June 12, 1962 W. E. DUDLEY ET AL 3,038,666

SPRINKLERS

Filed June 27, 1960 2 Sheets-Sheet 1

FIG-1

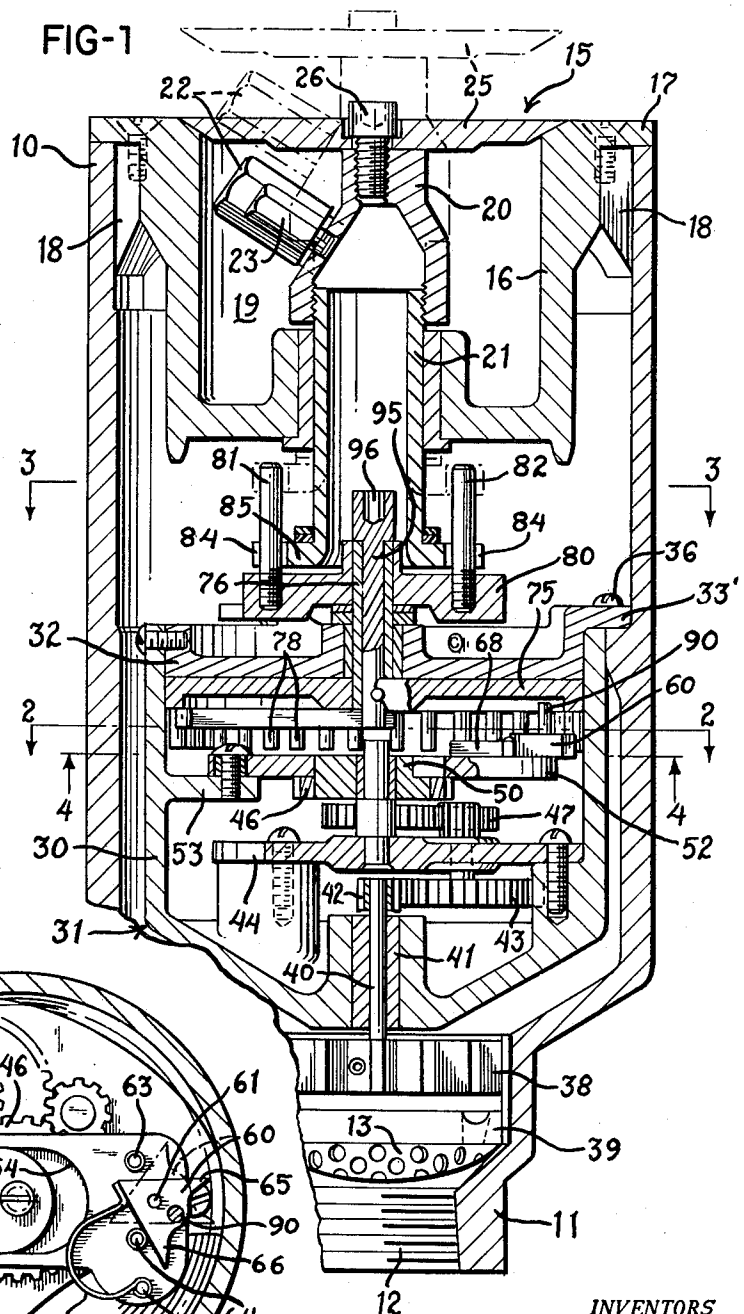
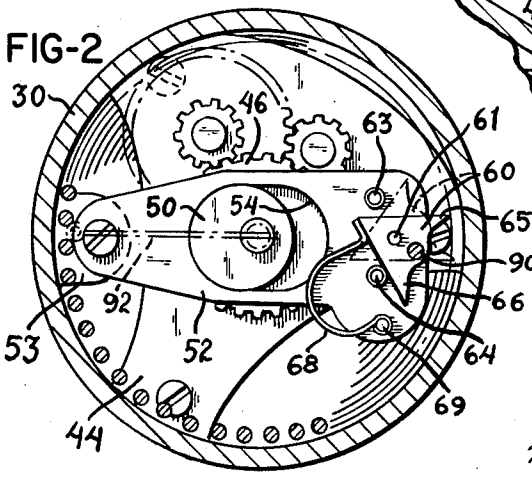


FIG-2



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June 12, 1962 W. E. DUDLEY ET AL 3,038,666

SPRINKLERS

Filed June 27, 1960 2 Sheets-Sheet 2

FIG-3

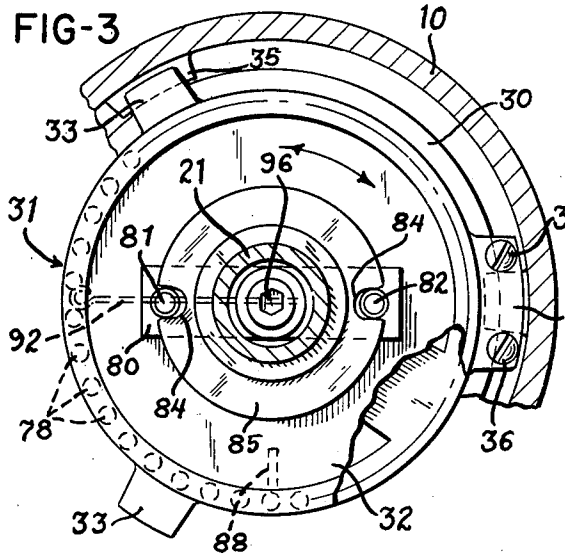


FIG-4

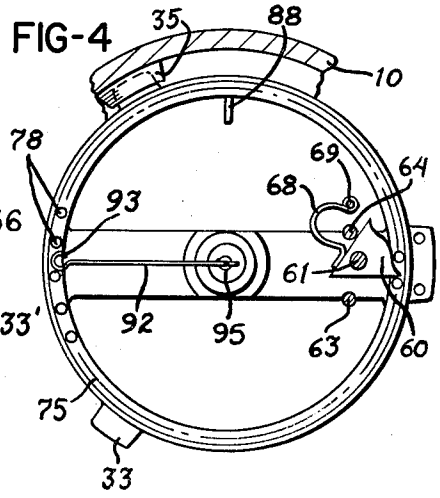


FIG-5

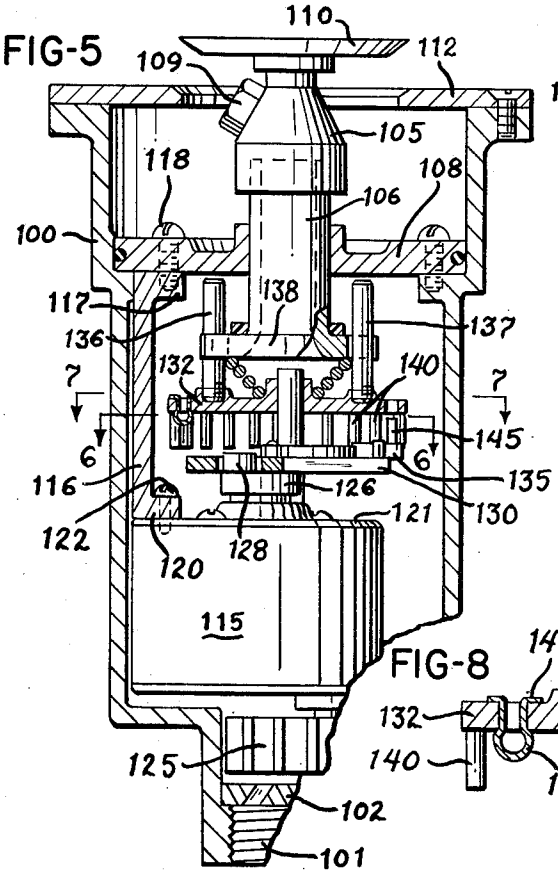


FIG-6

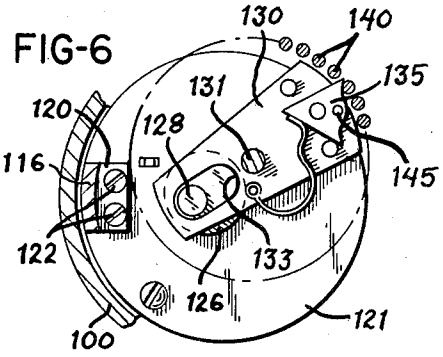


FIG-7

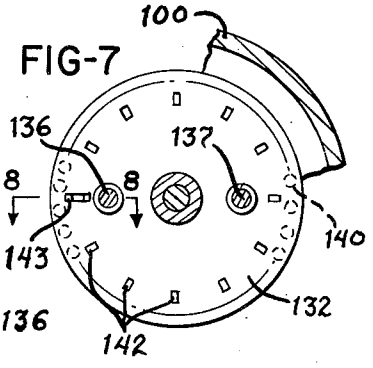


FIG-8

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SPRINKLERS

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3 Claims. (Cl. 239—206)

This invention relates to pop-up sprinklers and more particularly to such sprinklers for oscillating over an adjustably variable arc.

This invention provides pop-up sprinklers adapted for mounting within the ground which have oscillating drive mechanisms wherein the angle through which the nozzle head is driven is adjustable to cover any desired arc. Such adjustment may be effected from outside of the case without the necessity of disassembling any portion of the gear mechanism within the case, and without removing the sprinkler from the ground. In one embodiment, adjustment for the arc of travel is effected through an access opening within the top, and this may be done while the sprinkler is operated to observe the results of the adjustment, and a further embodiment of this invention is described which is convertible to full circle operation or may be arranged to oscillate through an adjustable arc.

The sprinklers of this invention include a turbine drive mounted within an outer case for rotation by the incoming water. The drive gearing is preferably enclosed within an inner gear case forming a capsule which is removably mounted as a unit within the outer case, thus simplifying the installation and maintenance. The reduction gearing is arranged to drive a reversible, overcenter pawl which has fingers in engagement with the teeth of an output gear to rotate this gear in either direction depending upon the position of the pawl, and the output gear is connected in driving relation to the head of the sprinkler.

The output gear includes one or more adjustable stops which are engageable with the pawl to effect overcenter movement thereof at predetermined adjustable limits of sprinkler head rotation. One embodiment includes an arrangement wherein one of such stops is adjustable in small increments with a hand tool from outside the sprinkler, and another embodiment includes an output gear with stops which are removable to provide for full circle continuous rotation when desired.

It is therefore an object of this invention to provide an oscillating pop-up sprinkler as outlined above having an adjustable arc of rotation with such adjustment being readily effected subsequent to the installation of the sprinkler in the ground.

A further object of this invention is to provide an oscillating pop-up sprinkler with a dependable positive reversing drive of long service life and which eliminates reversing gears and reversing valves.

Another object of this invention is to provide an oscillating sprinkler as outlined above wherein the arc of oscillating is adjustable with the unit in the ground without the necessity of disassembling the gearing or substituting any internal components.

A still further object of this invention is to provide an oscillating sprinkler which is convertible to full circle operation.

It is also an object of this invention to provide an oscillating pop-up sprinkler having an adjustable stop movable into any one of a plurality of incremental positions with a hand tool through an access opening in the sprinkler head from above the surface of the ground.

A further object of this invention is to provide a pop-up sprinkler as outlined above having a gear capsule removably received within an outer gear case which contains or supports the oscillating drive mechanism.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

In the drawings:

FIG. 1 is a transverse vertical section through a sprinkler constructed in accordance with this invention;

FIG. 2 is a section through the sprinkler of FIG. 1 taken generally along line 2—2 of FIG. 1 and shows the interrelation of the reversible pawl, the teeth of the output gear and the adjustable stop;

FIG. 3 is a section taken generally along line 3—3 of FIG. 1 and shows details of the driving connection of the sprinkler head with the output gear;

FIG. 4 is a section taken generally along line 4—4 of FIG. 1 on a somewhat reduced scale showing the crown gear and the fixed and adjustable stops carried therein;

FIG. 5 is a partially broken away vertical section through a modified form of the invention;

FIG. 6 is a section through the output gear showing the oscillating drive arrangement taken generally along line 6—6 of FIG. 5;

FIG. 7 is a section taken generally along line 7—7 of FIG. 5 showing the arrangement of the removable stops in the output gear; and

FIG. 8 is a fragmentary section through the output gear taken generally along line 8—8 of FIG. 7.

Referring to the drawings, which illustrate preferred embodiments of the invention, a sprinkler constructed in accordance with the invention is illustrated in FIG. 1 as including a generally cylindrical outer body or case 10 adapted for mounting within the ground and having a top opening adjacent the surface of the ground. A water inlet 11 is arranged in the lower end of the case 10 and includes a pipe fitting 12 and a screen 13.

A nozzle assembly 15 is mounted within case 10 and includes a body 16 formed with an annular lip 17 arranged for peripheral engagement with the walls of the case 10. Internal projections 18 are formed in the case 10 to receive mounting screws through the flange 17 holding the body 16 in place. The body 16 forms a cavity 19 within which is received a pop-up sprinkler head 20. The head 20 is threaded onto a hollow stem 21 for rotational movement and for reciprocal or pop-up movement in the body 16 upon the application of water under pressure thereto from the inlet 11. Nozzle means such as the large and small nozzles 22 and 23 are threaded into the head 20 and open into the hollow interior of the stem 21 for receiving water from the inlet.

The nozzle head 20 carries a closure plate 25 for the cavity 19 which is rotatably and removably mounted on the head 20 by an access screw 26. The mounting of the plate 25 for free rotation on the nozzle head protects the drive mechanism against damage by reason of its being held during the operation of the sprinkler.

Nozzle head drive means includes an inner case 30 which is received within the outer case 10 and forms the body of a gear capsule 31. The capsule 31 is removable as a unit after removing the nozzle assembly 15 without the necessity of removing the case 10 from the ground or otherwise disturbing the turf. The gear capsule 31 is provided with a cover 32 fitted in sealing relation to the case 30, and it includes radial projections 33 (FIG. 3) for locating it within the case. Internal supports 35 are formed in the case 10 upon which the projections 33 rest, and one of the projections designated as 33' is provided with a pair of spaced locating screws 36 which straddle the adjacent support 35 to prevent the rotation of the capsule 31.

A turbine wheel 38 is rotatably mounted on the inner case 30 and positioned adjacent a nozzle plate 39 at the inlet 11 for rotation due to the swirling action of the water through the inlet. The wheel 38 is connected to

rotate an input shaft 40 which forms a seal with the interior of the capsule within a sleeve bushing 41. A spur gear 42 is mounted on the inner extended end of the shaft 40 for the engagement with a reduction gear train.

The reduction gear train may take one or more convenient forms suitable for the purposes of this invention, and the spur and wheel gears shown represent one such suitable arrangement. Therefore, the spur gear 42 is shown as being in engagement with a gear 43 rotatably mounted on a gear plate 44. The gear 43 is arranged to drive a final gear 46 through an intermediate gear 47 also mounted on the plate 44. The case 30 may be packed with a suitable non-saponifying grease for lubrication and for the exclusion of water.

The final gear 46 is provided with an eccentric output in the form of a cam 50 mounted thereon for rotation therewith. The eccentric motion of the cam 50 is translated into arcuate oscillating motion by an arm 52 which is pivotally mounted on an extension 53 formed within the case 10. The arm 52 includes a cam slot 54 within which the cam 50 is received, as shown in FIG. 2.

Reversible drive means consists of a generally triangularly shaped, reversing pawl 60 pivotally mounted on a rivet 61 on the extended end of the arm 52. The pawl 60 is movable overcenter in either of two possible driving positions as shown by the full line and broken line views of the pawl in FIG. 2. The arm 52 therefore provides a means connecting the pawl 60 to the eccentric output of the cam 50 for back and forth movement upon the rotation of the turbine wheel 38.

A pair of pins 63 and 64 in the arm 52 adjacent the pawl 60 define limits of overcenter movement or the driving positions of the pawl. The pawl 60 is provided with driving finger portions 65 and 66, one each of which projects outwardly in driving position in each of the positions thereof. A clip spring 68 has an inner loop end secured to a pin 69 in the arm 52 and an outer end engageable with the sides of the pawl 60 urging it into either one of its two driving positions.

The capsule 30 includes an output drive therein in driving relation to the nozzle head 20. The output drive consists of a crown gear 75 rotatably mounted on a tubular shaft in the cover 32. The gear 75 is formed with a plurality of depending spur teeth or pins 78 engageable with the finger portions 65 and 66 of the pawl 60 in either of its driving positions. Therefore, the pawl 60 imparts a step-by-step rotational movement to the crown gear 65 in one direction or the other upon the rotation of the turbine wheel 38.

Drive means connecting the gear 75 to the nozzle head 20 includes the tubular gear shaft 76 and a cross yoke 80 mounted for rotation with the shaft 76. The yoke 80 supports a pair of upstanding driving pins 81 and 82 which are slidably received within arcuate slots 84 formed within the enlarged bottom 85 of the stem 21, as shown in FIGS. 1 and 3. The stem 21 is therefore rotatably driven by the gear 75 through the yoke 80 and pins 81 and 82, and these pins are of sufficient length to maintain driving engagement in slots 84 throughout the pop-up movement of the head 20.

Means are carried on the gear 75 for engagement with the pawl 60 at predetermined limits of gear rotation to effect overcenter movement of the pawl 60 to reverse the direction of gear and nozzle head rotation. Such means includes a fixed stop 88 projecting inwardly from the inside surface of the gear 75 for engagement with an upwardly extending pin 90 carried on the pawl, and a movable stop.

The movable stop is in the form of an extending spring 92 with a looped outer end 93 receivable between successive pairs of the pins 78. The spring 92 has its inner end secured for rotation with an adjusting shaft 95. The shaft 95 extends coaxially through the tubular shaft 76 and terminates in a driving head 96 accessible from within the stem 21. The head 96 may be rotated by a suitable tool inserted through the opening provided by removing the screw 26 in the head 20 to position the movable stop spring 92 in as many increments as there are spaces between the pin 78, so that with the crown gear having 36 pins, as shown provides for an adjustment in 10° increments. The movement of the spring 92 provides an audible click as the loop 93 snaps from one space to the next to provide a clear indication of the adjustment.

Operation of the embodiment shown in FIGS. 1–4 is largely self-evident from the foregoing description. The incoming water through the inlet 11 is directed by the nozzle plate 39 to impinge upon the turbine wheel 38 causing its rotation. The water continues upwardly between the outer and inner cases to the hollow stem 21 of the nozzle assembly 15. The pressure causes the nozzle head 20 to rise with the stem 21 so that the spray nozzles 22 and 23 direct their stream onto the surrounding lawn or turf.

The rotation of the wheel 38 is reduced by the reduction gearing and is translated to a back and forth arcuate movement of the pawl 60 through the cam 50 and the arm 52. The pawl 60 operates to move the crown gear 75 one step at a time in one direction until the engagement of either one of the stops 88 or 92 effects overcenter movement of the pawl 60 to reverse the direction of such rotation. The friction in the stem 21 at the body 16, due to the side thrust of the nozzles 22 and 23, is sufficient to cause the pawl to ratchet into engagement with the next adjacent pin 78 on the return movement so that the gear is driven first in one direction, and then in the other.

Adjustment of the arc of rotation may be made by removing the screw 26 which holds the cover plate 25 and inserting a suitable instrument into engagement with the head 96 to rotate the adjustable stop, as desired. This may be accomplished while the sprinkler is operating while observing the results of the adjustment.

The feature of adjustability is also important where a number of the sprinkler units of FIGS. 1–4 are employed and where the gear capsule or other internal components of one sprinkler is removed and replaced with a standby unit. In such instances, the adjustment for the desired arc of travel is readily made, as described above, without the necessity of substituting internal parts or gearing.

The embodiment of the sprinkler of FIGS. 5–8 includes provision for achieving full circle operation when desired. The sprinkler of FIGS. 1–4 described above may be adjusted for substantially 360° operation by placing the adjustable stop 92 in superimposed relation to the fixed stop 88. However, this has the undesirable effect of reversing at substantially the same position and thereby tending to overwater one area of ground. This is avoided in the embodiment of FIGS. 5–8 by the provision of adjustable stops which are removable to permit continuous operation in either direction when desired.

The outer case 100 is adapted for mounting within the ground with an inlet 101 and a nozzle plate 102 is similar to the inlet 11 and plate 39 of the embodiment described above. A nozzle head 105 is rotatably and reciprocably mounted in the case 100 on a hollow stem 106. The stem is slidably mounted in an internal closure plate 108. The head 105 includes a single spray nozzle 109 and carries an outer closure plate 110 which cooperates with a ring 112 to form a closed top for the sprinkler when it is not operating.

A gear capsule 115 is removably mounted within a lower portion of the case 100 on a bracket 116. An upper portion 117 of the bracket 116 is secured to the lower surface of the plate 108 by screws 118 and is formed with a bottom foot 120. The foot 120 is secured to the cover 121 of the capsule 115 by screws 122. In this mounted position of the capsule 115, a turbine

wheel 125 is positioned above the nozzle plate 102 for rotation by incoming water.

The rotation of the turbine wheel 125 is reduced by reduction gearing within the capsule 115 to an output consisting of a rotating crank or block 126 to which a crank pin 128 is fixed in offset relation. The crank pin 128 provides the eccentric output of the capsule 115, and its eccentric motion is translated to arcuate back and forth movement by an arm 130 mounted for pivotal movement on a stud shaft 131. The shaft 131 is fixed to the cover 121 and extends upwardly therefrom for the support of the arm 130 and a crown gear 132. The pin 128 is received within an elongated slot 133 formed in one extended end of the arm 130 on one side of the shaft 131, and a pawl 135 similar in construction and operation to the pawl 60 is mounted on the other extended end of the arm 130.

The crown gear 132 of this embodiment is mounted outside the capsule 115 and includes a pair of driving pins 136 and 137 threaded in upstanding relation on the back thereof and arranged to engage the enlarged end 138 of the stem 106. The crown gear 132 further includes a plurality of depending pins 140 which are arranged for sequential engagement with the pawl 135 for driving the gear 132 in the step-by-step manner in response to the rotation of the turbine wheel 125.

Adjustable means for defining the rotation limits of the gear 132 travel includes openings 142 which are formed in circumferentially spaced relation through the gear 132 and are arranged to receive removable U-shaped metal clips 143. The clips 143 have bottom portions 144 which extend through the gear in the assembled position to engage a trip pin 145 on the pawl 135 to reverse its driving position. The clips 143 may be inserted in position, as desired, subsequent to the installation of the sprinkler in the ground preferably by removing the inner plate 108 with the capsule 115 attached for access to the gear 132. Preferably two of the clips 143 are employed to define a desired arc of rotation. However, full circle continuous rotation may be obtained, when desired, by removing all of the clips, thus permitting the pawl to drive continuously in one direction.

The operation of the embodiment of FIGS. 4–8 is also substantially self-evident from the foregoing description. It will be seen that the sprinkler is versatile and yet of simple and rugged construction. Also, the arrangement of the removable clips and the output gear makes possible the stocking of a single unit for use in a multiple of different installations.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that this invention is not limited to these precise forms of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A reversing sprinkler having an adjustable arc of coverage, comprising a case adapted for mounting within the ground, said case having a water inlet connectible to an underground water supply pipe, a pop-up sprinkler head rotatably received in said case for delivering a stream of water from said inlet, an adjustable head driving oscillating mechanism received in said case in driving relation to said head, said mechanism having a pair

of reversing stops adjustable in relation to each other for varying the arc of rotation of said head, and means in said head defining an opening providing access to said mechanism for the adjustment of one of said stops in relation to the other to change said arc of coverage of said sprinkler.

2. A reversing pop-up sprinkler comprising a body arranged for mounting within the ground and having an inlet adjacent a lower end thereof for connection to a source of water under pressure, a sprinkler head rotatably mounted in said body and arranged for pop-up movement upon the application of water under pressure thereto from said source, a turbine wheel mounted in said case for rotational movement with water flow from said inlet to said head, reduction gearing having an input connection to said turbine wheel and an eccentric output, a drive pawl movable overcenter in either of two driving positions, means connecting said pawl to said eccentric output for back and forth movement upon the rotation of said turbine wheel, a gear mounted for rotation in driving relation to said sprinkler head, said gear having teeth engageable with said pawl in either of said driving positions thereof for step-by-step movement by said pawl, a fixed stop carried on said gear for engagement with said pawl to effect said overcenter movement thereof to reverse the driving direction of said pawl, an adjustable stop, and means mounting said adjustable stop for angular pivotal movement with respect to said fixed stop to vary the arc of coverage of said head.

3. A sprinkler comprising a body adapted for mounting within the ground and having an inlet arranged for connection to a source of water under pressure, a sprinkler head rotatably mounted on said body, means defining an access opening in said head, passageway means in said body connecting said inlet to said head, means in said passageway positioned for rotation by said water and having an eccentric output, an arm mounted for reciprocal movement by said output, a drive pawl carried on an extended end of said arm and selectively movable into one of two driving positions, an output gear rotatably mounted in said body in driving relation to said sprinkler head and having teeth engageable with said pawl in each of said driving positions thereof for step-by-step rotational movement upon the reciprocation of said arm by the application of water pressure to said inlet, a fixed stop carried by said gear for engagement with said pawl to effect overcenter movement thereof into the other of said driving positions, a shaft rotatably mounted in said gear and being formed with a drive end accessible for rotation by a tool inserted through said access opening, and a movable stop engageable with said pawl to effect overcenter movement thereof and connected for angular movement with said shaft for the adjustment of the arc of rotation of said head.

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