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ADJUSTABLE NOZZLE

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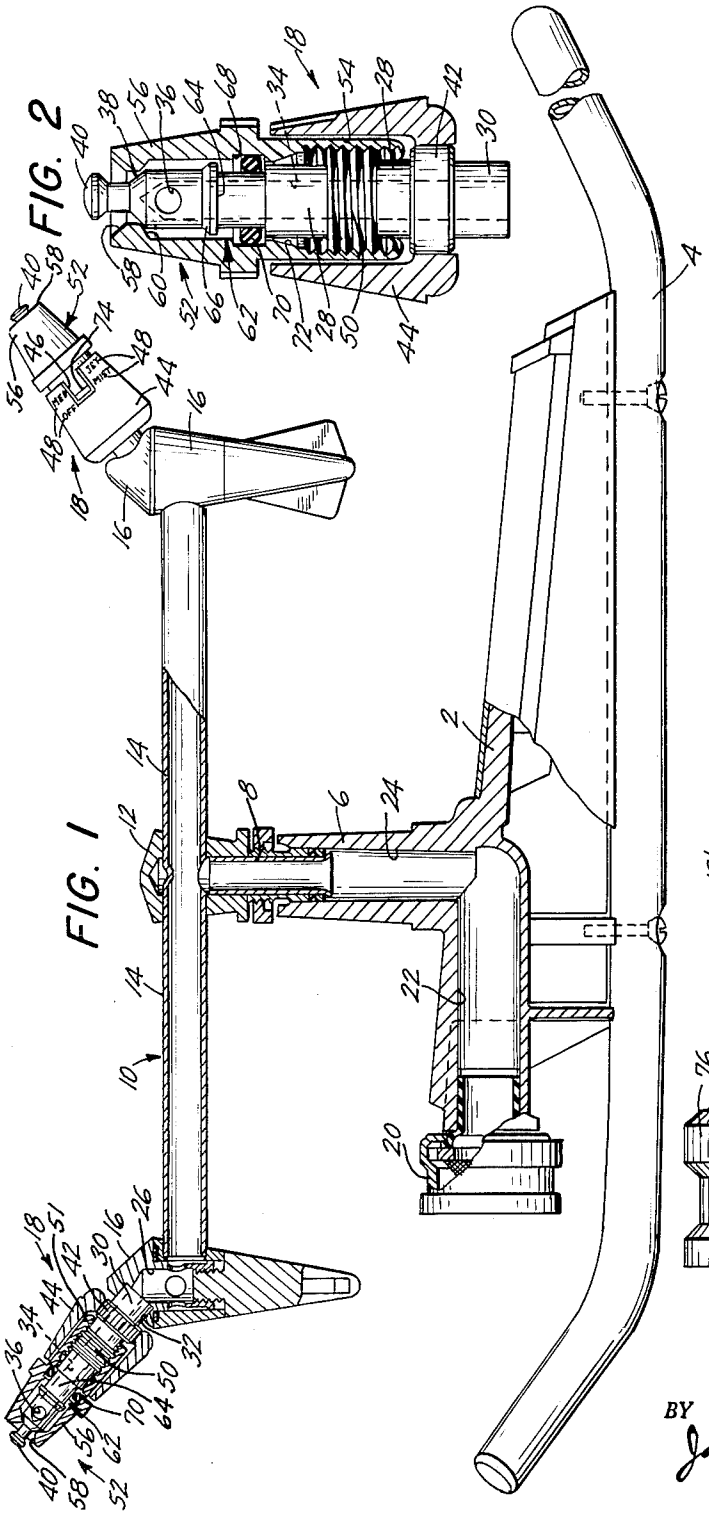


FIG. 1

FIG. 2

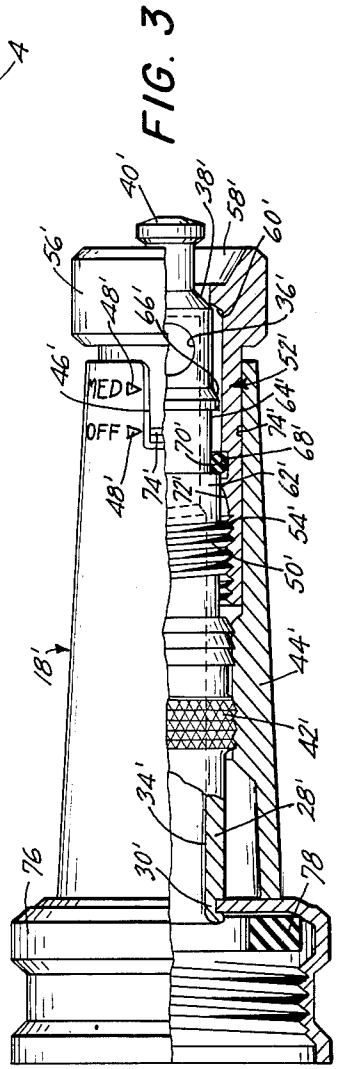


FIG. 3

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ADJUSTABLE NOZZLE

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The present invention relates to the construction of an adjustable nozzle of the type adapted to be used for the sprinkling of lawns and the like.

The nozzle construction of the present invention is especially designed to give a visible indication of the operative status of the nozzle—whether it is closed or, if it is open, what type of stream it is set to produce. This is of importance where spraying is to be carried out in restricted areas, or in the vicinity of fragile plants which might be injured by a jet type of spray should the water be turned on when the nozzle is set to produce that type of spray. Visual indication of the status of the nozzle is of particular importance when the nozzles are attached to a rotating sprinkler. In that case the setting of the nozzles will determine the speed at which the sprinkler rotates and the area which will be sprayed. If the nozzles are incorrectly set when the water is turned on, thus producing an undesired spray pattern, it is necessary to turn the sprinkler off before the nozzles can be reset, or else the operator must walk through the spray to get to the sprinkler and make the necessary adjustments. The latter alternative is often out of the question, and always unpleasant. The former alternative is inconvenient, particularly when, as is often the case, the master valve controlling the flow of liquid through the hose to which the sprinkler is attached is located an appreciable distance from the sprinkler itself.

A further prime object of the nozzle structure of the present invention is to so connect the relatively movable parts of the nozzle which cooperate to control the nozzle status as to limit their desired movement within a designed range and prevent disassembly of the relatively movable parts once the nozzle has been assembled. In accordance with the present invention the same structure which seals the nozzle against leakage also functions to control and limit the relative movement of the adjustable nozzle parts.

The structure of the present invention involves the use of but a limited number of parts, all of which may be readily manufactured on a mass-production basis at minimal expense and without requiring the maintaining of excessively fine dimentional tolerances, which parts may be assembled with one another quickly and easily even by relatively unskilled personnel.

In addition, the nozzle structures of the present invention are characterized by having an exceptionally attractive appearance.

In accordance with the present invention, the nozzle comprises a conduit member surrounded by a valve member adjustably positionable relative thereto, the conduit member and valve member having cooperating surfaces the relative position of which controls the opening and closing of the nozzle and the type of fluid stream which emanates therefrom when it is open. A ring is sealingly received between these two members in grooves formed in facing surfaces thereof. At least one of those grooves is axially elongated relative to the width of the sealing ring, and the grooves are provided with abrupt sides which prevent the escape of the ring from either of the grooves once it has been put in place. Hence the sealing ring cooperates with the grooves in which it is received not only to seal the nozzle against leakage, as is conventional, but also to control and limit the degree

of relative movement permitted between these two members, restricting that relative movement to that desired for the closing of the valve and the production of fluid streams of desired character. The sealing ring-groove cooperation further prevents disassembly of the nozzle once it has been assembled.

Fixedly secured to the conduit member and partially surrounding it is an outer housing, the valve member being received between the housing and the conduit member. The housing is provided with an opening over a portion of the valve member, the valve member being relatively movable to control the operative condition of the nozzle, and the housing and the valve member are provided, adjacent the opening in the housing, with cooperating index marks calibrated to correspond to the position of the valve member relative to the conduit member, thereby to visually indicate the operative condition of the valve for any given position of the valve member relative to the conduit member.

To the accomplishment of the above, and to such other objects as may hereinafter appear, the present invention relates to the construction of a nozzle as defined in the appended claims and as described in this specification, taken together with the accompanying drawings in which:

FIG. 1 is a side elevational view, partially broken away and cross-sectioned, of a rotary sprinkler fitted with an adjustable nozzle constructed according to the present invention;

FIG. 2 is a cross-sectional view, on an enlarged scale, of the nozzle of FIG. 1; and

FIG. 3 is a side elevational view, partially broken away and cross-sectioned, of an alternative embodiment of a nozzle constructed according to the present invention, and specifically designed for direct connection to a hose and manual manipulation.

The rotary sprinkler shown in FIG. 1 comprises a base **2** mounted on supporting rails **4** and having an upstanding portion **6** from which a tube assembly **8** extends upwardly, a rotor generally designated **10** being rotatably mounted on the tube assembly **8** and comprising a hub **12** from which tubular arms **14** extend in opposite directions, those arms carrying mounting bodies **16** at their ends within which nozzles generally designated **18** are mounted. The body **2** carries a coupling **20** adapted to be connected to a hose or the like and communicating with a fluid passage **22** which in turn communicates with a fluid passage **24** in the upstanding body portion **6** and thence through the tubes **8** and **14** and central passages **26** in the mounting bodies **16** to the nozzles **18**.

The nozzles **18**, as specifically disclosed in FIGS. 1 and 2, comprise a hollow conduit member **28** having an end **30** sealingly received in aperture **32** in the mounting body **16**, the internal fluid passage **34** therein being closed at its upper extremity and having fluid outlet openings **36** extending out laterally therefrom. Above the outlet openings **36** the conduit member **28** is provided with a radially inwardly and axially forwardly tapered valve surface **38** and a tip portion **40**.

The conduit member **28** is further provided adjacent its end **30** with a radially enlarged portion **42**, and an outer housing **44** is fixedly secured to the conduit portion **42** in any appropriate manner and extends forwardly therefrom around and spaced from the conduit member **28**. The forward portion of the housing **44** is provided with a slot **46**, and the sides of that slot are provided with index marks **48**, which may be identified with various legends relating to the operative status of the nozzle, as will become apparent hereinafter. The axial length of the housing **44** is appreciably less than that of the conduit member **28** in this embodiment.

That portion of the conduit member 28 received inside and surrounded by housing 44 is provided with an externally threaded area 50, with which a valve member, generally designated 52, threadedly cooperates. The valve member 52 has a rearwardly extending internally threaded part 54 which is received between the housing 44 and the conduit member 28 and threadedly engages with the area 50. The valve member 52 also has a forwardly extending portion 56 open at its tip 58 which extends around the forward portion of the conduit member 28 and is provided with a valve surface 60 adapted to engage the valve surface 38 on the conduit member 28, thereby to close the nozzle, and adapted to move away from the conduit member valve surface 38 in order to open the nozzle and permit fluid to escape therefrom, the cooperation between the open tip 58 of the valve member 52 and the tip 40 of the conduit member 28, and in particular the relative spacing therebetween, serving to control and modify the nature of the fluid stream emanating from the nozzle in well known manner.

The conduit member 28 is provided rearwardly of its fluid outlet openings 36, with a portion generally designated 62 of closely the same size as the interior of the valve member 52, that portion being provided with an axially elongated groove 64 and with an axially rearwardly and radially outwardly tapered surface 66 immediately forward thereof. The corresponding portion of the valve member 52 which is adapted to surround the conduit member portion 62 is provided with a groove 68 in its inner surface, and a sealing ring 70 is adapted to be compressively received within the grooves 64 and 68, thereby to prevent any leakage of fluid rearwardly therebeyond between the conduit member 28 and the valve member 52. The axial length of the groove 68 is closely the same as the width of the sealing ring 70 and both of the grooves 64 and 68 have abrupt side surfaces. The valve member 52 is provided, rearwardly of its groove 70, with an axially rearwardly and radially outwardly tapered surface 72.

That portion of the valve member 52 which is located beneath the slot or opening 46 in the outer housing 44 is provided with an index mark 74, here shown as a groove extending therearound, the index mark 74 being adapted to cooperate with the index marks 48 on the housing 44.

The embodiment of FIG. 3 is essentially the same as the nozzle 18 of FIGS. 1 and 2, and similar parts are provided with similar reference numerals, differentiated however, by being primed. It differs from the nozzle of FIGS. 1 and 2 primarily in that it is designed for direct attachment to a hose and for manual manipulation thereafter to direct a stream of fluid to a desired location. To that end, in the specific structure disclosed, the conduit member 28' and the outer housing 44' are both connected in any appropriate manner to an internally threaded coupler 76 adapted to be threaded on to the end of a hose, and preferably internally provided with a sealing ring 78, as is conventional. It will be noted that the operative nozzle parts in the embodiment of FIG. 3 cooperate with one another in substantially the same manner as to the parts of the nozzle of FIGS. 1 and 2, and that such differences as exist relate primarily to detailed design.

The assembly and mode of operation of the nozzle of the present invention will now be described, making specific reference to the nozzle of FIGS. 1 and 2, it being understood, however, that substantially the same explanation applies to the embodiment of FIG. 3.

After the conduit member 28 and housing 44 have been connected to one another, the sealing ring 70 may be slipped over the tip 40 of the conduit member 28 and rolled or slid into the groove 64, the radially outwardly tapered surface 66 facilitating this operation by camstretching the ring 70. Thereafter the valve member 52 is slid over the conduit member 28 and inside the housing 44 until its internally threaded portion 54 reaches the externally threaded portion 50 of the conduit member 28.

This will take place before the axially forwardly and radially inwardly tapered surface 72 thereof engages with the sealing ring 70. The inner diameter of the internally threaded member portion 54 is preferably slightly larger than the outer diameter of the sealing ring 70 in order to facilitate assembly of the parts. The valve member 52 is then screwed into place, moving rearwardly relative to the conduit member 28 of the housing 44 until its tapered surface 72 reaches the sealing ring 70. Further rotation of the valve member 52 will result in its further inward movement, and its tapered surface 72 will cam-compress the ring 70 to permit such further inward movement, although exerting some sensible resistance thereto. At this point the ring 70 will have been forced to the rear end of the slot 64 in the conduit member 28, but it will not move out therefrom because of the abrupt rear side of that groove. When the valve member 52 has been screwed in sufficiently to bring its groove 68 into registration with the ring 70, that ring will expand into the groove 68. Since the axial length of the groove 68 approximates the width of the ring 70, and since its side surfaces are abrupt, further inward movement of the valve member 52 would be inhibited by the cooperation between the ring 70 and the grooves 64 and 68. However, before this actually occurs the valve surfaces 38 and 60 on the conduit member 28 and valve member 52 respectively will have moved into engagement with one another, thus positively limiting further inward movement of the valve member 52 and closing the valve. At this point the index mark 74 on the valve member 52 will be opposite that index mark 48 on the housing 44 which corresponds to, and is preferably identified as representing, the "off" condition of the nozzle.

As the valve member 52 is screwed out, its valve surface 60 will move away from the conduit member valve surface 38, thus permitting the water to escape from the nozzle if there is water pressure in the hose or conduit which is connected thereto, and the open tip 58 of the valve member 52 will approach the tip 40 of the conduit member 28 in order to modify the character of the stream of fluid which emanates from the nozzle. Movement of the valve member 52 relative to the conduit member 28 in this outward direction is permitted because of the axially elongated nature of the slot 64, the sealing ring 70 being pushed forwardly along that slot by the valve member 52. As the valve member 52 moves forwardly its index mark 74 will also move forwardly and thus will progressively come into registration with the other index marks 48 on the housing 44, those index marks corresponding to, and preferably identifying, the particular type of fluid stream which will emanate from the nozzle for selected positions of the valve member 52 relative to the conduit member 28.

Eventually, as the valve member 52 continues to be moved forwardly, the sealing ring 70 will be pushed to the forward end of the slot 64, where it will come up against an abrupt wall which will prevent its escape from the groove 64. Since the groove 68 on the valve member 52 also has abrupt sides, the sealing ring 70 will not be permitted any further movement under ordinary circumstances, and thus will prevent further forward movement of the valve member 52. Thus, for all practical purposes, the sealing ring 70 when once received within the grooves 64 and 68 will limit the forward movement of the valve member 52 and prevent its disassembly from the remainder of the nozzle structure while at the same time preventing leakage of fluid from the nozzle. (If disassembly of the valve member 52 is required, that can be accomplished by the application thereto of very great unscrewing forces, such as could be applied thereto by means of a large wrench, but such forces are greatly in excess of those which could be applied thereto merely by manual manipulation. Thus, the arrangement not only prevents accidental disassembly, but also inhibits experimental

disassembly by inquisitive children or do-it-yourself enthusiasts.)

All of the parts which make up the nozzle are readily manufactured. The conduit member 28 and the valve member 52 are readily produced on screw machines. The housing 44 may be similarly fabricated or it may be formed of molded plastic. The cooperation between the parts is such as to permit assembly without requiring the maintenance of excessively rigorous dimensional tolerances.

While but a limited number of embodiments of the present invention have been here specifically disclosed, it will be apparent that many variations may be made therein, all within the scope of the instant invention as defined in the following claims.

We claim:

1. A nozzle comprising a fixed structure including an outer housing and a conduit member fixed relation to and located inside said housing a forward portion of said conduit member being spaced radially inwardly from the forward portion of said housing and having a valve surface and an outlet opening located rearwardly of said valve surface, and a valve member received between the forward portions of said housing and said conduit member, articulately mounted on said fixed structure for movement forwardly and rearwardly relative thereto, and having a valve surface sealingly engageable with and movable away from the valve surface of said conduit member, the forward portion of said housing having an opening through which a portion of said valve member is visible, said valve member portion and said housing having index marks cooperating with one another to indicate the relative positions of said valve surfaces for different relative positions of said conduit member and said valve member.

2. The nozzle of claim 1, in which said conduit member, rearwardly of its outlet opening, and said valve member have registering grooves in their facing surfaces, at least one of said grooves being elongated in the direction of the axis of said nozzle, a sealing ring being received within said grooves, said grooves having abrupt side walls, thereby to inhibit disassembly of said members and escape of said ring from said grooves, and at least one of said members having adjacent its groove, and to that side thereof facing the groove in the other member when the members are forwardly axially separated, a radially outwardly and axially rearwardly tapering surface, thereby to facilitate assembly of said members and entry of said ring into said grooves.

3. The nozzle of claim 2, in which said elongated groove is axially elongated by a distance corresponding to the desired movement of said valve member relative to said conduit member.

4. The nozzle of claim 2, in which said elongated groove is on one of said members and is axially elongated by a distance corresponding to the desired movement of said valve member relative to said conduit member, the registering groove on the other of said members having an axial length closely equal to that of said ring.

5. The nozzle of claim 2, in which said elongated groove is on one of said members and is axially elongated by a distance corresponding to the desired movement of said valve member relative to said conduit member, the registering groove on the other of said members having an axial length closely equal to that of said ring, said other of said members having said tapering surface.

6. The nozzle of claim 1, in which said conduit member, rearwardly of its outlet opening, and said valve member have registering grooves in their facing surfaces, at least one of said grooves being elongated in the direction of the axis of said nozzle, a sealing ring being received within said grooves, said grooves having abrupt side walls, thereby to inhibit escape of said ring from said grooves and disassembly of said members, said conduit member having, forwardly of and in communication with its groove, a radially outwardly and axially rearwardly extending outer surface, said valve member having, rearwardly of and in communication with its groove, a radially outwardly and axially rearwardly extending inner surface, thereby to facilitate assembly of said members and entry of said ring into said grooves.

7. The nozzle of claim 6, in which said elongated groove is on said conduit member and is axially elongated by a distance corresponding to the desired movement of said valve member relative to said conduit member, the registering groove on said valve member having an axial length closely equal to that of said ring.

8. A nozzle comprising a fixed structure comprising an outer housing and a conduit member fixed relative to and located inside said housing, said conduit member having an external valve surface and an outlet opening located rearwardly thereof, a valve member received over said conduit member and inside said housing and articulately mounted on said fixed structure for movement forwardly and rearwardly relative thereto and having a valve surface sealingly engageable with and movable away from the valve surface on said conduit member, said conduit member, rearwardly of its outlet opening, and said valve member having registering grooves in their facing surfaces, at least one of said grooves being elongated in the direction of the axis of said nozzle, a sealing ring being received within said grooves, said grooves having abrupt side walls, thereby to inhibit disassembly of said members and escape of said ring from said grooves, and at least one of said members having adjacent its groove, and to that side thereof facing the groove in the other member when the members are forwardly axially separated, a radially outwardly and axially rearwardly tapering surface, thereby to facilitate assembly of said members and entry of said ring into said grooves.

9. A nozzle comprising a fixed structure comprising an outer housing and a conduit member fixed relative to and located inside said housing, said conduit member having an external valve surface and an outlet opening located rearwardly thereof, a valve member received over said conduit member and inside said housing and articulately mounted on said fixed structure for movement forwardly and rearwardly relative thereto and having a valve surface sealingly engageable with and movable away from the valve surface on said conduit member, said conduit member, rearwardly of its outlet opening, and said valve member having registering grooves in their facing surfaces, at least one of said grooves being elongated in the direction of the axis of said nozzle, a sealing ring being received within said grooves, said grooves having abrupt side walls, thereby to inhibit escape of said ring from said grooves and disassembly of said members, said conduit member having, forwardly of and in communication with its groove, a radially outwardly and axially rearwardly extending outer surface, said valve member having, rearwardly of and in communication with its grooves, a radially outwardly and axially rearwardly extending inner surface, thereby to facilitate assembly of said members and entry of said ring into said grooves.

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