

May 12, 1959

E. W. SMITH ET AL
MECHANICAL DEVICE

2,886,250

Filed Jan. 24, 1957

4 Sheets-Sheet 1

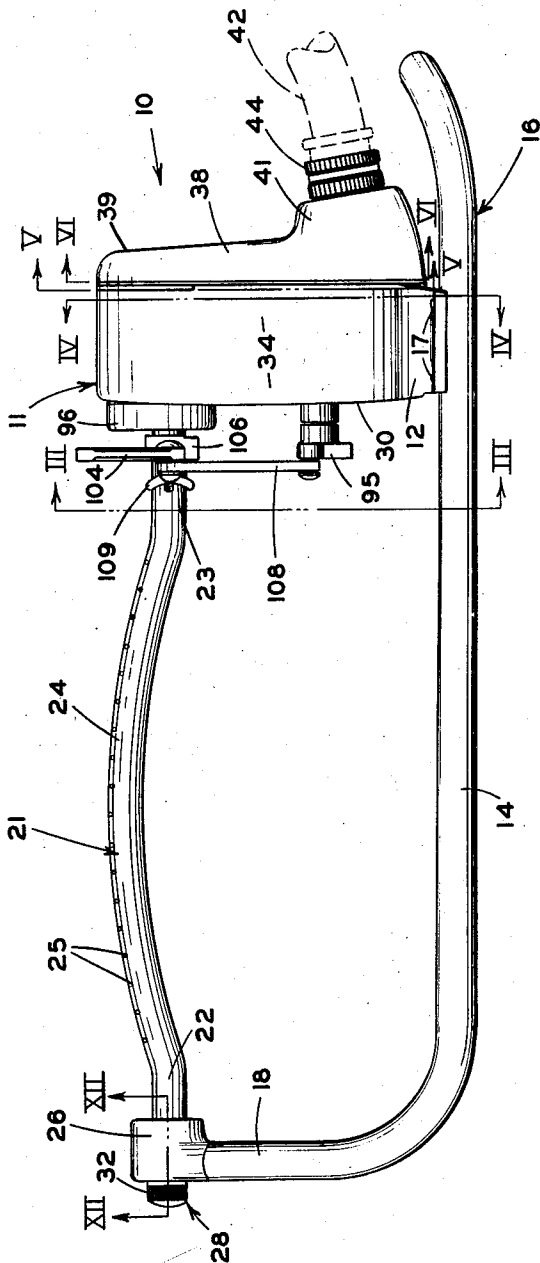
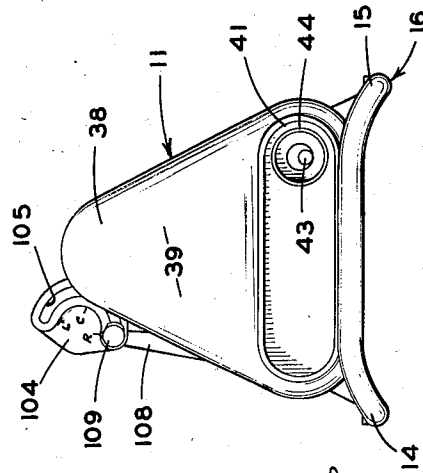


fig. 1



510.2

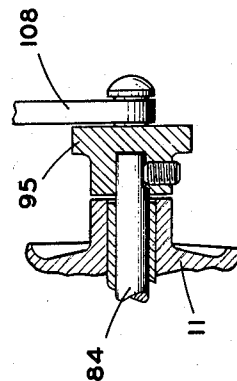


fig. 13

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4 Sheets-Sheet 2

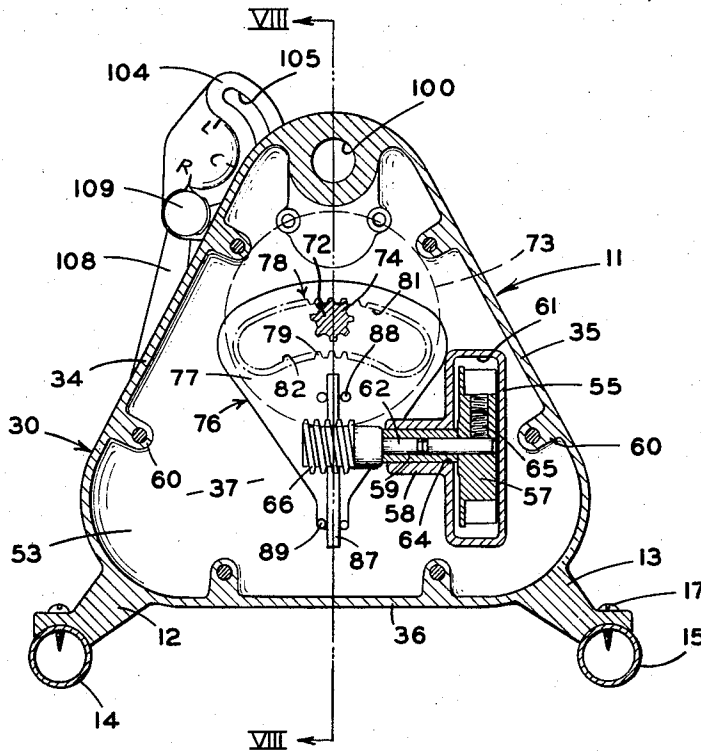


fig. 4

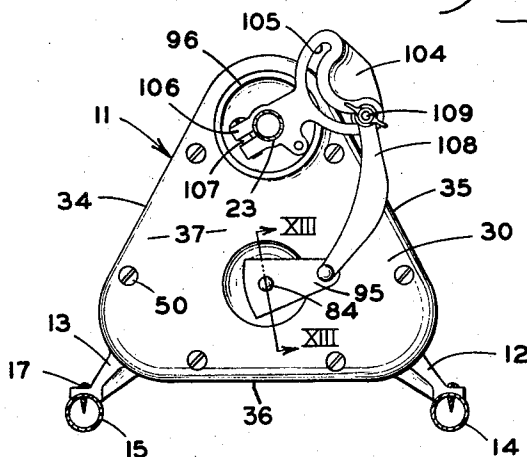


fig. 3

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4 Sheets-Sheet 3

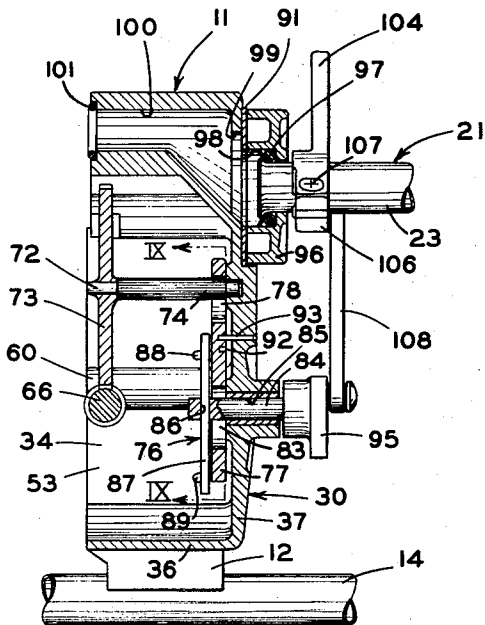


fig. 8

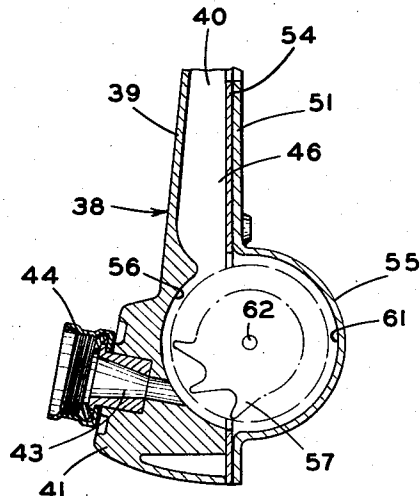


fig. 7

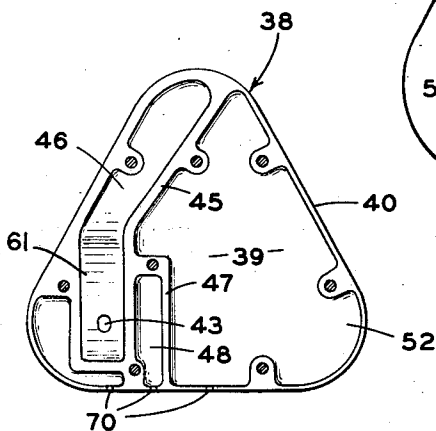


fig. 6

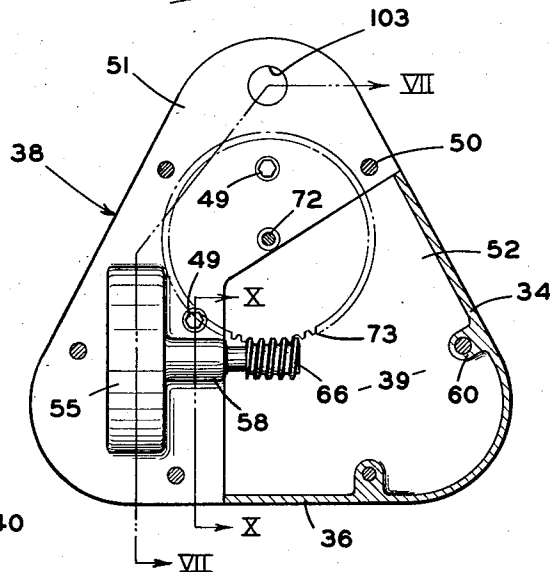


fig. 5

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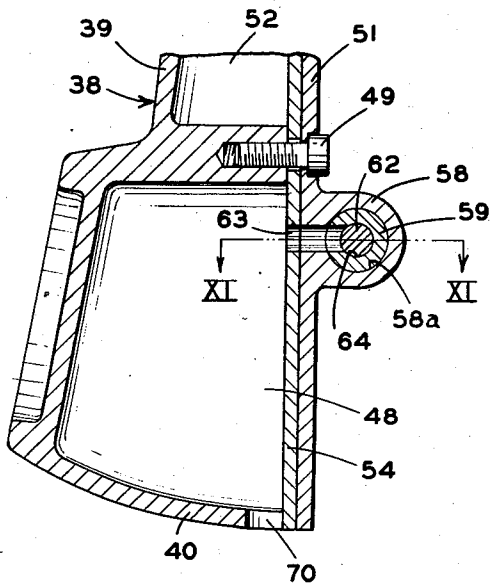


fig. 10

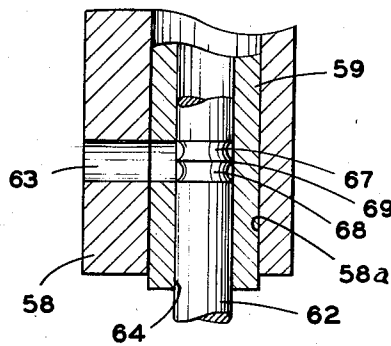


fig. 11

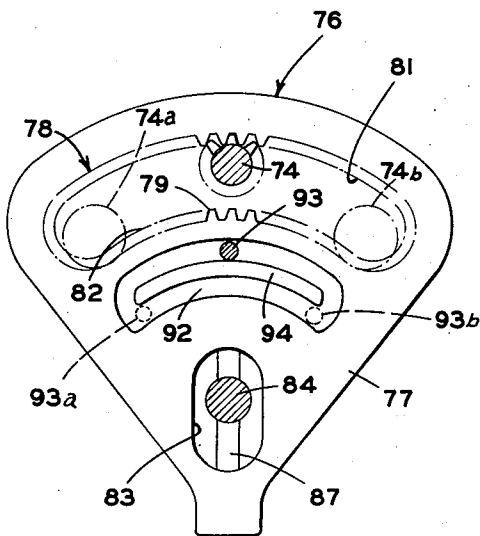


fig. 9

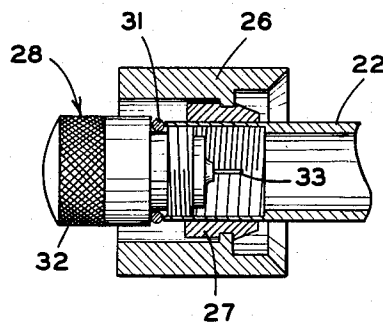


fig. 12

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MECHANICAL DEVICE

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Application January 24, 1957, Serial No. 636,161

5 Claims. (Cl. 239—120)

This invention relates in general to a lawn sprinkler having an oscillating discharge head and, more particularly, to a type thereof wherein the pressure of the water passing through the sprinkler is utilized to rotate a water wheel which in turn drives a mechanism for oscillating said discharge head, and wherein said mechanism is entirely independent of, and sealed off from, the path of water flow through the sprinkler.

Persons familiar with the fabrication and/or operation of lawn sprinklers having oscillating discharge heads which are driven by water power, have long recognized the desirability of isolating the oscillating mechanism from the water which flows through the sprinkler and drives such mechanism. This is largely due to the fact that the water tends to corrode the parts of said oscillating mechanism, particularly where some of the more economical materials are used therein. Furthermore, the water often contains impurities, which will tend to coat or corrode, or otherwise interfere with the operation of, the moving parts in said oscillating mechanism. Also, such submersion of said oscillating mechanism makes the use of conventional lubricating materials extremely difficult, if not impossible. Present alternatives, adopted to avoid these problems, include the fabrication of the oscillating mechanism from costly materials, which are relatively resistant to corrosion, or providing the sprinkler with an independent, complicated and costly mechanism for effecting oscillation of the discharge head.

Where the oscillation mechanism includes a water wheel driven by the water flow through the sprinkler, said water wheel usually operates at a relatively high rotational speed in order to develop the power necessary for effecting oscillation of the discharge head. Thus, considerable gear reduction is necessary to provide a suitable reciprocating motion for the discharge head. It is standard practice to effect this gear reduction within the housing upon which the discharge head is pivotally supported, and through which the water can circulate. It is also standard practice to provide a shaft, which extends externally from said housing and which is connected to the reduction end of the gear chain effecting such reduction. Where the shaft extending from the housing rotates when the water wheel is operated, and this is the usual arrangement, the conversion from rotary motion to the desired reciprocation or oscillation of the discharge head must be produced by linkage disposed externally of the housing. This arrangement has created problems of adjustment in the external linkage of the oscillation mechanism. Furthermore, the standard linkage utilized for converting rotary motion into pivotal, reciprocating motion produces prolonged dwells at the opposite ends of the reciprocable movement and a relatively rapid traverse of the oscillating head near the center of its path of movement. The result of such movement, which is simple harmonic in form, is the discharge of materially greater amounts of water at both ends of the sprinkling pattern than at the intermediate zone.

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Accordingly, a primary object of this invention is the provision of an easily transportable lawn sprinkler, having an oscillatable discharge head, the oscillation of which is effected by mechanism which is substantially sealed from the flow path of water through the sprinkler.

A further object of this invention is the provision of a lawn sprinkler, as aforesaid, wherein the mechanism for effecting oscillation of the discharge head is arranged and constructed to effect a substantially constant motion, rather than a simple harmonic motion, during the sweep of its oscillation, thereby greatly reducing, or substantially eliminating, the prolonged dwells at the opposite ends of the oscillation path.

A further object of this invention is the provision of a lawn sprinkler, as aforesaid, wherein the conversion of rotary motion provided by a water motor to the oscillatory motion of the discharge head is accomplished entirely within the housing containing the water motor, thereby reducing the number of operating parts, reducing the exposure of the oscillating mechanism, and reducing the cost of fabrication.

A further object of this invention is the provision of a lawn sprinkler, as aforesaid, having parts which are arranged and constructed for quick and easy assembly, thereby maintaining the cost of fabrication, as well as maintenance, at a minimum.

A further object of this invention is the provision of a sprinkler, as aforesaid, wherein the mechanism for converting rotary motion to oscillating motion provides part of the means used to reduce the output speed of the water wheel.

Other objects and purposes of this invention will become apparent to persons familiar with this type of equipment upon reading the following specification and examining the accompanying drawings, in which:

Figure 1 is a broken, side elevational view of an oscillating-type lawn sprinkler embodying the invention.

Figure 2 is an end elevational view of the input end of said sprinkler.

Figure 3 is a sectional view substantially as taken along the line III—III of Figure 1.

Figure 4 is a sectional view, on an enlarged scale, substantially as taken along the line IV—IV of Figure 1 with part of the gearing omitted.

Figure 5 is a sectional view, on an enlarged scale, taken along the line V—V of Figure 1.

Figure 6 is a sectional view taken along the line VI—VI of Figure 1.

Figure 7 is a sectional view taken along the line VII—VII of Figure 5.

Figure 8 is a sectional view taken along the line VIII—VIII of Figure 4.

Figure 9 is a sectional view, on an enlarged scale, taken along the line IX—IX of Figure 8, and showing a motion-converting quadrant.

Figure 10 is a sectional view, on an enlarged scale, taken along the line X—X of Figure 5.

Figure 11 is a sectional view, on an enlarged scale, taken along the line XI—XI of Figure 10.

Figure 12 is a sectional view, on an enlarged scale, taken along the line XII—XII of Figure 1.

Figure 13 is a sectional view, on an enlarged scale, taken along the line XIII—XIII of Figure 3.

For the purpose of convenience in description, the terms "inner," "outer," and derivatives thereof, will have reference to the geometric center of the lawn sprinkler and parts thereof. The terms "upper," "lower," "horizontal," "vertical," and similar terms denoting direction or position, will have reference to the lawn sprinkler and parts thereof when positioned in their normal condition of use and as appearing in Figures 1 and 2.

General description

In order to meet the objects and purposes set forth above, as well as others related thereto, there has been provided a lawn sprinkler, comprised of a housing supported upon a skid type frame near one end thereof. An elongated discharge head is pivotally supported at its opposite ends upon part of said frame and said housing for oscillating movement about a substantially horizontal axis. Said discharge head is hollow and communicates with a passageway through said housing. A water wheel is mounted within the housing and arranged for rotation by water flowing through said passageway. Said housing is provided with a chamber, which is sealed from the water passageway. Mechanism, driven by the water wheel, is housed within said chamber and includes a shaft, which extends from the housing and which is pivoted by said mechanism. Linkage is provided for adjustably connecting the pivot shaft to the discharge head for oscillating same.

Detailed construction

As shown in Figures 1, 2 and 3, the sprinkler 10, which embodies the invention, is comprised of a housing 11 having a pair of legs 12 and 13, which are secured upon the parallel runners 14 and 15, respectively, of the support frame 16 by means of the screws 17. The support frame 16 is, in this particular embodiment, fabricated from light weight, tubular material arranged in a U-shaped form and having an upwardly extending end structure 18 spaced a substantial distance from said housing 11. The housing 11 is disposed upon the frame 16 near to the closed end thereof, which in this embodiment curves up slightly from the plane of the runners 14 and 15. This curvature, as well as the curvature provided where the end structure 18 joins said runners 14 and 15, is desirable for facilitating movement of said runners along a supporting surface such as the ground, and to add strength to the assembly, although by itself it forms no part of the invention.

The sprinkler 10 has an elongated, hollow discharge head 21 (Figure 1), which is advantageously fabricated from a length of cylindrical tubing and shaped to provide a pair of co-axial, straight segments 22 and 23 at opposite ends of, and integral with, a center segment 24, preferably of arcuate shape. Said center segment 24 is provided with a plurality of spaced discharge ports 25 located at pre-selected intervals along the upper side of the center segment 24.

The end structure 18 (Figure 1) of the support frame 16 has a sleeve 26 secured thereon, with its axis in a horizontal position and extending through the upper end of the housing 11. The leftward end segment 22 of the head 21 is co-axially and rotatably supported within said sleeve 26 (Figure 12), as by means of the bearing sleeve 27. Said end segment 22 is internally threaded for reception of an appropriately threaded end plug 28. An O-ring 31 is provided between the flanged head 32 on the plug 28 and the adjacent end of the segment 22 to provide a water-tight seal. A flexible pin 33 is preferably mounted upon, and extends from, that end of the plug 28 disposed within the segment 22 for use as described further hereinafter to clean the openings 25.

The housing 11 (Figures 1, 2 and 3) has a body 30 which is preferably triangular in cross-sectional contour, thereby providing a pair of sloping side walls 34 and 35 and a substantially horizontal bottom wall 36, each of which are integral along one edge with a substantially vertical outlet end wall 37 to provide the closed end of the housing. The other, or open, end of said housing body 30 is covered by the end member 38 (Figure 6), which is comprised of a substantially triangular inlet end wall 39, provided with an integral flange 40 which is shaped to conform with, and abut against, the free edges of the side walls 34 and 35 and bottom wall 36 (Figure 4).

The inlet end wall 39 (Figures 1 and 7) is provided with

an outwardly extending boss 41 having an inlet opening 43 extending through said boss and through the wall 39 at a point near the lower edge and one side edge of said wall 39. A hose connection 44 is arranged on said boss 41 and around said opening 43 for coupling with a conventional garden hose 42. A partition 45 (Figure 6) which is preferably integral with the inlet end wall 39, extends therefrom, flush with the flange 40, and is arranged with a portion of said flange to define an inlet passageway 46, which extends upwardly from the inlet opening 43 to a point adjacent to the top of the end member 38. A partition 47 combines with the partition 45 to provide a seepage compartment 48 within, and adjacent to the lower edge of, said end member 38.

A substantially flat wall member 51 (Figure 5) is disposed between portions of the inlet end member 38 and the body 30 of the housing 11. Said wall member 51 is arranged and constructed so that it completes the enclosure of the inlet passageway 46 (Figure 6) and seepage compartment 48. The remainder of the cavity 52 surrounded by the flange 40 within the end member 38 communicates with the chamber 53 (Figure 4) defined by the lateral walls 34, 35 and 36 and the outlet end wall 37. A gasket 54 (Figures 7 and 10) is disposed between the wall member 51 and the adjacent portions of the flange 40 and partitions 45 and 47 on the inlet end member 38. Thus, the inlet passageway 46 and seepage compartment 48 are effectively sealed, both with respect to each other and with respect to the chamber 53 in the housing 11. The wall member 51 and gasket 54 are secured to the end member 38 by means of the bolts 49, which fastening assures a tight seal along the partitions 45 and 47. The end member 38 is secured to the housing body 30 by bolts 50 (Figure 3) which extend through said end member and are threadedly received into appropriate bosses 60 disposed within, and integral with, the housing 30.

As shown in Figures 5 and 7, the wall member 51 is provided with a substantially semi-circular and integral wheel casing 55, which cooperates with the arcuate recess 56 at the lower end of the inlet passageway 46 (Figure 7) to provide a cylindrical wheel cavity 61, in which the water wheel 57 is disposed for rotation about a horizontal axis. Said wheel casing 55 (Figure 4) has an integral boss 58 with a cylindrical opening 58a (Figures 10 and 11) coaxial with said wheel cavity 61 and communicating between said cavity 61 and the chamber 53 in the housing 30. A bearing sleeve 59 (Figure 4) is fixedly disposed within said opening 58a and preferably extends slightly from both ends thereof. A water wheel shaft 62 is rotatably supported within, and extends from both ends of, the sleeve 59. The lower end of the wheel cavity 61 (Figures 6 and 7) is arranged opposite the inlet opening 43 in the inlet end wall 39, so that water passing through the inlet opening 43 will cause the water wheel 57 to rotate in a counterclockwise direction.

As shown in Figures 10 and 11, the bearing sleeve 59 and the boss 58, within which said sleeve 59 is disposed, are provided with a radially disposed horizontal opening 63, which communicates between the cylindrical shaft opening 64 in the sleeve 59 and the seepage compartment 48. The water wheel 57 is mounted upon that end of the shaft 62 (Figure 4) within the cavity 61 by any convenient means, such as the set screw 65. The other end of the shaft 62, which is disposed within the chamber 53, supports a co-axial worm gear 66. The sleeve 59 acts as a spacer between the water wheel 57 and the worm gear 66, thereby also preventing axial movement of the shaft 62 with respect to the wheel casing 55.

The shaft 62 has a pair of adjacent, annular grooves 67 and 68, which preferably have arcuate cross-sections, as particularly shown in Figure 11. Said grooves 67 and 68 are arranged so that the annular ridge 69 formed between said grooves 67 and 68 is intersected at diametrically opposite points by the axis of the seepage opening 63 through the sleeve 59 and boss 58. A plurality of drain

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openings 70 (Figures 6 and 10) are provided through the lower portion of the flange 40 to permit the escape of water which may collect within the seepage compartment 48, the cavity 52 and the chamber 53.

A horizontal, main shaft 72 (Figures 4 and 8) is rotatably supported at its opposite ends upon the wall member 51 and outlet end wall 37 for rotation about an axis which is preferably disposed directly above the worm 66. A relatively large worm gear 73 is secured upon, and rotatable with, the shaft 72 near the wall member 51 for engagement with the worm 66. An axially elongated pinion 74 of relatively small diameter is mounted upon, and rotatable with, the shaft 72 near the outlet end wall 37. Thus, rotation of the water wheel 57 acts through the worm 66 and worm gear 73 to rotate the pinion 74 in a substantially conventional manner.

The pivot quadrant 76 (Figures 4, 8 and 9) is comprised of a flat, substantially triangular, support plate 77 disposed adjacent to the outlet end wall 37 within the chamber 53. Said support plate 77 is provided with a substantially horizontal, arcuate slot 78, which is disposed near the upper end of said plate 77. The mutually opposing edges of the slot 78 are provided with gear teeth 79, which are engageable with the teeth on the pinion 74, which extends through said slot 78. The gear teeth 79 arranged in a row 81 along the upper edge of the slot 78 are spaced from the teeth in the row 82 along the lower edge of said slot 78 a distance slightly greater than the outside diameter of the pinion 74, thus permitting toothed engagement between the pinion 74 and one of the rows of gear teeth 81 or 82, without interference from the non-engaged row of gear teeth. A vertically elongated pivot shaft slot 83 (Figures 8 and 9) is provided through the plate 77 below the arcuate slot 78. Said pivot shaft slot 83 is preferably arranged so that the center line of its lengthwise extent passes through the arcuate slot 78 at a point approximately midway between the ends thereof.

A pivot shaft 84 (Figures 8 and 9) is pivotally supported in, and extends through, an opening 85 in the outlet end wall 37 directly below, and parallel with, the axis of the main shaft 72. The pivot shaft 84, which extends through the pivot shaft slot 83 of plate 77, is provided with a transverse opening 86 in which a guide rod 87 is received and secured adjacent to the inner side of the plate 77. Thus, the plate 77 is disposed between the guide rod 87 and the outlet end wall 37, and is movable with respect to the pivot shaft 84 within the limits of the slot 83. The plate 77 has, on its inner face, upper and lower pairs of integral, spaced guide pins 88 and 89, respectively, which continuously and slidably embrace said guide rod 87 near the opposite ends thereof. The guide pins in each pair are preferably disposed on opposite sides of said lengthwise center line of the slot 83, and at substantial distances from the adjacent ends of pivot shaft slot 83. Thus, although the plate can move transversely of the axis of the pivot shaft 84, the guide rod 87 and guide pins 88 and 89 cooperate to effect a pivoting of the pivot shaft 84 in response to movement of the plate 77 around the axis of said pivot shaft 84. Accordingly, rotation of the pinion 74, which is engaged by the teeth 79 in the slot 78, causes the quadrant 76 to pivot the shaft 84 with respect to the housing 11. The pinion 74 is moved from one row of teeth 81 or 82 to the other row thereof, the rod and pin arrangement between the plate 77 and the pivot shaft 84 will permit movement of the plate 77 with respect to the pivot shaft 84. The arcuate slot 78 is arranged, for reasons appearing hereinafter, so that the pivotal movement of the plate 77, hence of the shaft 84, is somewhat less than 90 degrees, approximately half of which occurs on both sides of a plane defined by the axes of the main shaft 72 and pivot shaft 84.

The plate 77 (Figure 9) is provided with suitable means, such as an endless curved groove 92, for providing an arcuate cam 94 in the side of said plate adjacent to the outlet end wall 37, and between the arcuate slot 78 and

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the pivot shaft slot 83. A pin 93 (Figures 8 and 9) is mounted in the outlet end wall 37 so that it extends into the groove 92. Said arcuate cam 94 is shaped like the slot 78 and said groove 92 is so arranged that the pin 93 will be closely and slidably engaged by the cam 94 as the pinion 74 moves around the arcuate slot 78, while maintaining a continuous correct engagement of the pinion 74 with the gear teeth 79. Due to the character of the arcuate slot 78 and the pinion 74, it will be observed that, as the pinion 74 moves from the upper row 81 to the lower row 82, said pinion 74 will engage the adjacent gear teeth 79 in the end of the slot so that the pivot quadrant 76 will be moved upwardly with respect to the pivot shaft 84. Under normal circumstances, the pivot quadrant 76 would drop back downwardly again as soon as the pinion 74 moved into its 74a position at the beginning of the lower row 82. However, the pin 93 moves into its position 93a (Figure 9) below the arcuate cam 94 before the pinion 74 reaches the 74a position, thereby preventing downward movement of the pivot quadrant 76. The interengagement of the pin 93 and cam 94 will positively hold the pinion 74 in engagement with the lower row 82 until the pinion 74 reaches a position about as indicated in broken lines at 74b in Figure 9. However, at this point, the pin 93 will be approximately in its broken line position 93b (Figure 9), thereby permitting it to move around the end of the cam 94, hence, permitting the quadrant 76 to move downwardly in response to the movement of the pinion 74 along teeth at the rightward (as appearing in Figure 9) end of the slot 78.

The pivot shaft 84 mounts a crank bar 95 (Figures 3 and 8) externally of the housing 11 and directly below the pivot axis of the discharge head 21. The end segment 23 of the discharge head 21, which is disposed adjacent to the housing 11, is rotatably supported upon, and within, a sealing collar 96, which is secured to the outer surface of the outlet end wall 37 near the upper end thereof. A sealing ring 97 is provided between the flared, inner end of the segment 23 and the sealing collar 96 to act as a bearing for the segment 23 and to prevent water leakage therebetween. Water pressure against the flared end of tube 21 aids the O-ring 97 in making an effective seal. The central opening 98 in the sealing collar 96 is aligned through a gasket 91 with an outlet opening 99 through the outlet end wall 37, which communicates with a substantially horizontal passageway 100 within the upper end of the housing 11, the other end of the passageway 100 communicating with the upper end of the inlet passageway 46 through an appropriate opening 103 (Figure 5) in the wall member 51.

An adjustable pivot arm 104 (Figure 3), containing an arcuate slot 105 at one end thereof, is removably mountable upon the segment 23 of the discharge head 21 by means of the yoke 106 and lock screw 107. The arcuate slot 105 has, in this particular embodiment, its concave side facing away from the discharge head 21. A link bar 108, which is pivotally supported upon the free end of the crank bar 95, is also pivotally adjustably engagable with the pivot arm 104 by means of the adjustment bolt 109, which extends through the slot 105. The oscillation of the discharge head 21 is controllable within limits by adjusting the bolt 109 along the arcuate slot 105.

Operation

Prior to operation of the sprinkler 10, the hose connection 44 (Figures 1 and 7), which communicates with the inlet opening 43 through the end member 38, is connected to a suitable source of water under pressure, as by means of the garden hose 42. The runners 14 and 15 (Figures 1 and 2) of the support frame 16, being upwardly curved at the opposite ends thereof, provide for easy movement of the sprinkler 10 along the ground to the desired location for use thereof simply by pulling on the hose 42. When the sprinkler 10 is disconnected from said hose 42,

the closed end of the U-shaped support frame 16 provides a convenient handle for manually engaging and transporting the sprinkler.

When the hose is connected to the sprinkler 10 (Figure 7) and water under pressure is caused to flow through said hose, the water will first pass through the inlet opening 43 and then into the wheel cavity 61. The inlet opening 43 is so arranged that liquid flowing therethrough will be directed at, and impinge upon, the blades of the water wheel 57 near the bottom thereof, thereby causing said wheel to rotate in a counterclockwise direction. The water will move with said wheel around said cavity 61 through an arc of between 180° and 270° from said inlet opening 43 to the upper end of the recess 56 in the inlet passageway 46. The water then flows upwardly through the inlet passageway 46 and into the substantially horizontal passageway 100 (Figure 8) through the upper end of the housing 11, where it discharges into the adjacent end of the discharge head 21. The discharge ports 25 (Figure 1) are so constructed, by comparison with the volume of water which can flow into the discharge head 21, that substantially more water will be attempting to enter said discharge head 21 than can flow through the discharge ports 25. Thus, water will flow substantially uniformly through all of said ports, even when the pressure is relatively low.

Suitable sealing devices, namely, the gasket 54 (Figure 7), O-ring 101, gasket 91, sealing ring 97 (Figure 8) and the O-ring 31 (Figure 12), will prevent substantially all leakage of said water from its above described and desired path, as it moves from the inlet opening 43 to the discharge ports 25. A particular effort is made, however, to avoid leakage of water into the chamber 53. For example, it is recognized that water will tend to move along the water wheel shaft 62 (Figures 10 and 11) as it is rotated with the water wheel 57. However, the annular ridge 69, created by the adjacent annular grooves 67 and 68, will provide a slinger, by means of which water moving from the wheel cavity 61 along the shaft 62 will be thrown through the seepage opening 63 into the seepage compartment 48, from which it may escape through the drain opening 70 (Figures 6 and 7) and through the lower end thereof. In spite of these precautions some moisture, even though small in amount, will collect in the chamber 53. However, drain openings 70, provide in the bottom of the housing 11, permit the escape of such accumulations.

Rotation of said water wheel 57 (Figure 4) will be transmitted through the shaft 62, worm 66, large gear 73 and main shaft 72 to the pinion 74 on said shaft 72. The pinion 74 (Figures 4 and 9), being engaged with the gear teeth 79 in the arcuate slot 78 of the pivot quadrant 76, will cause said quadrant to pivot around, and with, the pivot shaft 84. Because of the interengagement between the pin 93 (Figure 9) and the associated cam 94, there will be a substantially constant, relative movement between the axis of the pinion 74 and the support plate 77 as said pinion 74 successively engages the teeth 79 along said arcuate slot 78. As appearing in Figure 4, the quadrant 76 will be pivoted in a rightward direction while the pinion 74 is engaging the upper row 81 of said gear teeth 79, and said quadrant 76 will be pivoted in a leftward direction while said pinion 74 is engaging the lower row 82 of said teeth 79. As the pinion 74 moves from the upper row 81 to the lower row 82 at the leftward ends thereof, or from the lower row 82 to the upper row 81 at the rightward ends thereof, the guide rod 87 and guide pins 88 and 89 will permit a corresponding movement of the plate 77, without effecting any change in the axis, or rotational position, of the pivot shaft 84. Due to the relatively short distance which the pivot quadrant 76 must move to disengage the pinion 74 from one of said rows of teeth 79 and effect engagement with the other row of said teeth, the period of dwell which occurs during such movement is rela-

tively immaterial by comparison with the period of dwell which occurs where a simple harmonic motion is used to oscillate the head 21. Except for extremely small increments of movement which occur at the extreme ends of the arcuate slot 78, the movement of the quadrant 76 effected by its engagement with the pinion 74 is substantially constant. Thus, rotational movement of the pinion 74 is converted into substantially constant, pivotal movement of the pivot shaft 84 by the pivot quadrant 76.

The pivotal movement of the shaft 84 is transmitted by the crank bar 95 (Figure 3), the pivot arm 104 and the link bar 108 to the discharge head 21, which is oscillated in a corresponding manner. Proper adjustment of the direction and extent of the oscillation of the discharge head 21 can be accomplished quickly and easily by adjustment of the position of the bolt 109 within the arcuate slot 105. Further adjustments can be made by releasing the lock screw 107 and repositioning the pivot arm 104 with respect to the discharge head 21, after which said screw 107 is again tightened. As a general rule, all necessary adjustments can be made by means of the bolt 109 within the arcuate slot 105.

As stated previously, it has been found advantageous to limit the pivotal movement of the quadrant 76 to an angle of less than 45° on either side of a substantially vertical plane defined by the axes of the shafts 72 and 84. Thus, when the pinion 74 is in its position 74a or position 74b (Figure 9) and, therefore, the pivot quadrant 76 will be moving with respect to the pivot shaft 84, the force vector parallel with the guide rod 87 will be at least as large as the force vector transversely disposed with respect thereto, thereby preventing the imposition of undesirably large forces upon the guide pins 88 and 89. It will be recognized, of course, that, by appropriate construction of the length of the crank bar 95 and the pivot arm 104, and by appropriate shaping of the arcuate slot 105, a pivotal movement by the pivot shaft 84 of less than 90° can be converted into a pivotal movement of the discharge head 21 or more than 90°.

If and when the discharge ports 25 become partially or totally clogged by solid material in the water, or other obstructions, such obstructions can be easily and quickly removed simply by removing the end plug 28 (Figure 12) from the discharge head 21 and inserting the flexible pin 33, supported upon the end plug, into said ports 25. Such solid material may then be flushed through the open end of the discharge head 21.

It will be apparent that the structure of the sprinkler, as shown and described, lends itself readily to ease of assembly and use, while maintaining the number of parts necessary for effective operation to a bare minimum.

Although a particular, preferred embodiment of the invention has been described in detail hereinabove for illustrative purposes, it will be understood that variations or modifications thereof, which do not depart from the scope of the invention, are fully contemplated unless specifically stated to the contrary in the appended claims.

We claim:

1. In a lawn sprinkler having an oscillatable discharge head pivotally mounted upon a housing, said housing having a water inlet opening, the combination comprising: means defining a passageway through said housing connecting said inlet opening to said head; partition means in said housing defining a seepage compartment adjacent said passageway and a chamber adjacent said seepage compartment; a water wheel rotatably disposed in said passageway whereby passage of water through said passageway will cause rotation of said water wheel, said water wheel having a shaft extending adjacent said seepage compartment and into said chamber, said shaft having a plurality of adjacent annular grooves with ridge means therebetween; means defining a port in said partition means extending radially from adjacent said ridge means and communicating with said seepage compartment whereby water moving along said shaft will be dis-

charged into said seepage compartment; and means in said chamber and driven by said shaft for oscillating said head.

2. In an oscillatable lawn sprinkler having an oscillatable discharge head pivotally mounted upon a housing, said housing having a water inlet opening, the combination comprising: means defining a passageway through said housing connecting said inlet opening to said discharge head; a water wheel rotatably disposed in said passageway, said water wheel having a shaft rotatable therewith; a pivot shaft in said housing and connected to said discharge head for oscillating the same; gear means driven by said water wheel shaft for oscillating said pivot shaft, said gear means including a pivot member connected to said pivot shaft for oscillating the same upon oscillating movement of said pivot member and cooperating guide means on said pivot member and said pivot shaft for supporting said pivot member for radial sliding movement with respect to said pivot shaft, said pivot member having an internally toothed, arcuate opening therein defining an endless rack disposed radially outwardly of said pivot shaft; and a rotatable pinion connected to said water wheel shaft and extending into said arcuate opening and engaging said rack for oscillating said pivot member in response to rotation of said water wheel.

3. In an oscillatable lawn sprinkler having an oscillatable discharge head pivotally mounted upon a housing, said housing having a water inlet opening, the combination comprising: means defining a passageway through said housing connecting said inlet opening to said discharge head; a water wheel rotatably disposed in said passageway, said water wheel having a shaft rotatable therewith; a pivot shaft in said housing and connected to said discharge head for oscillating the same; a pivot plate having an elongated slot therein, said pivot shaft extending through said slot whereby said plate may move radially with respect to said pivot shaft; means on said shaft and said plate for preventing relative pivotal movement therebetween whereby said pivot shaft will oscillate upon oscillation of said plate; said plate having an arcuate slot therein with gear teeth extending from the walls thereof to define a closed rack; and gear means connected to said water wheel shaft for rotation thereby, said gear means being drivingly connected to said rack for oscillating said plate and thereby oscillating said pivot shaft in response to rotation of said water wheel.

4. In an oscillatable lawn sprinkler having an oscillatable discharge head pivotally mounted upon a housing, said housing having a water inlet opening, the combination comprising: means defining a passageway through said housing connecting said inlet opening to said discharge head; a water wheel rotatably disposed in said passageway, said water wheel having a shaft rotatable therewith; a pivot shaft within said housing and having an outer end extending through an end wall thereof; a crank bar secured to the outer end of said pivot shaft and means, including a link, connecting said crank bar to said discharge head whereby said discharge head will be oscillated upon oscillation of said pivot shaft; a pivot plate positioned adjacent and substantially parallel with said end wall of said housing, said pivot plate having an elongated slot therein, said pivot shaft extending through said slot whereby said plate may move radially with respect to said shaft; means on said pivot shaft and said plate for preventing relative pivotal movement therebetween whereby said pivot shaft will oscillate upon

oscillation of said plate, said plate having an arcuate slot therein with gear teeth extending inwardly from the walls thereof to define a closed rack lying in a plane substantially parallel to said end wall of said housing; gear means connected to said water wheel shaft for rotation thereby; a pinion driven by said gear means and drivingly connected to said rack for oscillating said plate and thereby oscillating said pivot shaft in response to rotation of said water wheel; and cam means in said pivot plate adjacent the inner surface of said end wall and a cam follower secured to said inner surface and contacting said cam means for moving said plate radially with respect to said pivot shaft and said end wall and for holding said rack and pinion in driving engagement.

5. In a lawn sprinkler having an oscillatable discharge head pivotally mounted upon a housing, said housing having a water inlet opening, the combination comprising: means defining a passageway through said housing connecting said inlet opening to said discharge head; partition means in said housing defining a seepage compartment adjacent said passageway and a chamber adjacent said seepage compartment; a water wheel rotatably disposed in said passageway whereby passage of water through said passageway will cause rotation of said water wheel, said water wheel having a shaft extending adjacent said seepage compartment and into said chamber, said shaft having a plurality of adjacent annular grooves thereon with ridge means therebetween; a port extending radially from adjacent said ridge means and communicating with said seepage compartment whereby water moving along said shaft will be discharged into said seepage compartment; a pivot shaft within said chamber and having an outer end extending through an end wall thereof; a crank bar secured to the outer end of said pivot shaft and means including a link connecting said crank bar to said discharge head whereby said discharge head will be oscillated upon oscillation of said pivot shaft; a pivot plate positioned adjacent and substantially parallel with said end wall of said housing, said pivot plate having an elongated slot therein, said pivot shaft extending through said slot whereby said plate may move radially with respect to said shaft; means on said shaft and said plate for preventing relative pivotal movement therebetween whereby said pivot shaft will oscillate upon oscillation of said plate; said plate having an arcuate slot therein with gear teeth extending inwardly from the walls thereof to define a closed rack lying in a plane substantially parallel to said end wall of said housing; gear means in said chamber and driven by said water wheel shaft for rotation thereby; a pinion driven by said gear means and drivingly connected to said rack for oscillating said plate and thereby oscillating said pivot shaft in response to rotation of said water wheel; a closed arcuate cam of shape similar to the shape of said slot in said pivot plate and positioned adjacent the inner surface of said end wall; a cam follower secured to said inner surface and contacting said cam for moving said plate radially with respect to said pivot shaft and said end wall and for holding said rack and pinion in driving engagement.

References Cited in the file of this patent

UNITED STATES PATENTS

1,611,914	Jenkins	Dec. 28, 1926
2,132,314	Needler	Oct. 4, 1938
2,676,842	Squiers	Apr. 27, 1954
2,769,665	Spender	Nov. 6, 1956