Oct. 24, 1961 E. W. SMITH 3,005,592

MECHANICAL DEVICE

Filed April 11, 1958 2 Sheets-Sheet 1

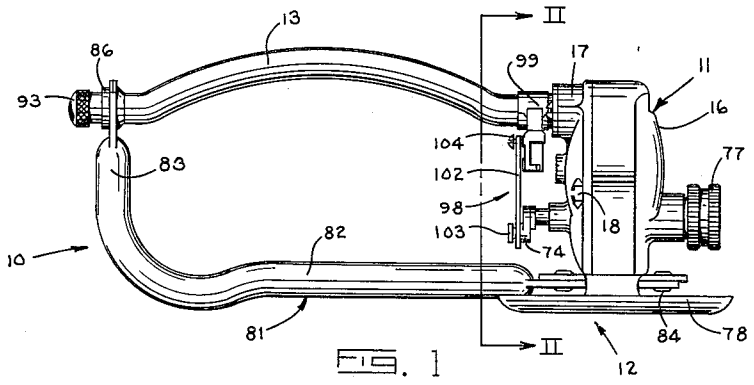


FIG. 1

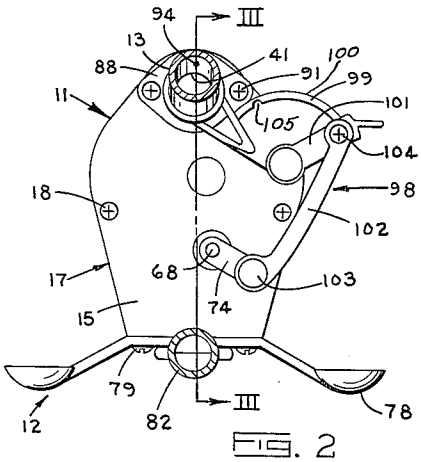


FIG. 2

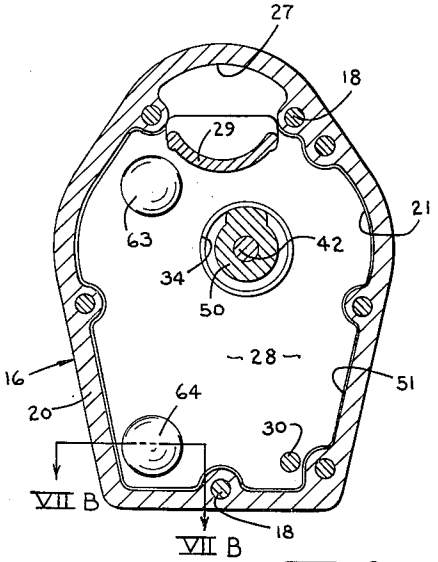


FIG. 6

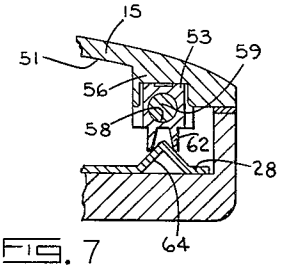


FIG. 7

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MECHANICAL DEVICE

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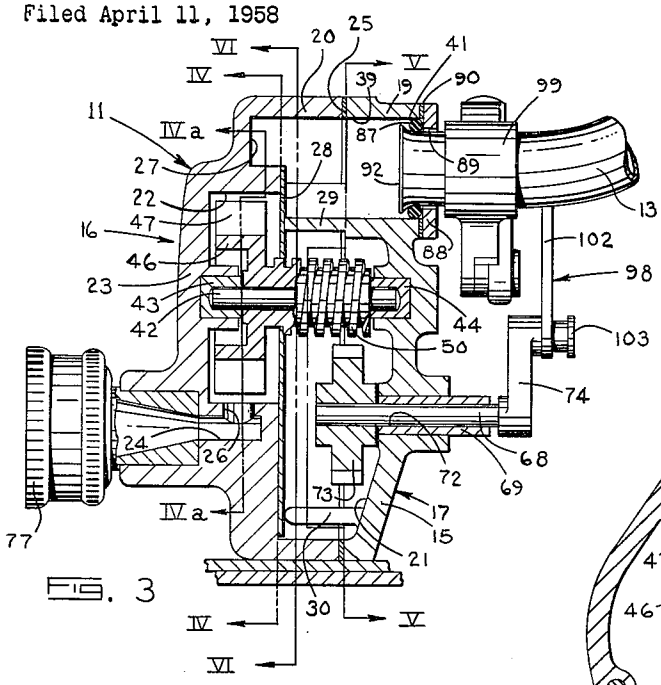


Fig. 3

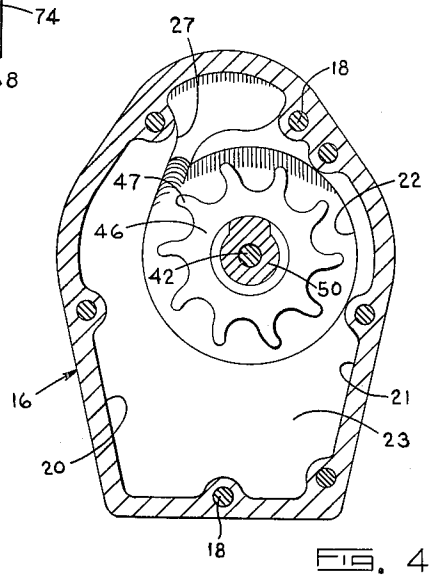


Fig. 4

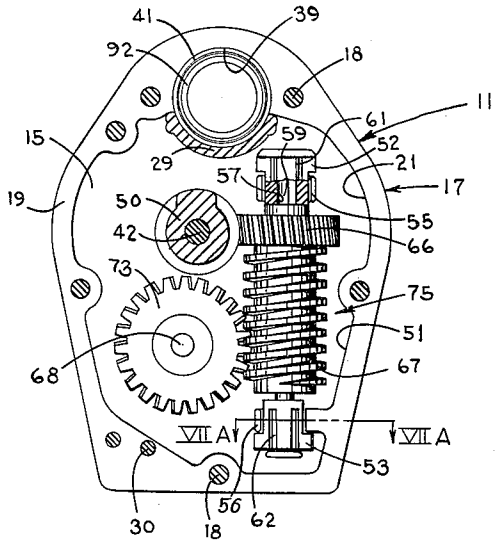


Fig. 5

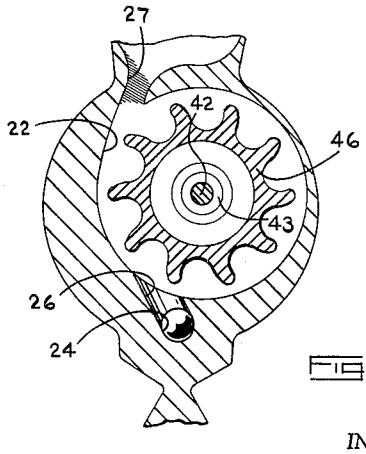


Fig. 4a

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3,005,592

MECHANICAL DEVICE

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Filed Apr. 11, 1958, Ser. No. 727,900
5 Claims. (Cl. 239—242)

This invention relates in general to a lawn sprinkler having an oscillating discharge head and, more particularly, relates to an improved mechanism for effecting oscillation of the discharge head, said mechanism being capable of operation within a relatively small housing.

The manufacture and sale of lawn sprinklers has long been a highly competitive business involving quantity production and small margins of profit. Accordingly, even a very small reduction in the cost per unit can result in very large savings to the manufacturing organization. In a continuing effort to improve upon the structures of oscillating sprinklers, and thereby realize such savings, many types of oscillating mechanisms, including water driven motors, have been developed. Usually these mechanisms have included a water wheel which is rotated by the water passing through, and discharged by, the sprinkler head. The water wheel is connected by a gear train and a lever system to the discharge head so that rotation of said wheel effects oscillation of said head.

Previous attempts hav been made to reduce the cost of oscillating sprinklers by reducing the cost of the individual parts in the oscillating mechanism. Other attempts have been made to reduce assembly costs by simplifying the internal organization of the parts. These efforts have resulted, in many cases, in producing an inefficient oscillating mechanism, which has often operated irregularly or even stopped, particularly where the water flow through the sprinkler has been at one-half or less of full volume. This approach, which has generally overlooked the housing for the oscillation mechanism, has also often resulted in unnecessarily large units, excessive use of material and often undesirable weight in the finished product.

In dealing with this problem, I have completely redesigned the oscillating mechanism and housing therefor so that they occupy a minimum of space and the mechanism can operate with maximum efficiency from the water stream flowing therethrough even at low adjustments of the water volume. This provides for accurate control of the oscillating mechanism through a much wider range of volume settings than was available previously.

Accordingly, the principal object of the invention has been to provide an oscillating sprinkler having a water driven motor which will have the maximum degree of response to water pressure applied thereto, but which can be constructed at a minimum of expense without impairing its satisfactory operation.

A further object of the invention has been to provide an oscillation mechanism including a water driven motor which will respond accurately to the volume of water flowing therethrough.

A further object of the invention has been to provide an oscillation motor, as aforesaid, including a water wheel and a closely confined path through which the water flows past the water wheel and is closely controlled without requiring a construction of such complexity as to involve added expense.

A further object of the invention has been to provide an oscillation mechanism, as aforesaid, which will achieve the accuracy in the response, but will require less material than similar devices for the same purpose and thereby achieve a substantial savings in material cost.

A further object has been to provide an oscillating sprinkler construction, as aforesaid, which can be easily assembled and readily opened for replacement of parts and other maintenance services, as may be needed.

A further object of the invention has been to provide a sprinkler construction, as aforesaid, which will be of sufficiently simple construction throughout as to be capable of manufacture at a minimum of cost, and which will be sturdy and able to resist a maximum of rough usage.

Other objects and purposes of the invention will be obvious to persons acquainted with devices of this general type upon reading the following specification and inspecting the accompanying drawings, in which:

FIGURE 1 is a side elevational view of a lawn sprinkler embodying the invention.

FIGURE 2 is an enlarged sectional view taken along the line II—II of FIGURE 1.

FIGURE 3 is an enlarged sectional view substantially as taken along the line III—III of FIGURE 2.

FIGURE 4 is a sectional view taken along the line IV—IV of FIGURE 3 with parts omitted therefrom to simplify the figure.

FIGURE 4*a* is a section taken on the line IV*a*—IV*a* of FIGURE 3 with parts omitted therefrom to simplify the figure.

FIGURE 5 is a sectional view substantially as taken along the line V—V of FIGURE 3 with parts omitted therefrom to simplify the figure.

FIGURE 6 is a sectional view taken along the line VI—VI of FIGURE 3 with parts omitted therefrom to simplify the figure.

FIGURE 7 is a sectional view taken partly along the line VIIA—VIIA of FIGURE 5 and partly along the line VIIB—VIIB of FIGURE 6 and showing the parts in assembled position with respect to each other.

For convenience in description, the terms "upper," "lower" and derivatives thereof will have reference to the lawn sprinkler in its normal position of operation as shown in FIGURES 1, 2 and 3. The terms "inner," "outer" and derivatives thereof will have reference to the geometric center of said lawn sprinkler and parts thereof.

GENERAL DESCRIPTION

In general I have provided a lawn sprinkler having a housing in which a water motor is disposed for oscillating a discharge head supported at least in part upon said housing. Said water motor includes a water wheel and gearing which have been rearranged in such a manner that the water wheel is closely confined and the water is directed at said water wheel so as to impart power thereto in a highly efficient and effective manner. This improvement in efficiency makes it possible to reduce the mechanical advantage in the gear train driven by the water wheel, thereby reducing the space requirements of said gear train. This, is turn, permits a substantial reduction in the size of the housing surrounding such gear train which makes possible an appreciable saving in the cost of materials. Thus, my improved sprinkler has a more accurate and sensitive response to the volume and/or pressure of the water supplied thereto and, at the same time, can be produced at a material reduction in cost.

Detailed construction

A lawn sprinkler **10** (FIGURE 1), herein selected to illustrate the invention, is comprised of a motor housing **11**, a support structure **12** and an elongated tubular discharge head **13** pivotally supported upon, and between, the motor housing **11** and an upright element **83** of the support structure **12**. The motor housing **11** (FIGURES 1 and 2) is preferably composed of a pair of hollow, cooperating shells, hereinafter referred to as the inlet shell

16 and the outlet shell 17, which are held together by the bolts 18. The outlet shell 17 has an end wall 15 which is integral with, and bounded by, a sidewardly projecting peripheral wall 19. The inlet shell 16 has an end wall 23 which is bounded by an integral, sidewardly projecting peripheral wall 20. The shells 16 and 17 are arranged so that the free edges of the peripheral walls 19 and 20 engage opposite sides of a gasket 25 and said shells, when so arranged, define a motor cavity 21. Said shells 16 and 17 may, for example, be fabricated from a light weight metal, such as aluminum.

The cavity 21 (FIGURES 3 and 4), includes a substantially circular recess 22 in the end wall 23 of the inlet shell 16. Said end wall 23 also has an inlet opening 24 which extends toward, but is spaced from, the cavity 21. The inner end of the inlet opening 24 is connected by an inlet passageway 26 (FIGURE 4*a*) with the circular recess 22, the axis of the passageway 26 being substantially tangential to said recess 22. In this embodiment, the inlet opening 24 is below the circular recess 22 and the passageway 26 communicates with the recess 22 through the periphery thereof. A recessed passageway 27 is provided in said end wall 23 near the upper end of the circular recess 22 and communicates tangentially with said recess 22 through its periphery.

A partition plate 28 (FIGURES 3 and 6), which is disposed within the cavity 21 adjacent to the end wall 23, has a peripheral contour which preferably conforms with the inner surface of the peripheral wall 20. Said plate 28 is held against the inner surface of the end wall 23 by the projections 29 and 30 which are integral with, and extend inwardly from, the end wall 15 of the outlet shell 17. The partition plate 28 has an opening 34 (FIGURE 6) which is substantially coaxial with the circular recess 22 and is disposed below the projection 29. Said partition plate 28 (FIGURES 3 and 6) is preferably arranged so that it does not cover the upper end of the passageway 27. The upper projection 29 co-operates with the upper portion of the peripheral wall 19 on the outlet shell 17 to define an outlet passageway 39 which communicates with said upper end of said recessed passageway 27 in the end wall 23. The end wall 15 of the outlet shell 17 has an outlet opening 41 which communicates with said outlet passageway 39. Accordingly, water entering the inlet opening 24 in the end wall 23 can flow to the outlet opening 41 in the end wall 15 through a path defined by said inlet passageway 26, said circular recess 22, the recessed passageway 27 and the outlet passageway 39.

A water wheel shaft 42 (FIGURES 3 and 4) extends coaxially through the opening 34 in the partition plate 28 substantially perpendicularly therewith. Said shaft 42 is rotatably supported at its opposite ends in bearings 43 and 44 supported upon the end walls 23 and 15, respectively. In this particular embodiment, the shaft 42 is fabricated from steel and the bearings 43 and 44 are fabricated from a non-corrosive, lubric, material, such as nylon. A water wheel 46, which is rotatably disposed within the circular recess 22, is coaxially secured upon the water wheel shaft 42 for rotation of said shaft. Said water wheel 46 has backwardly curved blades 47 (FIGURES 3 and 4) which are engaged by the jet of water entering the circular recess 22 through the inlet passageway 26, thereby rotating the water wheel 46 in a well-known manner. The passageways 26 and 27 (FIGURE 4*a*) are preferably arranged so that they penetrate the periphery of the recess 22 in opposite rotational directions and at points about 120 degrees apart. Thus, the water can enter the recess 22, rotate the wheel 46 and depart from said recess with a minimum of obstruction to its flow toward the outlet opening 41.

A horizontal worm 50 (FIGURES 3 and 5) is coaxially supported upon, and is rotatable with, the water wheel shaft 42 and is primarily disposed within the upper end of the gear chamber 51. Said gear chamber 51 comprises that portion of the cavity 21 defined by the partition plate 28, the end wall 15 and peripheral wall 19 of said outlet shell 17, the peripheral wall 20 of the inlet shell 16 and the lower side of the upper projection 29.

A pair of bearing blocks 52 and 53 (FIGURES 5 and 7) are removably engaged by the vertically spaced bearing supports 55 and 56, respectively, which are integral with, and extend inwardly from, the end wall 15 of the outlet shell 17. Said bearing blocks have coaxial, substantially vertical bores 57 and 58 into which the opposite ends of the gear shaft 59 are rotatably received. The bearing blocks 52 and 53 each have a pair of spaced extensions 61 and 62, respectively, which are resiliently flexible and which extend toward the partition plate 28 (FIGURES 5 and 7). The partition plate 28 is provided with integral, conically shaped offset portions 63 and 64, which extend between, and are engageable with, the extensions 61 and 62 for holding the bearing blocks 52 and 53 firmly within their bearing supports 55 and 56. The extensions 61 and 62 and the offset portions 63 and 64 are preferably arranged so that said extensions are slightly spread apart when said blocks are in their assembled, operative positions.

A spur gear 66 (FIGURE 5), which meshes with the horizontal worm 50, is secured coaxially upon the upper end of the gear shaft 59 for rotation therewith. A vertical worm 67 is secured to, and rotatable with, the gear shaft 59 below said spur gear 66. A crankshaft 68 (FIGURES 3 and 5) is rotatably supported within the bushing 69 which is in turn seated within a substantially horizontal opening 72 through the end wall 15, substantially directly below the wheel shaft bearing 44. The inner end of the crankshaft 68 extends into the gear chamber 51 where it is coaxially secured to the spur gear 73 which meshes with the vertical worm 67. The outer end of the crankshaft 68 is secured to one end of a crank 74. The crankshaft 68 is preferably fabricated from steel. The water wheel 46, the gear shaft 59, the worms 50 and 67 and the gears 66 and 73 are, in this particular embodiment, fabricated from a non-corrosive, lubric material, such as nylon, which is impervious to water. However, it will be recognized that other materials can be used without departing from the scope of the invention, providing they are capable of operating satisfactorily while immersed in water containing a variety of impurities and varying materially in its temperature. The worms 50 and 67 and the gears 66 and 73 comprise a gear train 75 whereby the water wheel 46 can rotate the crankshaft 68.

A hose connection 77 (FIGURE 3) is supported upon the inlet shell 16 in communication with the inlet opening 24. The support structure 12 includes a housing base 78 (FIGURES 1 and 2), which is secured to the lower surface of the inlet shell 16, in this particular embodiment, by means such as the screws 79. Said support structure 12 also includes an L-shaped skid 81 having a horizontal element 82 and an integral, substantially upright element 83. The horizontal element 82 is secured at the end thereof remote from the upright element 83 to the housing base 78 by means, such as the rivets 84 (FIGURE 1).

One end of the discharge head 13 is rotatably supported within a bearing 86 (FIGURE 1) supported upon the upper end of the upright element 83. The other end of the discharge head 13 is rotatably supported within the outlet opening 41 (FIGURE 3) in the outlet shell 17 by means of the sealing ring 87. A retaining plate 88 (FIGURES 2 and 3), having a circular opening 89 through which the inner end of the discharge head 13 is slidably and snugly received, and gasket 90 associated therewith is secured to the end wall 15 of the outlet shell 17 by means of the screws 91 (FIGURE 2). The inner end 92 of the discharge head 13 is flared, and the sealing ring 89 is held between the flared end 92 and the retaining plate 88. A flanged plug 93 is threadedly received into the outer end of the discharge head 13, both to close such end of the head and to limit movement of said head

toward the housing 11. The hollow discharge head 13 has a plurality of relatively small spray openings 94 (FIGURE 2) through which water can pass.

The discharge head 13 (FIGURES 1 and 2) is oscillated around its lengthwise axis by means of the linkage 98, which includes the crank 74 and a pivot member 99 which is secured upon, and extends radially from, the discharge head 13 adjacent to the housing 11. The pivot member 99 has an arcuate flange 100 with a recess 105 therein adjacent discharge head 13 and a corresponding recess (not shown) remote from said discharge head. An adjustment arm 101 is pivotally supported near one end thereof upon the pivot member 99 for movement around an axis substantially parallel with the lengthwise axis of said discharge head 13 between positions where it is aligned with one or the other of said recesses. A link bar 102 is pivotally secured at its opposite ends upon the outer end of the crank 74 and the free end of the adjustment arm 101 by means of the pivot pins 103 and 104, respectively. The linkage 98 is arranged so that rotation of the crank 74 effects an oscillation of the pivot member 99, hence the discharge head 13 secured thereto. The adjustment arm 101 is movable between two positions with respect to the pivot member 99 wherein the pivot pin 104 is at two materially different radial distances from the axis of the discharge head 13 so that said discharge head may be oscillated through two arcs of different arcuate extent.

For further details regarding the linkage 98, reference is made to the copending application entitled "Mechanical Device," Serial No. 720,899, and assigned to the assignee of this application.

Operation

In order to operate the lawn sprinkler 10, the hose connection 77 (FIGURE 3) may be connected to an appropriate source of water, such as a hose (not shown), in a conventional manner, whereby water can be caused to flow under pressure into the inlet opening 24 in the end wall 23. As shown in FIGURES 3 and 4*a*, said water moves from the inlet opening 24 into the passageway 26 which is disposed tangentially with respect to the water wheel 46 in the circular recess 22. Thus, the water passing through the passageway 26 impinges upon the blades 47 of the water wheel 46 thereby causing the wheel to rotate at a high rate of speed. The water effecting such rotation of the wheel 46 then passes into and through the passageway 27 and thence into the outlet passageway 39, which communicates with the inner end of the discharge head 13. Accordingly, the water entering the inlet opening 24 flows in a path of minimum turns through the housing 11 and the discharge head 13 while at the same time rotating the water wheel 46.

Rotation of the water wheel 46 (FIGURE 3) operates through the gear train 75 to effect rotation of the crankshaft 68, at a greatly reduced speed by comparison with the rotational speed of the water wheel 46. Rotation of the crank 74 operates through the link bar 102 to effect a pivotal movement of the pivot member 99, thereby producing a corresponding pivotal oscillation of the discharge head 13. The amount and type of pivotal movement thus effected may be controlled and manually changed by adjusting the adjustment arm 101 in a manner set forth in detail in the above-mentioned copending application.

Because the water moves in a confined path (FIGURE 4) from the inlet opening 24 at least through the lower portion of the recessed passageway 27, it will be recognized that the wheel 46, the gear train 75 and the linkage 98 will operate to effect oscillation of the discharge head 13 even though the pressure and volume of water entering the inlet opening 24 may vary over a substantially wide range. Accordingly, sudden reductions in pressure and/or volume, which are not uncommon in domestic water supplies and systems, will not materially or disadvantageously affect the operation of the lawn sprinkler 10. That is, the water motor within the motor housing 11 will continue to oscillate the discharge head 13 although the frequency of such oscillation may be momentarily retarded by a drop in the volume and/or pressure of the water entering the inlet opening 24. The arrangement of the gear train 75 and the directness of the water flow from the inlet opening 24 to the discharge head 13 permit the use of a very compact housing requiring a minimum of space and materials.

Although a particular preferred embodiment of the invention has been disclosed above in detail, it will be understood that variations or modifications of such disclosure, which lie within the scope of the appended claims, are fully contemplated.

What is claimed is:

1. A lawn sprinkler comprising: a housing having a cavity therewithin and an inlet opening communicating with said cavity; a discharge head pivotally supported upon said housing and means including a partition plate dividing said cavity into a gear chamber and a substantially circular recess which is located between said inlet opening and said discharge head, said partition plate having an opening therethrough; said housing having a first passageway connecting said inlet opening to said recess and having a second passageway connecting said recess to said discharge head, said passageways being substantially tangent to said recess; a water wheel closely confined with said recess and being mounted for rotation therewithin about an axis extending substantially through the center of said opening and perpendicular to said partition plate, said rotation being effected by water flow through said recess; a crankshaft supported by said housing for rotation about an axis parallel with and spaced from the axis of said water wheel; a reduction gear train within said gear chamber connecting said water wheel to said crankshaft whereby rotation of said water wheel effects a rotation of said crankshaft at a materially reduced speed, said gear train including a spur gear and a worm supported on a shaft; a pair of bearing blocks rotatably supporting said shaft; positioning means projecting from a wall of said gear chamber, said bearing blocks being held between and removably supported by said positioning means; and linkage connecting said crankshaft to said discharge head for effecting oscillation of said discharge head about its pivot axis.

2. In a lawn sprinkler, an outlet shell and an inlet shell, means interconnecting said inlet and outlet shells to form a housing having an inner cavity, a partition member extending between said inlet and outlet shells and partitioning said cavity into a water wheel chamber adjacent the inlet shell and a gear chamber adjacent the outlet shell, said outlet shell having means forming a pair of spaced bearing supports thereon inside of said gear chamber, a bearing block in each bearing support, and each bearing block having formed therein on one side a bore for receiving a corresponding end of a gear shaft, each bearing block having formed on another side thereof a pair of spaced extensions extending toward said partition member, said partition member having formed therein an offset portion opposite each corresponding bearing block shaped to engage the corresponding bearing block between said extensions, thereby to retain the bearing blocks firmly in said bearing supports.

3. In an oscillating sprinkler, an inlet shell having a hose connection forming an inlet for water to be distributed, an outlet shell connected to said inlet shell and together therewith forming a housing, said outlet shell having an outlet through which the water is supplied to a discharge head, a sheet form partition member in said housing dividing the interior of said housing into a gear chamber and a water wheel chamber, a pair of bearing blocks carried by said housing in said gear chamber for journaling gears and each bearing block having integral spaced resiliently flexible extensions projecting toward

said partition member, and an offset portion formed on said partition member for each bearing block and being shaped to engage said extensions, thereby slightly spreading said extensions apart and holding the bearing blocks firmly in place.

4. In an oscillating sprinkler, an inlet shell having a hose connection forming an inlet for water to be distributed, an outlet shell connected to said inlet shell and together therewith forming a housing, said outlet shell having an outlet through which the water is supplied to a discharge head, a sheet form partition member in said housing dividing the interior of said housing into a gear chamber and a water wheel chamber, a pair of bearing blocks carried by said housing in said gear chamber for journaling gears and each bearing block having integral spaced resiliently flexible extensions projecting toward said partition member, and an offset portion formed on said partition member for each bearing block and being shaped to engage said extensions, thereby slightly spreading said extensions apart and holding the bearing blocks firmly in place, a worm and gear member in said gear chamber having shaft extensions journaled in said bearing blocks, a crankshaft journaled in said outlet shell and adapted to be operatively connected to the discharge head, said crankshaft having a spur gear connected thereto and being in said gear chamber in mesh with the worm of said worm and gear member, and a water wheel in said water wheel chamber having a worm portion extending through said partition member into said gear chamber for meshing engagement with the gear portion of said worm and gear member, thereby to rotatably drive the gear train for oscillation of the discharge head.

5. A lawn sprinkler comprising: a housing having a cavity therewithin and an inlet opening communicating with said cavity; a discharge head pivotally supported upon said housing and means including a partition plate dividing said cavity into a gear chamber and a substantially circular recess which is located between said inlet opening and said discharge head, said partition plate having an opening therethrough; said housing having a first passageway connecting said inlet opening to said recess and having a second passageway connecting said recess to said discharge head, said passageways being substantially tangent to said recess; a water wheel closely confined with said recess and being mounted for rotation therewithin about an axis extending substantially through the center of said opening and perpendicular to said partition plate, said rotation being effected by water flow through said recess; a crankshaft supported by said housing for rotation about an axis parallel with and spaced from the axis of said water wheel; a reduction gear train within said gear chamber connecting said water wheel to said crankshaft whereby rotation of said water wheel effects a rotation of said crankshaft at a materially reduced speed, said gear train including a spur gear and a worm supported on a shaft; a pair of bearing blocks rotatably supporting said shaft; positioning means projecting from a wall of said gear chamber, said bearing blocks being held between and removably supported by said positioning means; said bearing blocks having integral spaced resiliently flexible extensions projecting towards said partition plate, said partition plate having projecting portions shaped to engage and slightly spread said extensions, thereby to hold said bearing blocks firmly in place, and linkage connecting said crankshaft to said discharge head for effecting oscillation of said discharge head about its pivot axis.

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