

Dec. 6, 1960

J. M. HAIT

2,963,228

HAMMER DRIVEN SPRINKLER

Filed Nov. 28, 1958

4 Sheets-Sheet 1

FIG 1

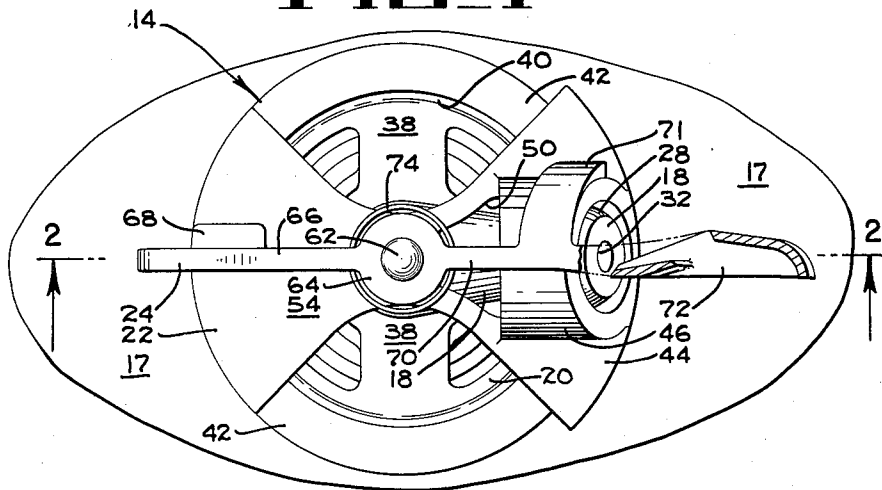
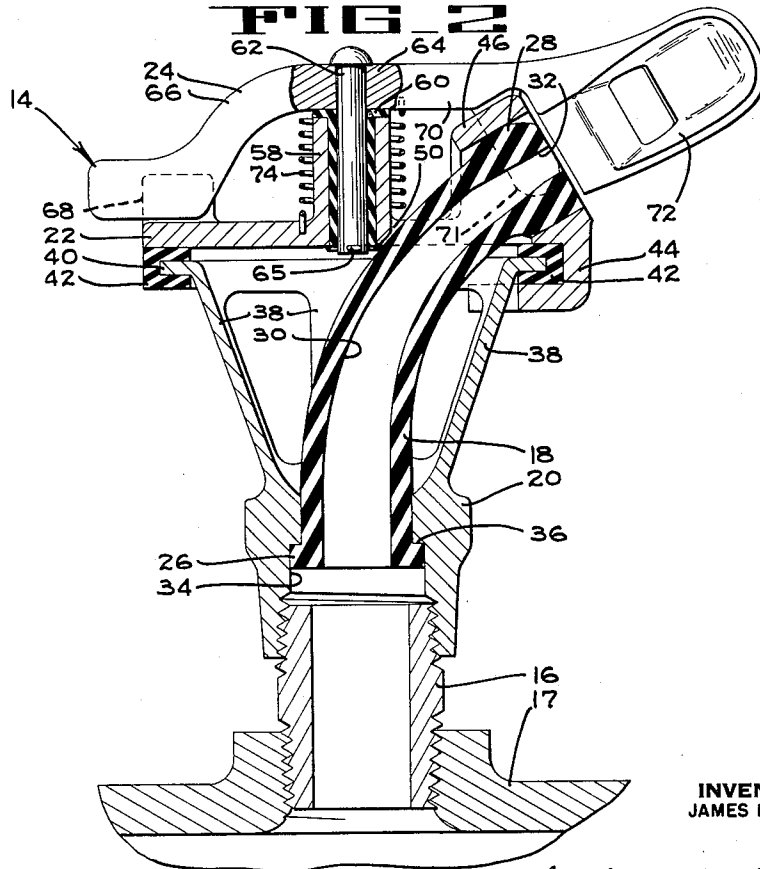


FIG 2



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FIG 3

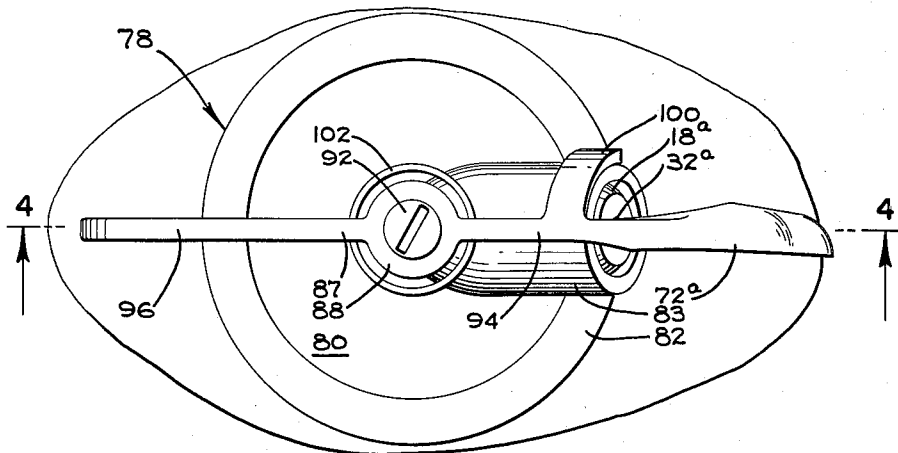
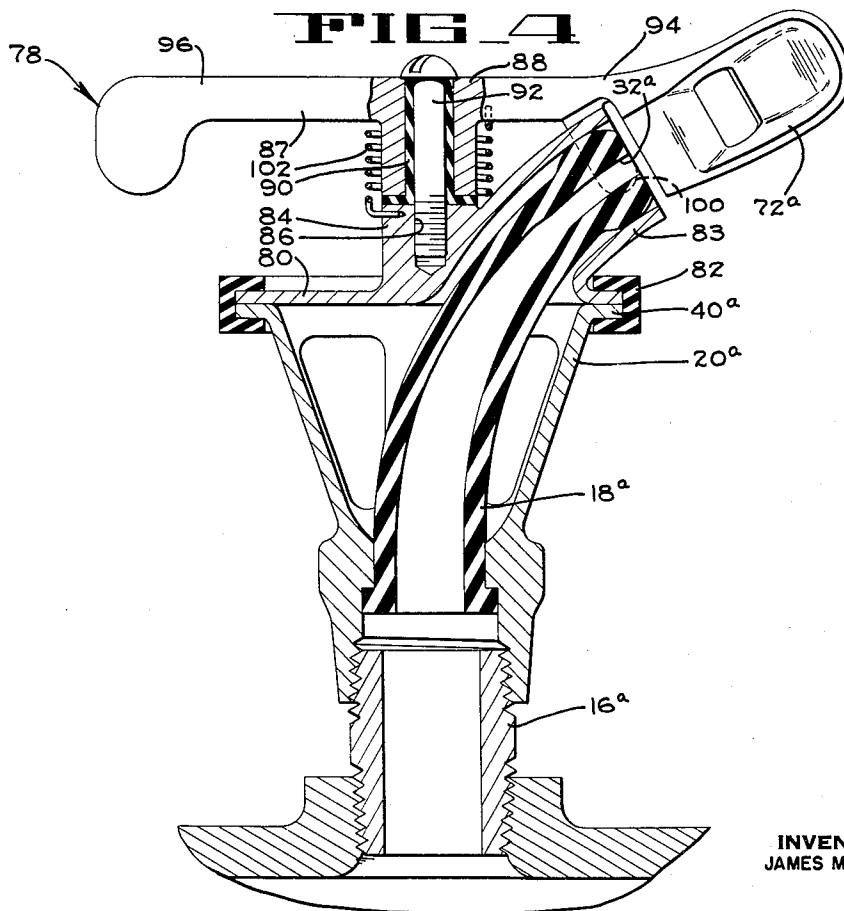


FIG 4



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FIG 5

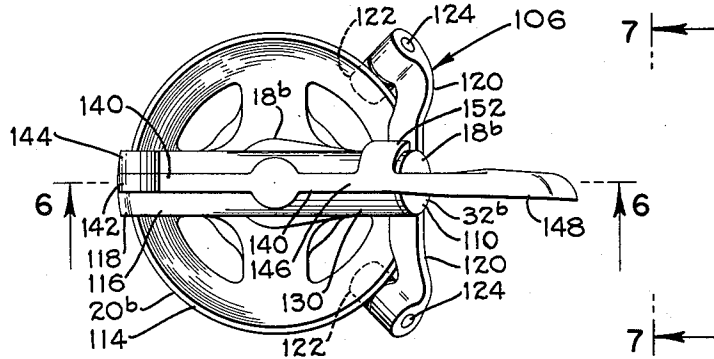


FIG 6

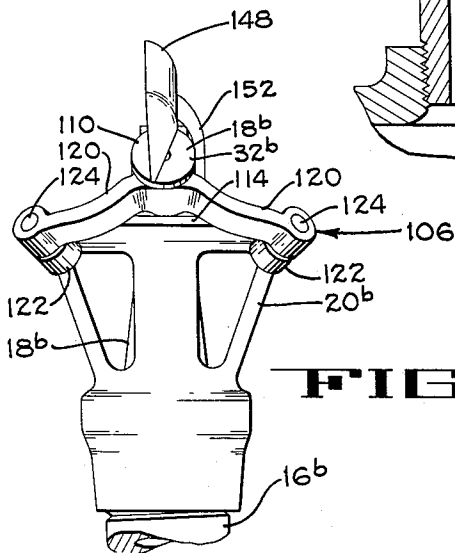
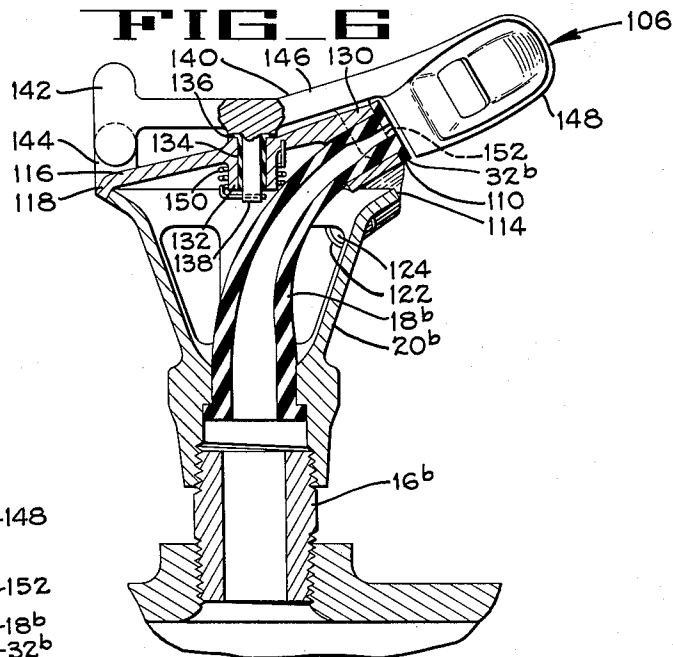


FIG 7

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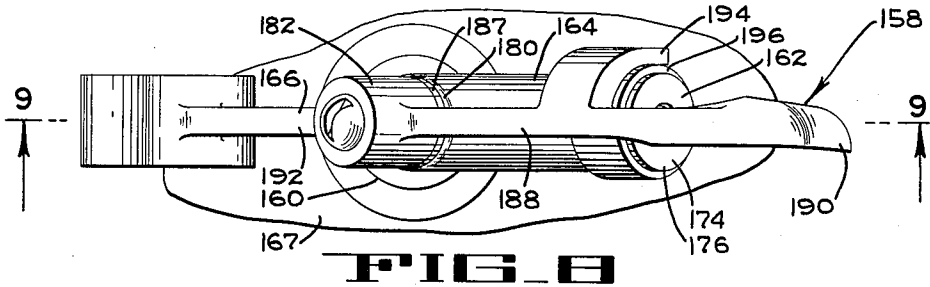
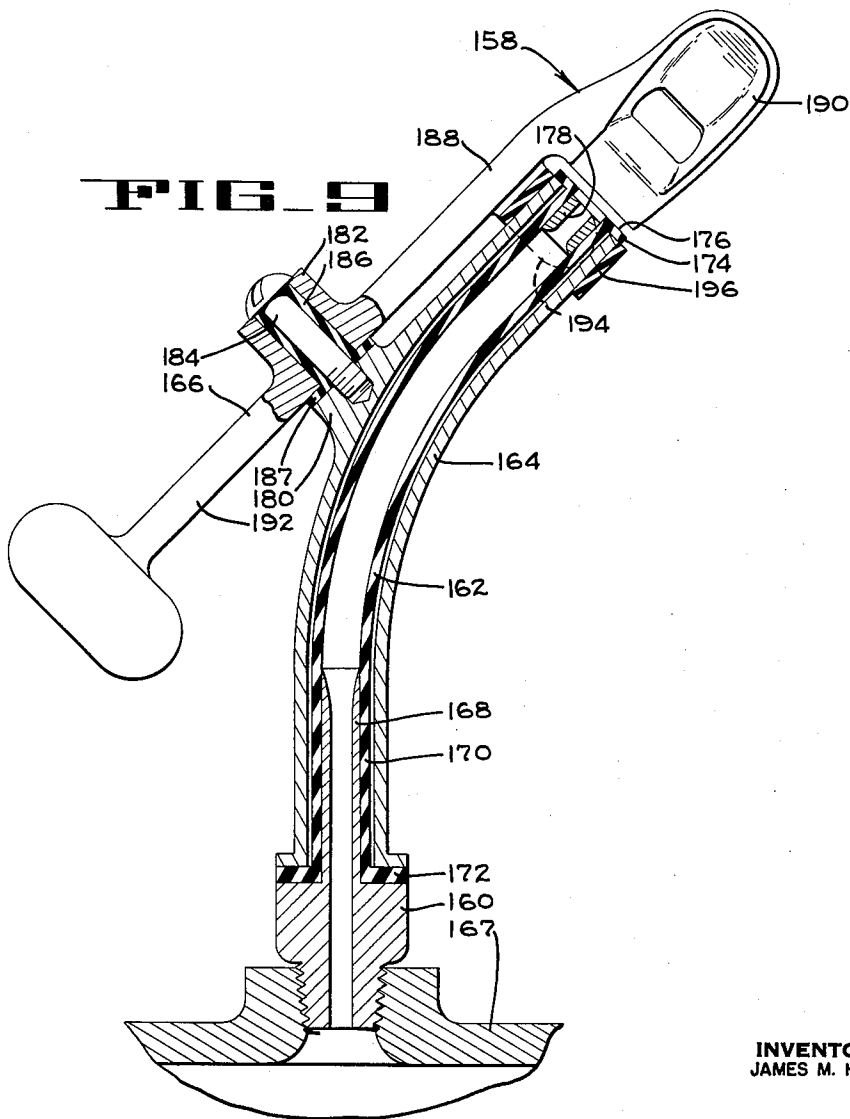


FIG. 9



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HAMMER DRIVEN SPRINKLER

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8 Claims. (Cl. 239-230)

The present invention appertains to fluid distributing apparatus and more particularly relates to impact type sprinklers for portable irrigation systems or the like.

Most sprinklers of the impact or hammer-driven type include a central stationary member and a nozzle that is journaled for rotation on the central member so that the fluid will be discharged over a circular area. Since the joint between the nozzle and the stationary member is in the flow passage of the sprinkler, a liquid tight packing gland must be used at this joint. These sprinklers are not only expensive but also they are quite frequently rendered inoperative due to the fact that small particles of sand or grit, which are entrained in the water, become lodged in the gland between the moving parts, causing the parts to become locked together. Obviously, all the water that is discharged from sprinklers locked together in this manner will be directed to only one portion of the circular area which would be watered by the sprinklers when operating properly. This results in over-irrigation and possibly erosion at this one portion of the circular area, while the remaining portion of the area is not irrigated at all. It is apparent therefore, that packing glands are a considerable source of trouble with sprinklers of the impact type.

It is, therefore, one object of the present invention to provide an improved impact type sprinkler for a portable irrigation system or the like.

Another object is to provide an improved sprinkler which has no relatively moving parts in the fluid flow passage thereof.

These and other objects and advantages of the present invention will become apparent from the following description and the drawings, in which:

Fig. 1 is a plan of a first embodiment of the improved sprinkler of the present invention, certain parts being shown in section.

Fig. 2 is a vertical section taken along lines 2-2 of Fig. 1.

Fig. 3 is a plan of a second embodiment of the improved sprinkler of the present invention.

Fig. 4 is a section taken along lines 4-4 of Fig. 3.

Fig. 5 is a plan of a third embodiment of the improved sprinkler of the present invention.

Fig. 6 is a section taken along lines 6-6 of Fig. 5.

Fig. 7 is a side elevation of the sprinkler of Fig. 5 looking in the direction of the arrows 7-7 in Figure 5.

Fig. 8 is a plan of a fourth embodiment of the improved sprinkler of the present invention.

Fig. 9 is a section taken along lines 9-9 of Fig. 8.

The sprinkler 14 of the present invention is shown in Figures 1 and 2 mounted on a vertically extending riser pipe 16 (Fig. 2), which may be considered as an extension of the sprinkler, and communicates with and is supported by any suitable fluid conducting means such as a pipe section 17 of a portable irrigation system. The sprinkler 14 comprises a flexible resilient tube 18 having one end securely held by a stationary frame 20 in flow communication with the riser pipe 16. A rotatable, hammer-supporting plate 22 is supported by the frame 20 and is arranged to guide the discharge end of the tube 18

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in a circular path. A fluid actuated hammer 24 is carried by the plate 22 and is arranged to rotate the plate 22 about the vertical axis of the riser pipe 16 in angular increments to carry the tube 18 in its circular path.

More specifically, the tube 18 is provided with an annular flange 26 at its lower inlet end and with a bulb-shaped section 28 on the discharge end. The tube 18 has a bore 30 which terminates in a reduced diameter discharge nozzle 32. The lower end of the tube 18 is frictionally secured within an opening 34 in the stationary frame 20 with the flange 26 seated against a shoulder 36. Fluid pressure holds the flange 26 in firm engagement with the shoulder 36 and prevents leakage of fluid and movement of the flange 26 relative to the stationary frame 20.

The frame 20 includes four upwardly extending, outwardly flaring legs 38 which are connected at their upper ends to an annular, horizontally disposed flange 40 which is concentric with the opening 34. A rubber ring 42 of U-shaped cross section is fitted on the flange 40 and provides a wear surface along which the hammer supporting plate 22 slides.

The hammer supporting plate 22 rides on the ring 42 and has an arcuate flange 44 integral therewith and disposed below and in sliding contact with the ring 42. The flange 44 extends somewhat less than 180° around the ring 42. An upwardly projecting, tube-retaining strap 46 is integral with the flange 44 and receives the bulb-shaped section 28 of the tube 18. The tube 18 projects through a hole 50 in the plate 22 and the bulb-shaped section 28 is rotatable within the tube retaining strap 46. It is to be particularly noted that the reaction force of the fluid being discharged from the tube 18 is not sufficiently strong to dislodge the bulb-shaped section 28 from within the strap 46. It should also be noted that this reaction force, and also the resilient force exerted by the tube 18, tends to force a fan-shaped portion 54 of the plate 22, which is disposed diametrically opposite the flange 44, downwardly against the rubber ring 42. Thus, no additional structure is required to maintain the portion 54 of the plate 22 in the above described operative position on the ring 42.

A hub 58 formed on and projecting upwardly from the plate 22 is bored concentrically relative to the axis of both the riser pipe 16 and the annular flange 40 and receives therein a flanged rubber bushing 60. A pivot pin 62, secured in a hub 64 of the hammer 24, is received for rotation in the bushing 60 and is held from dislodgement by a key 65. The hammer 24 comprises a downwardly projecting counterbalancing arm 66 having the lower portion arranged to swing over the fan-shaped portion 54 of the plate 22 and, at one end of its oscillating stroke, the arm 66 contacts an upwardly projecting lug 68 integral with the plate 22. A hammer actuating arm 70 projects outwardly from the hub 64 in a direction opposite to that of the arm 66. The hammer actuating arm 70 is provided with an impact member 71 in the form of an arm which is curved around one side of the tube retaining strap 46 and is arranged to contact the strap 46 simultaneously with the striking of the lug 68 by the arm 66. The hammer arm 70 terminates in a vane 72, of well known design, which is arranged to be alternately moved into and deflected away from the stream of water being discharged from the tube 18. A torsion spring 74 is disposed around the hub 58 and is connected at one end to the plate 22 and at the other end to the hammer 24 to normally urge the hammer 24 to pivot in a clockwise direction (Fig. 1).

In the operation of the sprinkler 14 shown in Figs. 1 and 2, water received from the riser pipe 16 flows through the flexible tube 18 and is discharged from the reduced diameter discharge end of the tube 18 in a high

pressure stream. This stream of water contacts the vane 72 of the hammer 24 causing the hammer 24 to pivot in a counterclockwise direction (Fig. 1), moving the vane 72 out of the path of the stream against the urging of the spring 74. The spring 74 then reverses the direction of movement of the hammer 24 causing the hammer 24 to pivot in a clockwise direction. The hammer 24 is abruptly stopped as the arm 66 and the impact member 71 simultaneously strike the lug 68 and the strap 46, respectively. The impact resulting from the abrupt stopping of the hammer 24 causes the rotatable plate 22, including the attached upper portion of the tube 18, to rotate several degrees in a clockwise direction (Fig. 1) for each stroke of the hammer. Thus, the discharge end of the tube 18 and the stream of water discharged therefrom, are rotated 360° about the axis of the riser pipe 16 in relatively small angular increments while the inlet end of the tube 18 remains stationary.

From the foregoing description it will be seen that the present invention provides a sprinkler of the impact type that is capable of distributing water in a circular pattern but has no joints between moving parts which can become clogged by sand or the like.

The second embodiment of the present invention comprises an improved sprinkler 78 (Figs. 3 and 4) having certain parts which are identical to parts in the first modification of the invention. Therefore, these identical parts will not be described in detail and will be assigned the same numerals as those assigned to the first embodiment followed by the suffix "a."

A riser pipe 16a, a tube 18a and a stationary frame 20a are identical to those parts disclosed in the embodiment of Fig. 1 and also cooperate with each other in the manner described in relation to that embodiment. A rotatable hammer supporting plate 80, which is circular and of the same diameter as the flange 40a of the frame 20a, is concentrically mounted thereon and is held in place by a flexible rubber ring 82 of U-shaped cross section which fits over the edges of the flange 40a and the plate 80. A curved tubular guiding member 83 is integrally formed on the plate 80 and is arranged to rotatably receive and guide the discharge end portion 32a of the tube 18a.

A boss 84 on the plate 80 is provided with a threaded hole 86 which is concentric with the flange 40a of the stationary frame 20a. A hammer 87, having a hub 88 bored to receive a flanged rubber bushing 90, is rotatably mounted on a bolt 92 which is screwed into the threaded hole 86 in the boss 84, thereby mounting the hammer 87 for rotation relative to the plate 80. The hammer 87 includes a hammer actuating arm 94 projecting outwardly from the hub 88 and a counterbalance arm 96 projecting outwardly from the hub 88 in a direction diametrically opposite to the arm 94. A vane 72a of the hammer actuating arm 94 is movable into and out of the path of the stream of water being discharged from the tube 18a. A downwardly projecting impact leg 100 is positioned on the arm 94 to contact the hose guiding member 83 when the vane 72a is moved to its maximum extent into the path of the fluid being discharged from tube 18a. A torsion spring 102 disposed around the hub 88 and connected between the arm 94 and the boss 84 normally urges the hammer 87 to pivot in a clockwise direction, as viewed in Fig. 3. Fluid being discharged from the tube 18a contacts the vane 72a and pivots the hammer 87 in a counterclockwise direction against the resistance of spring 102.

The operation of the second modification of the invention is substantially the same as that disclosed in the first modification. The hammer 87 is pivoted in a counterclockwise direction (Fig. 3) when the stream of water contacts the vane 72a and is thereafter returned to the position shown in Fig. 3 by the torsion spring 102. As the hammer is returned to this position, the leg 100 strikes the hose guiding member 83 adjacent its outer end

to advance the plate 80 and the discharge end 32a of the tube 18a several degrees in a clockwise direction (Fig. 3). This operation is repeated for each actuation of the hammer 87 thus causing the discharge end of the tube 18a, and the stream of water emitted therefrom, to move in increments of several degrees of angular movement around the vertical axis of the stationary frame 20a.

The third embodiment of the invention comprises a sprinkler 106 (Figs. 5, 6 and 7) which has certain parts similar to those of the other two modifications. These parts will be assigned the same numerals as those in the first modification followed by the suffix "b."

A stationary frame 20b of the sprinkler 106 is screwed on a riser pipe 16b, and the lower end of a tube 18b is secured in the frame 20b in the same way and for the same purpose as has already been described in connection with the other two forms of the invention. The tube 18b has an annular locking flange 110 on its discharge end 32b and the frame 20b terminates at its upper end in an annular circular edge 114.

A relatively narrow hammer support plate 116 extends across the upper end of frame 20b and has a lip 118 on one end that is arranged to slide along the edge 114 of the frame. At its other end, the support plate 116 has a pair of laterally and downwardly projecting legs 120 (Figs. 5 and 7) integrally formed thereon, and each leg 120 has a pin 124 on which a rubber bushing 122 is rotatably mounted. The rubber bushings 122 are positioned to roll along under the circular edge 114 of the stationary frame 20b. A tubular sleeve 130, formed integrally on the hammer support plate 116, rotatably receives the discharge end 32b of the tube 18b with the flange 110 of the tube positioned outwardly of the sleeve 130. It is to be noted that the hammer supporting plate 116 will not become dislodged from the stationary frame 20b since the resilience of the tube 18b tends to swing the plate 116 to the left (Fig. 6), urging the bushings 122 into engagement with the underside of the frame 20b.

A hammer mounting boss 132, integral with the plate 116, is provided with a bore 134 which is concentric with the vertical axis of the stationary frame 20b. A flanged rubber bushing 136 is inserted in the bore 134 and a pivot shaft 138 which is integral with a hammer 140, is pivotally received in the bushing 136. A counterbalancing arm 142 of the hammer 140 extends radially outward from the shaft 138 with the end portion in position to strike a boss 144 projecting upwardly from the plate 116. The hammer 140 also includes a hammer actuating arm 146 which projects outwardly from the shaft 138 in a direction opposite to that of the arm 142. A vane 148 of the actuating arm 146 is moved into the path of water being discharged from the tube 18b by a helical torsion spring 150 which is fitted around the boss 132 and is connected at one end to the plate 116 and at the other end to the shaft 138. A hammer leg 152 which projects downwardly from the actuating arm 146 contacts the sleeve 130 at the same time that the counterbalancing arm 142 contacts the boss 144. It is apparent therefore, that water discharged from the tube 18b strikes the vane 148 causing the hammer to pivot in a counterclockwise direction (Fig. 5) and that the spring 150 returns the hammer 140 to the position shown in Figure 5 with sufficient impact to rotate the upper end of the tube 18b and the hammer supporting plate 116 several degrees in a clockwise direction for each actuation of the hammer 140.

The fourth embodiment 158 of the sprinkler of the present invention is shown in Figs. 8 and 9. This sprinkler 158 comprises a stem 160, a flexible tube 162, a curved, tubular, hammer-supporting housing 164 surrounding the tube 162, and a hammer 166 rotatably supported by the housing 164.

The stem 160 is tubular in construction and has a threaded end that is adapted to be screwed into any suitable fluid conducting means, such as a section of pipe 167

of a portable irrigation system having water under pressure therein. The stem 160 (Fig. 9) extends vertically upwardly and has an upper portion 168 which is reduced in external diameter and receives the lower portion 170 of the tube therearound. A flange 172 on the lower end of the tube 162, and the lower portion 170 of the tube are cemented to the stem 160 to provide a rigid fluid tight connection between the tube 162 and stem 160. A retaining flange 174 is integrally formed on the discharge end 176 of the tube 162, and a reduced diameter water restricting nozzle 178 is secured, as by cementing, in the discharge end of the tube.

The tubular, hammer-supporting housing 164 is rotatably fitted over the tube 162 and is held from axial displacement by the flanges 172 and 174. The housing 164 is curved in order to direct the water, that is discharged from the tube 162, at a desired angle outwardly and upwardly. A boss 180 on the housing 164 is drilled and threaded at an acute angle relative to the horizontal.

The hammer 166 has a bored hub 182 which receives a rubber bushing 186. A pivot bolt 184 extends through bushing 186 and is screwed into the boss 180 to rotatably support the hammer. A flange 187 on the bushing 186 serves as a bearing between the hub 182, and the boss 180. The hammer 166 includes an upwardly extending actuating arm 188 having a vane 190 arranged to alternately enter the stream of water being discharged from the tube 162 and be deflected by the stream out of the path of the same. A weighted counterbalance arm 192 extends outwardly from the hub 182 in a downward direction and serves to return the vane 190 into the stream of water after each outward stroke of the hammer 166. An impact member 194 on the actuating arm 188 is arranged to strike the rubber sleeve 196 fitted around the end of the housing 164.

In the operation of the fourth embodiment of the sprinkler 158 of the present invention, water flows through the tube 162 and is discharged in a stream through the nozzle 178. The stream of water impinges against the vane 190 of the hammer 166 causing the hammer to be pivotally deflected in a counterclockwise direction (Fig. 8) moving the vane 190 out of contact with the discharged water. The force of gravity acting on the counterbalance arm 192 then reverses the direction of pivotal movement of the hammer 166 causing the vane 190 to again enter the stream of water and the impact member 194 to strike the rubber sleeve 196 with sufficient force to rotate the housing 164 several degrees in a clockwise direction as viewed in Fig. 8. The above cycle of operation is repeated over and over again thereby rotating the discharge end of the tube 162 and the stream discharged therefrom in angular increments about the vertical axis of the stem 160.

It is apparent from the foregoing description that each embodiment of the improved hammer type sprinkler of the present invention includes a flexible resilient tube which eliminates the necessity of a packing gland usually required with the present type of sprinkler. Each of the disclosed sprinklers is simple in design and construction and cannot be rendered inoperative by debris present in the fluid being discharged.

While several embodiments of the present invention have been shown and described, it will be understood that various changes and modifications may be made without departing from the spirit of the invention or the scope of the appended claims.

Having thus described the present invention what I claim as new and desire to protect by Letters Patent is:

1. A sprinkler for distributing fluid from a conduit containing fluid under pressure comprising mounting means secured to said conduit and having a circular peripheral edge, a flexible resilient tube having one end secured by said mounting means in flow communication with the conduit and in concentric relation to said circular edge, a guide member supported by said housing for rotation

about a fixed axis concentric with said circular edge and arranged to hold the other end of said tube bent away from said axis against the resiliency of said tube, resilient means operatively connected between said mounting means and said guide member to provide a wear surface which resiliently resists the tendency of said resilient tube to assume a straight position in alignment with said axis and to guide said guide member for circular movement about said axis, and means for rotatably advancing said guide member through successive increments of rotary movement.

2. A sprinkler for distributing fluid from a conduit containing fluid under pressure comprising mounting means secured to said conduit and having outwardly flaring legs interconnected at their outer ends to provide a circular peripheral edge, a flexible resilient tube having one end secured by said mounting means in flow communication with the conduit and in concentric relation to said circular peripheral edge, a guide member supported by said housing for rotation about a fixed axis concentric with said circular edge and arranged to loosely hold the other end of said tube adjacent said circular peripheral edge and bent away from said axis against the resiliency of said tube, resilient means operatively connected between said mounting means and said guide member to provide a wear surface which resiliently resists the tendency of said resilient tube to assume a straight position in alignment with said axis and which guides said guide member for circular movement about said axis, said resilient means being effective to establish a yieldable material in contact with certain surfaces of said mounting means and said guide member which surfaces move in relation to said resilient means, and means for rotatably advancing said guide member through successive increments of rotary movement.

3. A sprinkler for distributing fluid from a conduit containing fluid under pressure comprising mounting means secured to said conduit and having an annular flange, a flexible resilient tube having one end secured by said mounting means in flow communication with the conduit and in concentric relation to said flange, a flexible ring of U-shaped cross-section mounted on said annular flange, a guide member supported on said flexible ring for rotation about a fixed axis and arranged to hold the other end of said tube bent away from said axis against the resiliency of said tube, said guide member having a hooked portion disposed in sliding hooked engagement with said ring and being arranged to resist the resilient urging of said tube and to cooperate with said tube to retain said annular guide member in operative position on said ring, and means for rotatably advancing said guide member through successive increments of rotary movement.

4. A sprinkler for distributing fluid from a conduit containing fluid under pressure comprising mounting means secured to said conduit and having an annular flange, a flexible resilient tube having an inner end secured by said mounting means in flow communication with the conduit and in concentric relation to said flange, a flexible ring of U-shaped cross section mounted on said annular flange, a guide member supported on said flexible ring for rotation about a fixed axis and arranged to hold the outer end of said tube bent away from said axis against the resiliency of said tube, said guide member having a hooked portion in sliding engagement with said ring, said hooked portion being arranged to resist the resilient urging of said tube and to cooperate with said tube to retain said guide member in operative position on said ring, a hammer mounted for limited rotation on said guide member and having an impact member arranged to engage said guide member and a vane arranged to alternately enter into and be deflected from a stream of fluid being discharged from said tube, and means urging said vane towards said stream to enter the same and move said impact member into contact with said guide member to rotatably ad-

vance said guide member and the outer end of said tube several degrees about said axis for each stream-entering movement of said vane.

5 5. A sprinkler for distributing fluid from a conduit containing fluid under pressure comprising mounting means secured to said conduit and having an annular flange, a flexible resilient tube having one end secured by said mounting means in flow communication with the conduit and in concentric relation to said flange, guide means supported for rotation on said flange and arranged to engage and guide the other end of said tube in a curved path, said guide means having a circular peripheral edge equal in curvature to the outside diameter of said annular flange, a flexible resilient ring of U-shaped cross section disposed over said peripheral edge of said guide means and over said flange to retain said guide means in operative position, and means for moving said guide means through successive increments of rotary movement.

10 6. A sprinkler for distributing fluid from a conduit containing fluid under pressure comprising mounting means secured to said conduit and having an annular flange, a flexible resilient tube having one end secured by said mounting means in flow communication with the conduit and in concentric relation to said flange, guide means supported for rotation on said flange and arranged to engage and guide the other end of said tube in a circular path, said guide means having a circular peripheral edge equal in diameter to the outside diameter of said annular flange, a flexible resilient ring of U-shaped cross section disposed over said peripheral edge of said guide means and over said flange to retain said guide means in operative position, a hammer mounted for limited rotary movement on said guide means and having an impact member arranged to engage said guide means and a vane arranged to alternately enter and be deflected from a stream of fluid being discharged from said tube, and means urging said vane toward said stream to enter the same and urging said impact member into engagement with said guide means to rotate said guide means through several degrees of angular movement during each rotary movement of said hammer.

15 7. A sprinkler for distributing fluid from a conduit containing fluid under pressure comprising mounting means secured to said conduit and having a circular edge, a flexible resilient tube having one end secured by said mounting means in flow communication with the conduit

and in concentric relation to said circular edge, guide means supported for rotation on said mounting means about a fixed axis and arranged to hold the other end of said tube displaced from said axis against the resiliency of said tube and to guide the other end of said tube in a circular path concentric relative to said circular edge, said guide means having a pair of legs projecting substantially radially outward from the upper end of said tube to spaced points adjacent said circular edge, a resilient roller rotatably supported by each leg and disposed in rolling engagement against said mounting means adjacent the circular edge thereof, said rollers being arranged to resist the resilient urging of said tube and arranged to cooperate with said tube to retain said guide means in operative position on said mounting means, and means for rotating said guide means.

8. A sprinkler for distributing fluid from a conduit containing fluid under pressure comprising mounting means secured to said conduit and having a circular edge, a flexible resilient tube having one end secured by said mounting means in flow communication with the conduit and in concentric relation with said circular edge, guiding means supported for rotation about a fixed axis on said mounting means and arranged to hold the other end of said tube spaced from said axis against the resiliency of said tube and to guide said other end of said tube in a circular path concentric relative to said circular edge, said guiding means having a pair of legs projecting substantially radially outward from the upper end of said tube to spaced points adjacent said circular edge, a resilient roller rotatably supported by each leg and disposed in rolling engagement against said mounting means adjacent the circular edge thereof, said rollers being arranged to resist the resilient urging of said tube and being arranged to cooperate with said tube to retain said guiding means in operative position on said mounting means, a hammer mounted for limited rotation on said guiding means and having a vane arranged to alternately enter into and be deflected from a stream of fluid being discharged from said tube, and means urging said vane towards said stream to enter the same.

References Cited in the file of this patent

UNITED STATES PATENTS

1,297,818	Fawkes	Mar. 18, 1919
2,869,925	Crow	Jan. 20, 1959