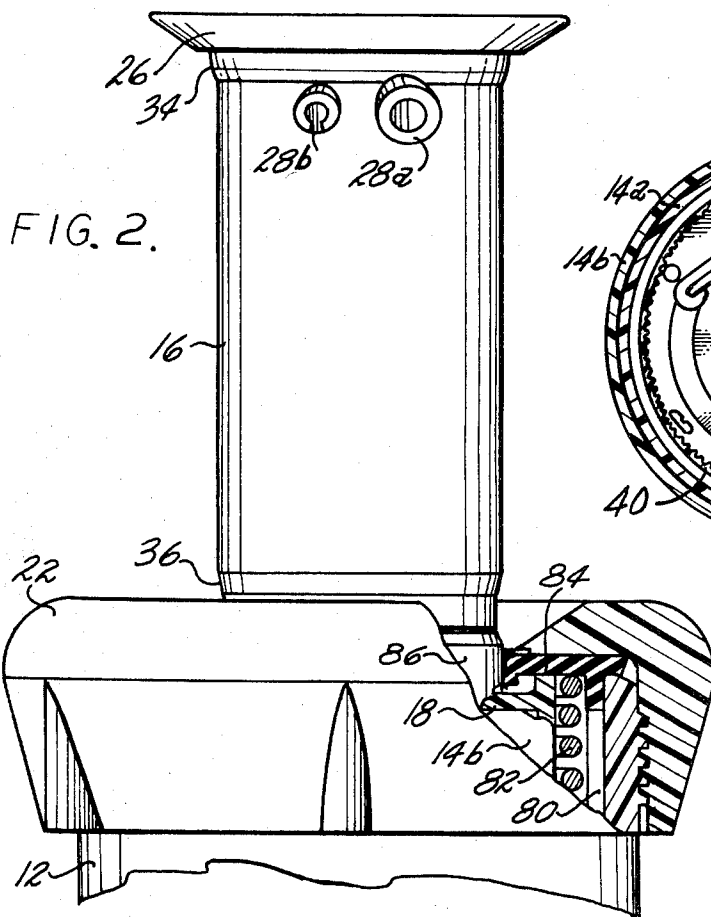


FIG. 2.

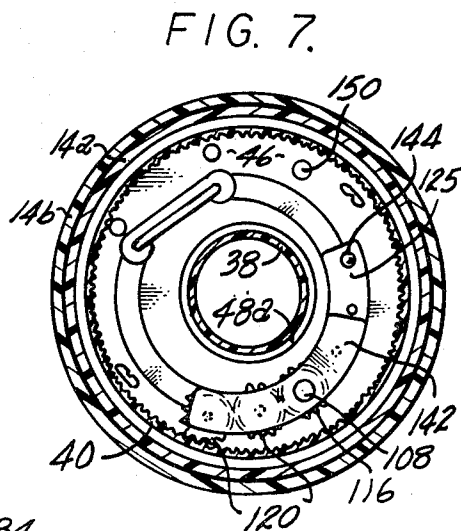


FIG. 7.

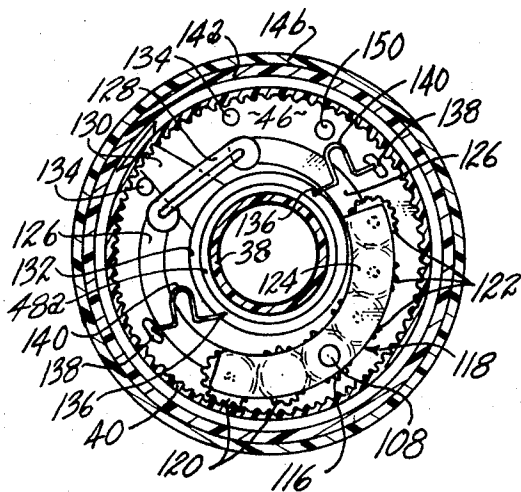


FIG. 6.

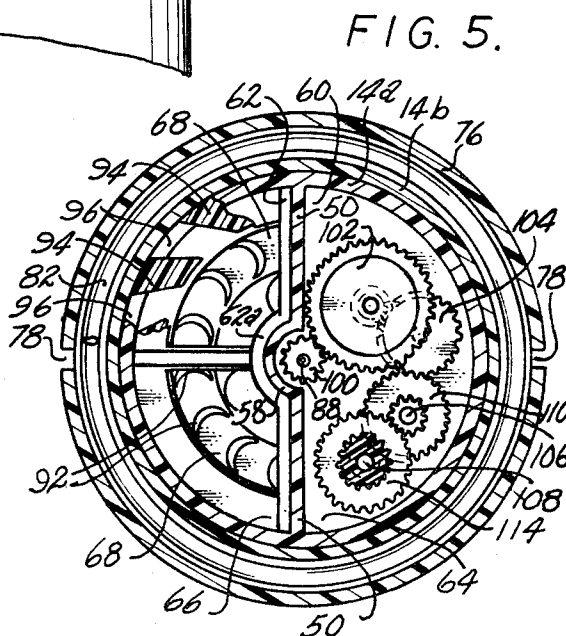


FIG. 5.

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ROTARY POP-UP SPRINKLER

CROSS-REFERENCE TO RELATED PATENT

This application is related to U.S. Pat. No. 3,107,056, issued Oct. 15, 1963, to E. J. Hunter for "Sprinkler."

BACKGROUND OF INVENTION

The present invention relates to sprinklers, and more particularly to rotary sprinklers of the pop-up type. This invention provides an improvement over the sprinkler disclosed and claimed in applicant's aforementioned U.S. Pat. No. 3,107,056. The patent discloses a gear-driven oscillating sprinkler of the pop-up type in which a water actuated motor is contained in a housing fixedly mounted in a casing. A nozzle tube is slidably mounted on the motor housing and is coupled to the motor for rotation thereby by means of gearing including an internal gear having a tubular hub within which the nozzle tube telescopes and to which it is slidably keyed. A seal fixed to the motor housing sealingly surrounds the rotatable hub of the internal gear. Although the sprinkler of the patent has been very effective as a rotary pop-up sprinkler, its pop-up stroke is limited and the seal and hub are subject to flooding and the attendant possibility of sand or the like getting into the parts, causing the nozzle tube to stick and otherwise hampering proper operation of the sprinkler. Any sand between the gear hub and the seal imposes frictional drag on the rotation of the nozzle tube and causes excessive wear of the seal.

It is therefore a primary object of the present invention to provide a rotary sprinkler of the pop-up type in which the pop-up stroke thereof is substantially greater than prior art rotary pop-up sprinklers.

Another object is to provide a rotary pop-up sprinkler in which a nozzle is rotatably mounted on a support and has a surrounding seal, the nozzle being movable to an extended pop-up position in which flooding of the seal is obviated.

A further object is to provide a rotary pop-up sprinkler in which the nozzle and support are movable as a unit to dispose the nozzle in extended pop-up position.

Still another object is to provide a rotary pop-up sprinkler in which the nozzle and support are disposable in a casing and the nozzle is extendable therefrom to dispose the surrounding seal above the casing.

A still further object is to provide a rotary pop-up sprinkler in which a second seal is fixed to the casing and is engaged with a stationary part during rotation of the nozzle so that wear on the second seal is minimized.

Another object of the present invention is to provide a rotary pop-up sprinkler in which the second seal is sealingly engaged with the nozzle before pop-up and is disengaged therefrom after pop-up, for minimization of drag on the rotary movement of the nozzle.

Still another object of the present invention is to provide a rotary pop-up sprinkler in which the nozzle and a water-actuated motor therefor are movable as a unit within a casing, and the casing has a seal which is engaged with the nozzle prior to pop-up and stationarily engaged with the motor after pop-up.

These and other objects and advantages of the present invention are achieved by the provision of a hollow cylindrical casing provided with a pair of diametrically disposed longitudinal ribs to which a

motor housing is keyed for sliding axially of the casing. The motor housing is divided into a water chamber and a gear chamber containing a train of gears driven by a water turbine wheel supported on the lower end of the motor housing. The gearing terminates in an internal gear having an axially disposed tubular shaft extending upwardly from the motor housing and surrounded by an internal seal. Secured to the shaft, in axial alignment therewith, is a substantially cylindrical nozzle body which receives water for sprinkling by way of the hollow shaft and has a lower portion which protects the internal seal. The motor housing is provided with a smaller substantially cylindrical portion which is coaxial with the nozzle body and has substantially similar cross dimensions. A seal at one end of the casing is adapted to alternately engage the nozzle body and said smaller cylindrical portion of the motor housing. The second seal serves to limit the movement of the motor housing and nozzle body and is held in place by a centrally apertured retainer screwed to the end of the casing. The other end of the casing is formed to be connected to a source of water under pressure which is adapted to actuate the turbine wheel and flow through the water chamber, the hollow shaft and the nozzle body for effecting pop-up of the nozzle against the action of a retracting spring and causing rotation of the nozzle body. Thus, in the absence of water pressure, the nozzle body is stationary in retracted position in the casing and sealingly engaged with the second seal, but after pop-up and rotating it is disengaged from such seal so that the seal imposes no drag on the rotation of the nozzle. During rotation of the nozzle, the second seal is sealingly engaged with the smaller cylindrical portion of the motor housing in stationary relationship thereto. Also, in the pop-up position the internal seal around the tubular shaft is located above the casing and protected against flooding. These relationships of the seals to the nozzle body and motor housing have the advantages that drag on the rotation of the nozzle body is minimized and wear on the seals is greatly reduced, thus providing for a relatively long life of the seals and easier turning of the nozzle body.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a vertical view of a sprinkler embodying the principles of the invention, with the nozzle body in retracted position and parts broken away or in section to show the inner mechanisms.

FIG. 2 is a fragmentary vertical view of the sprinkler with the nozzle body in extended pop-up position and parts in section to show the seal in engagement with the slidable housing.

FIG. 3 is a perspective view of the internally toothed gear which is a part of the sprinkler drive means.

FIG. 4 is a smaller scale perspective view of the shell portion of the housing, partly broken away to show details thereof.

FIG. 5 is a horizontal sectional view along line 5—5 in FIG. 1, with the casing omitted and parts broken away.

FIG. 6 is a horizontal sectional view along line 6—6 in FIG. 1, with the spring and casing omitted.

FIG. 7 is a view similar to FIG. 6, but showing a modification in the sprinkler drive means.

DESCRIPTION OF EMBODIMENT

Referring to the drawings, there is shown in FIG. 1 a vertical view, with parts broken away or in section, of a rotary pop-up sprinkler 10 embodying the principles of the present invention. The sprinkler includes a hollow cylindrical casing 12, a housing 14 mounted for sliding within the casing, and a nozzle body 16 mounted for rotation on the housing and slidable therewith as a unit between positions in which the nozzle body is retracted into the casing, as shown in FIG. 1, and a position in which the nozzle body is extended in pop-up position, as shown in FIG. 2. A circular seal 18 has yieldable lips 20 which surround the nozzle body in sealing engagement therewith when the nozzle body is in retracted position; when the nozzle body is in extended pop-up position, the seal is disengaged therefrom.

The seal 18 is secured to the upper end of the casing 12 by a retainer 22 which is suitably apertured centrally for receiving the nozzle body. The casing and retainer are provided with buttress threads 24 for interconnection with each other.

The nozzle body 16 is substantially cylindrical and is topped by a cover plate 26 which is conventionally shaped to fit the retainer 22. Internally, the nozzle body is provided with one or more nozzles 28 having orifices 28a or 28b, suitably shaped to obtain desired near and far range sprinkling, as is well known in the art. The nozzle body is also provided with a threaded connector 30 having an opening 32, centrally disposed. The upper end of the nozzle body has a tapered enlargement 34 and the lower end of the nozzle body has a tapered reduction 36, better seen in FIG. 2.

Threadedly connected to the connector 30, in axial alignment with the opening 32, is a tubular member 38 with a lower end portion 38a serving as a hollow shaft for a gear 40. The gear has a skirt 40a with internal teeth 40b, better seen in FIG. 3. Depending from the skirt are a main tab 42 and minor tabs 44a, b, c, for a purpose later appearing. The tubular member also serves as a conduit for the passage of water.

The shaft end 38a is journaled for rotation in the housing 14 which has a cylindrical shell portion 14a and a multi-diameter cap portion 14b, the former fitting into the latter, as shown in FIG. 1. The shell 14a is formed with a horizontal dividing plate 46 which supports a centrally disposed cylindrical bearing sleeve 48. The shaft end is received in the sleeve and is coterminous therewith. The sleeve has a portion 48a thereof which extends above the dividing plate; better seen in FIG. 4.

Depending from the horizontal dividing plate 46 are diametrically aligned dividing walls 50 joined thereto and to the sleeve 48 and inner walls of the shell 14a. Below the sleeve, the walls 50 are interconnected by an intermediate arcuate wall 52 which is an extension of the sleeve to one side of the walls. Closing off the lower end of the arcuate wall 52 is a circular plate 54 which, with the lower end of the sleeve, defines a water inlet port 56. The dividing walls 50 extend slightly below the plate 54 and are interconnected by an intermediate arcuate wall 58 oppositely curved from the arcuate wall 52.

Fitted within the lower end of the shell 14a is a bottom plate 60 formed with a rib 62 having an arcuate in-

termediate rib portion 62a adapted to fit against the lower ends of the walls 50 and 58, as shown in FIG. 5. The plates 46 and 60, dividing walls 50, 52, 58, plate 54 and shell 14a define a gear chamber 64 and a water chamber 66. The bottom plate is provided with a pair of segmental water ports 68.

Returning to FIG. 1, the upper end of the cap portion 14b mounts an annular bearing 70 through which the hollow shaft 38 extends. Associated with the bearing is a ring seal 72 which is covered and protected by the lower portion of the nozzle body 16. Also, when the nozzle body is extended, as shown in FIG. 2, the ring seal is well above the casing and flooding of the ring seal is obviated.

A spacing sleeve 74 encircles the hollow shaft 38 and maintains the gear 40 properly positioned. At its lower end the cap portion 14b has a peripheral channel 76 provided with a pair of diametrically opposite notches 78, better seen in FIG. 5. The notches are adapted to receive a pair of diametrically disposed, longitudinally extending ribs 80 formed on the inner wall of the casing 12. Thus, the housing 14 can slide axially of the casing but is maintained in nonrotatable relationship thereto.

Disposed about the housing 14 and the nozzle body 16 is a coil spring 82 the lower end of which is received in the channel 76 and the upper end thereof pressing against the seal 18. The cap portion 14b also has an annular edge 84 which presses against the seal when the nozzle body 16 is in extended pop-up position, as shown in FIG. 2. Inwardly of the edge 84, the cap portion is formed with a smaller diameter cylindrical portion 86 having cross dimensions substantially similar to those of the nozzle body. The slightly tapered reduction 36 on the nozzle body provides for a substantially smooth transition of the seal from engagement with the nozzle body to engagement with portion 86 as the nozzle body moves into extended pop-up position.

Referring to FIGS. 1 and 5, journaled for rotation in the bottom plate 60 is a shaft 88 to the lower end of which is secured a water turbine wheel 90 having curved blades 92. Fitted to the bottom plate and encasing the water turbine wheel is a stator 94 having slanted water inlet ports 96 which direct water flowing therethrough against the blades to cause rotation of the wheel.

Water under pressure is admitted to the casing 12 through a threaded water inlet connection 98, such water passing through a strainer 99 fitted to the shell 14a. Thus, water entering through the inlet 98 is screened by the strainer, passes through the ports 96 against the blades 92, and through the segmental ports 68 into the water chamber 66, thence through the hollow shaft 38 into the nozzle body 16. Substantially simultaneously, the pressure of the water moves the housing 14 and nozzle body against the force of the spring 82, causing the nozzle body to pop up out of the casing. During pop-up of the nozzle body, the seal lips 20 are disengaged from portion 34 of the nozzle body and engage with portion 86 of the housing, as shown in FIG. 2.

Secured to the upper end of shaft 88 is a spur gear 100 which is positioned in the gear chamber 64, directly under the circular plate 54. Mounted for rotation on the bottom plate 60 is a pinion spur gear 102, the pinion of which meshes with the gear 100 and the

spur of which meshes with an idler gear 104, also mounted for rotation on the bottom plate.

Mounted in the plates 46 and 60 are vertical shafts 106 and 108, the latter being journaled for rotation. Freely rotatable on the shaft 106 is a stack of three pinion spur gears 110, the pinion of the lowermost gear 110 meshing with the idler gear 104 and the spur of the uppermost gear 110 meshing with a driven gear 112 secured to the shaft 108. The gears 110 are part of a gear train which includes a stack of two pinion spur gears 114 meshing with the gears 110, as shown in FIG. 1. This gear train is substantially similar to that described in greater detail in the aforementioned U.S. Pat. No. 3,107,056. Thus, drive is transmitted from the turbine wheel 90 to gear 112.

Secured to the upper end of the shaft 108 is a drive gear 116 which is part of an oscillatable drive 118 including a set of two gears 120 to one side and a set of three gears 122 to the other side, as shown in FIG. 6. The gears 116, 120 and 122 are mounted between a pair of vertically spaced arcuate support plates 124, 125, oscillatable about the axis of the shaft 108. Extending from the ends of the lower support plate 125 are a pair of arcuate arms 126 the ends of which are interconnected by a bridge member 128.

Disposed under the bridge member 128, and between the ends of the arcuate arms 126, is a radial trip lever 130 which is fixed to a collar 132 journaled on the sleeve portion 48a. The trip lever is adapted to swing between a pair of spaced stops 134 extending upwardly from the horizontal dividing plate 46. The ends of the arcuate arms are so spaced that the trip lever engages one arm, or the other, before engaging a corresponding stop, and oscillates the drive 118 to place the gears 120, or 122, in driving connection with the internally toothed gear 40, as shown in FIG. 6.

The collar 132 is provided with a pair of diametrically located notches 136 adjacent to which are notched bosses or posts 138 extending upwardly from the plate 46. A pair of overcenter springs 140 extend between the posts and the collar, each spring having an intermediate arcuate portion and oppositely directed ends which are received in the notches of the collar and posts. The action of the springs is to urge the trip lever 130 into one of its extreme positions against a stop 134.

Inviting attention also to FIG. 3, the gear 40 is disposed relative to the trip lever 130 so that the main tab 42 is to one side of the lever and the nearest minor tab 44a is to the other side (to the left and right, respectively, as viewed in FIG. 6). Thus, when the gear is driven clockwise, as viewed in FIG. 6, the main tab moves the lever away from one stop 134 and after movement past center the springs 140 urge the lever against the other stop and the end of the corresponding arm 126. This action oscillates the drive 118 so that gears 120 are disconnected from the gear 40 and gears 122 are connected thereto for driving it in the opposite direction (counterclockwise as viewed in FIG. 6). When the minor tab 42a moves the trip lever in the opposite direction the action is reversed.

With the trip lever 130 disposed between the tabs 42 and 44a, the arc of movement of the nozzle body 16 is one-quarter turn or 90°. To obtain a 180° arc of movement, the tab 42a is removed, as by cutting or the like, and the trip lever becomes responsive to the action of

tabs 42 and 44b. For 270° movement, tab 42b is also removed and tabs 42 and 42c effect tripping of the lever 130.

Where all-around sprinkling is desired, the sprinkler drive is modified, as shown in FIG. 7, so that the nozzle body 16 revolves continuously in one direction. In such modification, the gears 122, trip lever 130 and associated collar 132 and springs 140 are unnecessary and are omitted. The gears 120 are mounted between arcuate support plates 125 and 142, the latter being a shortened version of plate 124. The gears 120 are held in operative connection with the gear 40 by a pin 144 which locks the plate 125 to the horizontal dividing plate 46.

Provision is made for lubricating the gearing of the sprinkler drive means. To this end, as shown in FIG. 1, the cap portion 14b of the housing 14 has an opening 146 providing access to a perforation 148 which communicates with the interior of the gear chamber 64. The horizontal dividing plate 46 also has a perforation 150, better seen in FIG. 6, which communicates with the gear chamber. Thus, when lubricant under pressure is introduced through the perforation 148 it fills the gear chamber and passes through the perforation 150 to fill that part of the cap portion which houses the oscillatable drive 118 and associated parts. A plug, not shown, serves to close the perforation 148.

The sprinkler is made up mainly of parts of plastic material which are cemented or glued together as necessary to join and seal the parts.

OPERATION

It is believed that the operation of the sprinkler of the present invention is clearly apparent, and is briefly summarized at this point. Referring to FIG. 1, water under pressure enters the casing 12 via the inlet 98 and passes through the slanted ports 96 in the stator 94 to drive the turbine wheel 90. The water then flows upwardly through the segmental ports 68 into the water chamber 66 and through the tubular member 38 into the nozzle body 16 and discharges from the nozzles 28. The water pressure forces the housing 14 to slide upwardly and causes the nozzle body to extend to pop-up position, as shown in FIG. 2, the seal 18 disengaging from the nozzle body and engaging with cylindrical portion 86 of the cap portion 14b of the housing. The turbine wheel drives the gear 40 to cause rotation of the nozzle body. When the water is cut off, rotation of the nozzle body ceases and the spring 82 causes it to move to retracted position, as shown in FIG. 1, in which the seal is reengaged with the non-rotating nozzle body.

There has thus been provided a rotary pop-up sprinkler which has a gearing seal that is protected against flooding during sprinkling and a seal that is disengaged from any moving parts of the sprinkler drive during rotation of the nozzle body so that drag on the rotation of the nozzle body is minimized and wear of the seals is reduced, with the result that the seals have a longer life and the nozzle body is easily driven.

Although the present invention has been herein shown and described in considerable detail in what is believed to be the most practical and preferred embodiment thereof, it is to be understood that many variations thereof are possible and that the present in-

vention is not to be limited to such details but is to be considered in its broadest aspects and accorded the full scope of the appended claims.

Having described the invention, what is claimed as new and desired to be protected by Letters Patent is:

1. A rotary pop-up sprinkler comprising:
 - a casing;
 - a nozzle body mounted for movement in the casing between a retracted position and an extended position;
 - means for rotating the nozzle body; and
 - a seal within the nozzle body, said seal being disposable above the casing in the extended position of the nozzle body for protecting the seal against flooding.
2. The sprinkler of claim 1 wherein said means includes gearing and a shaft to which the nozzle body is secured, and said seal surrounds the shaft.
3. The sprinkler of claim 2 wherein said gearing is contained in a housing which is movable with the nozzle body as a unit.
4. The sprinkler of claim 1 wherein said support contains a motor actuated by flow of water therethrough and through the nozzle, means coupling the nozzle and motor for rotation of the former by actuation of the latter, said nozzle being movable and disposable in a retracted position in a casing, said seal being mounted on the casing and sealingly engaged with the nozzle in the retracted position thereof, and means for introducing water pressure into the casing, said water pressure being effective to move the nozzle from retracted position and cause the nozzle to extend from the casing free of the seal.
5. The sprinkler of claim 4 wherein said nozzle has a substantially cylindrical body circumscribed by said

seal and sealingly engaged therewith in the retracted position of the nozzle, and said support has a substantially cylindrical portion, said portion and body being coaxial and having substantially equal cross dimensions so that when the nozzle is extended free of the seal the seal circumscribes the cylindrical portion in sealing engagement therewith.

6. The sprinkler of claim 5 wherein said means coupling the nozzle and motor include gearing selectively alterable to provide a predetermined arc of rotation of the nozzle.

7. A sprinkler comprising:
 - a support;
 - a nozzle rotatably mounted on said support; and
 - a relatively movable seal sealingly engageable with said nozzle when the same is stationary and disengaged therefrom when the nozzle is rotating; whereby drag on rotation of the nozzle is minimized.

8. The sprinkler of claim 7 wherein said seal is sealingly engaged with said support when disengaged from the nozzle, and said seal and support are mounted to be devoid of relative movement when sealingly engaged with each other; whereby wear on the seal is minimized.

9. The sprinkler of claim 8 wherein said support is mounted in a casing for axial nonrotatable movement relative thereto, and said seal is fixed to the casing.

10. The sprinkler of claim 9 wherein said support and nozzle are movable as a unit for disposition thereof in retracted position in the casing and for extension of the nozzle from the casing in response to water pressure, and means for urging the unit into retracted position; whereby the nozzle is disposed within the casing in the absence of said water pressure and extends from the casing when said water pressure is present.

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