Sept. 24, 1963 W. G. MUSCHETT 3,104,822

POP-UP SPRINKLER

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Fig. 4.

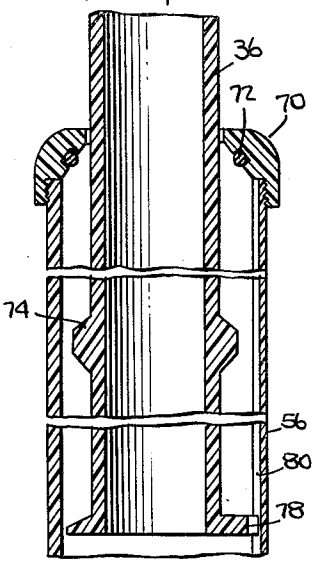


Fig. 5.

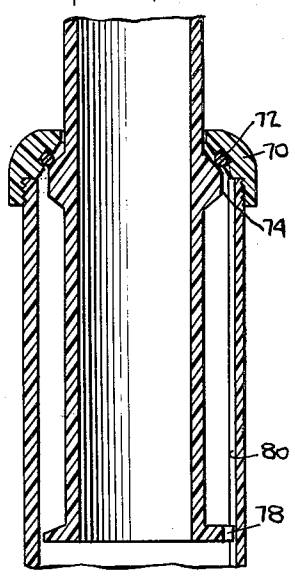


Fig. 2.

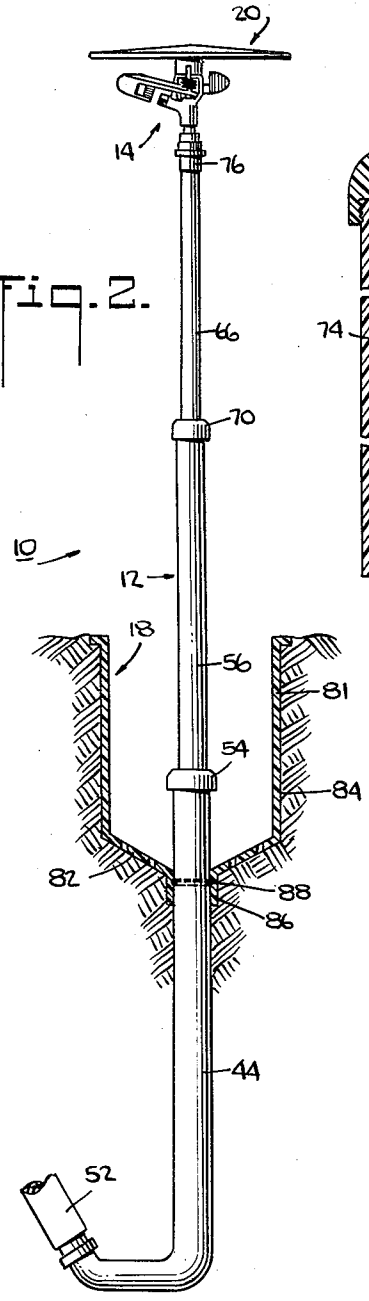
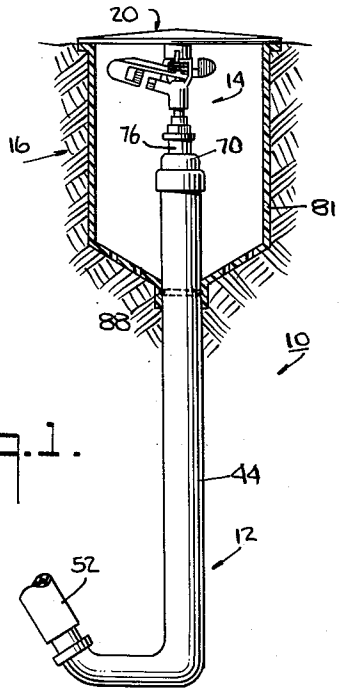


Fig. 1.



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POP-UP SPRINKLER

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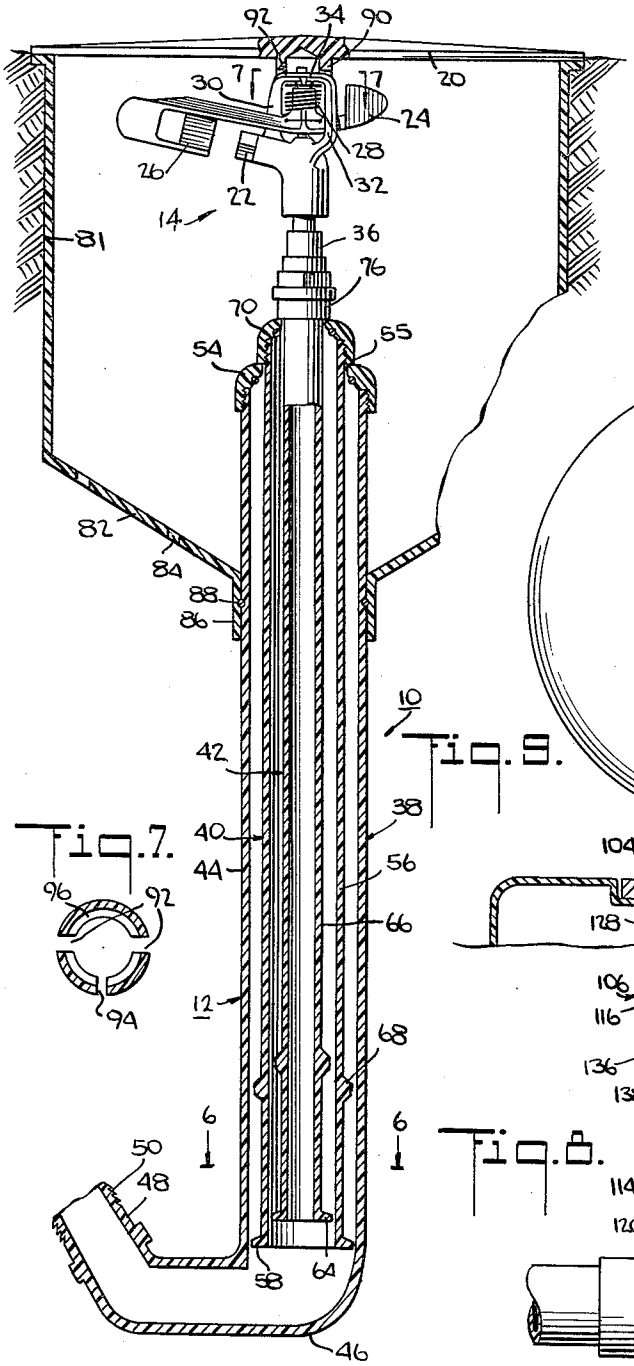


Fig. 3.

Fig. 7.

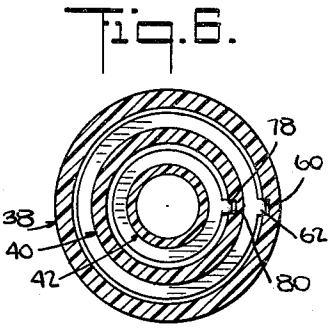


Fig. 6.

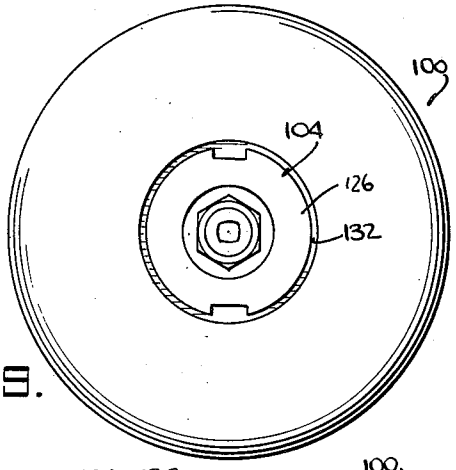


Fig. 9.

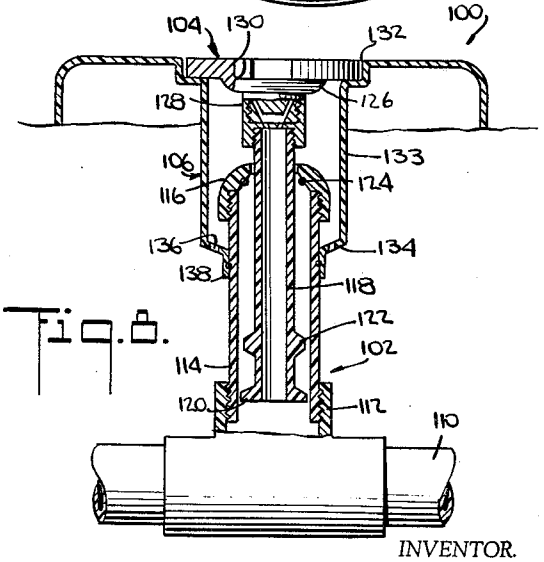


Fig. 8.

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POP-UP SPRINKLER

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6 Claims. (Cl. 239—206)

This invention relates to a pop-up sprinkler and, more particularly, to an improved pop-up standpipe as well as to auxiliary equipment for use in conjunction with a pop-up standpipe.

The advantages of a pop-up standpipe are well known, e.g., avoidance in a lawn of a permanently raised fixture which can cause accidents, which is unsightly and around which the grass must be edged or clipped by hand, and avoidance of damage to a sprinkler system by children playing with a permanent elevated standpipe or by accidentally hitting such a standpipe as with a lawn mower or car.

To realize such advantages many forms of pop-up sprinklers have been proposed, both commercially and in patent literature; but, up to the present, the commercial success of such sprinklers has only been mild. These proposed sprinklers were beset by sundry drawbacks that prevented any of them from realizing the full potential of an exceptionally wide market.

One drawback has been the complexity and number of parts of the pop-up sprinklers which made them costly to manufacture, difficult to assemble, repair and service, and not uniformly reliable in operation.

Another drawback has been their inability to seal well, thus causing an unnecessarily large drop in pressure so that fewer pop-up sprinklers than permanently raised sprinklers could be used on a supply line of given hydraulic capacity.

A further drawback was that pop-up standpipes presented conflicting problems which could not be satisfactorily resolved heretofore. Thus, to prevent a pop-up standpipe from rocking, it was necessary to have the relatively movable parts fit one another quite closely and to have lengthy bearing surfaces, i.e., lands. On the other hand, where the parts fitted closely, substantial friction developed and foreign matter tended to stick between the parts. This sometimes jammed the standpipe and at other times scored the parts so as to permit leakage to develop. Furthermore, the use of long lands required additional effort to raise the standpipe and made it more vulnerable to jamming.

Another drawback of previous pop-up standpipes was that they did not tend to assume and maintain the same predetermined substantially vertical position each time they were erected, this deriving from the play between the parts which permitted them to take on relatively different positions.

An additional drawback was the inability of former standpipes to erect to great heights because clearances and friction were unacceptably multiplied when the movement of the standpipe from retracted to extended position became appreciable.

Still another drawback was the difficulty experienced in locating the protective underground casing in proper relationship to the retracted pop-up standpipe so that both the casing and the standpipe would be at the proper levels relative to the ground.

One last drawback worthy of mention was the problem of attaching a lid or cover to a sprinkler head that was mounted on a pop-up standpipe. Previously proposed constructions have involved the use of separable attaching elements such as screws to hold the lid in place. These loosened and were lost rendering the sprinkler vulnerable to damage.

It is an object of my invention to provide a pop-up sprinkler and adjuncts therefor which are not subject to the foregoing drawbacks.

More particularly, it is an object of my invention to provide a pop-up standpipe which constitutes relatively few and simple parts and which can be made and assembled with ease and at a low cost.

It is another object of my invention to provide a pop-up standpipe in which the sliding clearances at the bearing surfaces, i.e., lands, are quite small and yet in which the erected, i.e., extended, standpipe is quite firm and stable.

It is another object of my invention to provide a pop-up standpipe which is so constructed as to minimize scoring of the lands.

It is another object of my invention to provide a pop-up standpipe which, despite small sliding clearances of the lands, has an excellent flushing action each time that the standpipe is elevated whereby to remove any foreign matter which may find its way into the standpipe.

It is another object of my invention to provide a pop-up standpipe which is automatically guided into a centralized position each time that the same is elevated whereby once the standpipe is permanently emplaced it can be relied upon to assume a predetermined position each time it is raised.

It is another object of my invention to provide a pop-up standpipe having a novel sealing arrangement for preventing leakage of water when the standpipe is elevated so that the presence of a pop-up standpipe in lieu of a stationary standpipe does not materially increase the pressure drop.

It is another object of my invention to provide a pop-up standpipe in which the effect of a long stabilizing bearing is secured with narrow lands whereby to secure the beneficial results of such a long stabilizing bearing without the disadvantages of substantial scoring and friction which are inherent in such long bearings.

It is another object of my invention to provide for pop-up standpipes improved supports which are capable of firmly and adjustably holding the standpipes at set levels.

It is another object of my invention to provide for pop-up standpipes improved supports which are of simple, inexpensive, light and sturdy construction.

It is another object of my invention to provide for a pop-up sprinkler head a lid which is capable in the field of being quickly and easily coupled to or uncoupled from a conventional sprinkler without the use of tools and without the use of removable fastener elements such as screws or pins.

Other objects of my invention in part will be obvious and in part will be pointed out hereinafter.

My invention accordingly consists in the features of construction, combinations of elements and arrangements of parts which will be exemplified in the pop-up sprinklers hereinafter described and of which the scope of application will be indicated in the appended claims.

In the accompanying drawings in which are shown various possible embodiments of my invention,

FIG. 1 is a partially sectional vertical view through a pop-up sprinkler embodying my invention, the same being shown in its retracted, i.e., concealed, position;

FIG. 2 is a view similar to FIG. 1, but illustrating the sprinkler in its extended, i.e., raised, position;

FIG. 3 is an enlarged view of the sprinkler as shown in FIG. 1, but with the standpipe fully sectioned;

FIG. 4 is a fragmentary vertical sectional view through the upper portion of the pop-up standpipe as it approaches but has not yet reached fully extended position;

FIG. 5 is a view similar to FIG. 4, but showing the standpipe in fully extended position,

FIGS. 6 and 7 are enlarged sectional views taken substantially along the lines 6—6 and 7—7, respectively of FIG. 3;

FIG. 8 is a vertical sectional view through a pop-up sprinkler embodying a modified form of my invention; and

FIG. 9 is a top view of the pop-up sprinkler shown in FIG. 8.

Referring now in detail to the drawings, and more particularly to FIGS. 1–7, the reference numeral 10 denotes a pop-up sprinkler constructed in accordance with my invention. This sprinkler essentially comprises three parts, to wit a pop-up standpipe 12, a sprinkler head 14, and a housing 16, the latter constituting a support casing 18 and a lid 20.

I should mention at this point that the sprinkler head 14 is entirely conventional. Various types of sprinkler heads are available on the market and in general they are characterized by an inclined laterally directed nozzle, a water inlet which leads to the nozzle and a coupling at the water inlet by means of which the sprinkler head is hydraulically and physically connected to the pop-up standpipe. Any of these heads can be used in connection with my invention. Thus, my invention contemplates the use of both stationary and rotating sprinkler heads. A stationary sprinkler head is characterized by a fixed nozzle whereas a rotating sprinkler head employs a rotary nozzle together with a suitable mechanism to turn the nozzle.

A rotating sprinkler head has been shown in the drawing by way of example and without limitation. Such heads are made, for instance, by L. R. Nelson Mfg. Co., Inc., of Peoria, Illinois, these heads being known as "Turf Bird" sprinklers. In such a sprinkler head a nozzle 22 inclined at a slight angle to the horizontal is mounted to rotate around a vertical axis through either a full 360° or to sweep in opposite directions through an arc of less than 360°. The sprinkler head which is shown has a full circle rotation. In order to intermittently apply turning pulses to the rotatable nozzle a flutter arm 24 is mounted for oscillation with respect to the nozzle and about the axis of rotation of the nozzle. The arm includes an intercepting deflecting plate 26 which is urged by a torsion spring 28 to a set position in which the plate is in front of the nozzle. When water issuing from the nozzle strikes the plate it will swing the plate to one side. When the plate returns under the action of the spring 28 it will strike a vertical leg 30 integral with the nozzle. The shock incident to such blow will swing the nozzle through a few degrees and in this fashion by repeated shocks the nozzle will be turned through a full circle. A second vertical leg 32 likewise integral with the nozzle is provided on the sprinkler head, said second leg being on the diametrically opposite side of the axis of rotation from the leg 30. The second leg is struck by the counter-balancing rear end of the flutter arm.

The nozzle is secured to a vertically depending pipe which extends through and is journalled in a sleeve 36 the lower end of which is provided with a male thread. The bottom of the pipe is enlarged to captively retain the sleeve on the pipe. It is to be understood that the aforesaid sprinkler head is entirely conventional and has been described solely by way of example and without limitation to facilitate understanding of my present invention. The male thread at the lower end of the sleeve 36 is for the purpose of coupling the sprinkler head to my novel pop-up standpipe 12.

The pop-up standpipe 12 includes a mainimum of two relatively movable telescoping sections. Optionally, more than two sections may be employed and in the example of my invention now being described I have shown three such sections. However, it should be understood that my invention includes anything from two to several sections. In passing,, it is observed that a pop-up standpipe consisting of only two sections is shown in the second form of my invention illustrated in FIGS. 8 and 9 and hereinafter described in detail. The number of sections will depend on how great an elevation is required of the extended standpipe and how great a length will be acceptable for the retracted standpipe.

The pop-up standpipe 12 constitutes an outer tubular section 38 which functions as a cylinder for an intermediate tubular section 40. A portion of the intermediate tubular section is in effect a piston that cooperates with the aforesaid cylinder and another portion of said intermediate section acts as an inner cylinder for an inner tubular section 42 that is in effect a piston cooperating with the inner cylinder.

In a preferred form of my invention all three tubular sections are made from a synthetic plastic material since this has a low coefficient of friction and can be quickly and inexpensively molded to the shapes desired. Although I may employ any conventional synthetic plastic, one which is particularly good due to its ability to withstand hard useage is a high impact polystyrene which, as is well known, comprises polystyrene mixed with a substantial percentage, e.g., 25%, of a copolymer of butadiene and styrene.

The outer tubular section 38 includes an erect rectilinear outer tubular portion 44 at the lower end of which I provide an elbow 46 terminating in an upwardly extending connector tube 48. Said tube may be provided with the usual series of parallel annular ribs 50 to facilitate engagement of the connector to a flexible plastic pipe 52 which supplies water under pressure.

The upper end of the outer tubular portion 44 is externally threaded to receive a female threaded cap 54 with a large central aperture 55 that slidably passes the intermediate tubular section 40 and constitutes an inwardly directed flange. This cap preferably is made of the same plastic as the sections 38, 40 and 42. The tubular section 40 constitutes an erect rectilinear intermediate tubular portion 56 which is of approximately the same length as the outer tubular portion 44 but the exterior diameter of which is less than the interior diameter of said outer portion 44. The lower end of the intermediate tubular portion 56 is externally enlarged to provide an arrangement which will act as a piston in conjunction with the internal surface of the outer tubular portion 44, the latter functioning as a cylinder for this piston. More particularly, at the lower end of the intermediate tubular portion 56 I provide an outwardly extending continuous annular outer piston flange 58, the outer diameter of which is only slightly less than the internal diameter of the outer tubular portion 44. The difference between these diameters constitutes the sliding clearance of the outer piston and cylinder action.

In accordance with my invention I prefer to employ a diametral clearance of between about $\frac{1}{32}$ to $\frac{1}{16}$ of an inch so that there is a radial sliding clearance of between about $\frac{1}{64}$ to $\frac{1}{32}$ of an inch. This sliding clearance is sufficient to permit a flushing action to take place that will be described hereinafter and also is sufficient to permit the passage through such space of foreign material that may find its way into the interior of the standpipe 12. However, the sliding clearance is not so great as to encourage wobbling of the standpipe when erected. It is appropriate to mention here that a construction soon to be described provides a stabilizing action on the erected standpipe.

Pursuant to my invention the height, i.e. dimension of the rim of the piston flange 58 parallel to the longitudinal axis of the standpipe, is narrow, that is to say, slight. A typical height for the rim of said piston flange is about $\frac{1}{8}$ to $\frac{1}{16}$ of an inch. Such a narrow rim is highly desirable both to minimize friction between the piston flange and the outer tubular portion 44 and to present a minimum length of annular space through which foreign material has to pass and in so doing possibly score the por-

tion 44 or the land of the piston flange. The term "land" as used herein denotes the rim of the piston flange, this being a sliding bearing surface that engages the inner surface of the outer tubular portion 44.

Although a narrow land is important, if the entire piston flange were as narrow as its rim, i.e., in the order of from ⅛ to 1/16 of an inch, the piston flange might be too weak and therefore in order to strengthen the same the base of the piston flange is made wider than the land (rim) or, phrased differently, the piston flange broadens as it approaches the intermediate tubular portion 56.

Under some circumstances, for example where a fixed nozzle is used as the sprinkler head or where the sprinkler head is so constructed, as indicated previously, that it alternately sweeps in opposite directions through an arc of less than 360°, it is necessary to inhibit relative rotary motion between the intermediate tubular portion and the outer tubular portion although permitting relative axial movement. For such purpose I prefer to employ a spline interengagement between these two portions. This is accomplished rather simply by providing a longitudinally extending straight groove 60 on the inner surface of the outer tubular portion 44 and a matching radially protuberant tooth 62 on the piston flange 58 of the intermediate tubular portion 56. The tooth is seated in the groove and is freely slidable along the length of the same.

A similar inner piston flange 64 is provided at the lower end of the inner tubular section 42 and if additional sections are provided each will have a like piston flange at its lower end. Such flanges function as pistons against which water under pressure will act to lift the same with respect to their associated cylinders whereby when water under pressure is admitted to the pipe 52 each piston will be thrust to the upper end of its corresponding cylinder. The cylinder for the outer piston flange 58 is the erect tubular portion 44 of the outer tubular section 38. The cylinder for the inner piston flange 64 is the erect rectilinear tubular portion 56 of the intermediate tubular section 40.

Due to the narrow widths of the lands (sliding bearing surfaces) of the two piston flanges 58, 64 which deliberately is employed to minimize friction and scoring it will be apparent that these lands by themselves are not capable of stabilizing the sections of the standpipe in raised condition and for this purpose and also to prevent escape of water from the standpipe when it is extended, the intermediate section and the inner section, that is to say, each section having a piston flange, is provided with an additional bearing surface which is spaced longitudinally from the associated piston flange and in cooperation therewith provides a stabilizing bearing. Particular attention is directed to the fact that this second bearing surface does not act to provide a sliding land; for this purpose only the flanges 58 and 64 are employed. There is a distinction between the sliding action and the stabilizing action and it is only in conjunction with the stabilizing action that the second bearing surface now to be described is utilized.

The second bearing surface for the intermediate tubular section 40 is furnished by an upper continuous annular radially protuberant flange 68 above and longitudinally spaced from the lower piston flange 58. The outer diameter of the upper flange 68 is less than that of the piston flange 58 so that said upper flange will not provide a sliding support and also so that a wider annular space is supplied for flushing action and for the nonscoring passage of foreign material. A typical satisfactory diametral clearance between the upper flange 68 and the interior of the outer tubular portion 44 is from about ¼ to ⅛ of an inch, i.e., a radial clearance of from about ⅛ to 1/16 of an inch.

The distance between the upper and lower flanges preferably is proportional to the length of the tubular section on which the flanges are located and usually will be in the order of about ¼ to ⅙ of the length of such tubular section. For example, on a tubular section 12" long a suitable interflange distance is about 2½"; on a tubular section 3" long a suitable interflange distance is about ½".

To keep scoring to a minimum, in addition to the extra radial clearances I fashion the upper (stabilizing) flanges with narrow lands, e.g. lands having heights in the order of the heights mentioned for the lands of the lower flanges, that is to say in the order of from about ⅛ to 1/16 of an inch. However to strengthen the upper flanges their bases are made broader than their lands. Specifically the upper surface, and optionally the lower surface as well, of each upper flange slopes in a longitudinal direction so that at least the upper surface of the upper flange, and desirably the lower surface too, is of a generally frusto-conical configuration. Such shape of the upper surface has three purposes, to wit, it strengthens the upper flange by broadening its base, it aids in sealing the upper standpipe against water leakage and it aids in centralizing and stabilizing the erected standpipe.

In order to appreciate the latter two functions it is necessary at this point to further describe the central aperture 55 in the cap 54 which provides a radially inwardly directed flange. This aperture is dimensioned to provide a diametral sliding clearance with respect to the external surface of the intermediate tubular portion 56 of about 1/16 to 1/32 of an inch, i.e. the same sliding clearance as is provided between the lands of the piston flanges and their associated cylinders. Moreover the height of the surface defining the aperture 55 is slight so as to form a narrow sliding land at this region as well, whereby to hold friction and scoring to a minimum. The sliding land at the aperture 55 preferably is of the same order of length as the lands of the piston flanges or, in other words, about ⅛ to 1/16 of an inch.

It thus will be appreciated that the sliding inter-engagement between the outer tubular section 38 (inclusive of the outer tubular portion 44 and the cap 54 functionally integral therewith) and the intermediate tubular section 40 is limited to two zones of sliding contact. One of these is between the land of the piston flange 58 and the inner surface of the outer tubular portion 44 and the second is between the land of the aperture 55 and the outer surface of the intermediate tubular portion 56. The extent of the sliding movement is determined on the one hand by abutment of the upper flange 68 against the cap 54 for the erected position of the standpipe and on the other hand by an abutment against the cap 54 of an apertured cap 70 screwed onto the top of the intermediate tubular section 42. This latter abutment determines the retracted position of the standpipe. The cap 70 has a construction similar to that of the cap 54 except that it is smaller to slidably receive the inner section 42.

Each cap 54, 70 is provided with an annular groove in its undersurface in which an elastic sealing member, e.g. an elastomeric O-ring 72, is received. This surface in which such groove is formed is inclined to the horizontal and to the vertical, that is to say, this surface is frusto-conical. The side walls of the groove are perpendicular to said surface so that the groove is directed inwardly and downwardly. The O-ring 72 is a snug fit and projects from such groove. However the O-ring is spaced from the outer surface of the intermediate tubular portion 56 so that there is absolutely no contact between the O-ring and said portion. This prevents the O-ring from inhibiting upward or downward sliding movement of the intermediate tubular portion with respect to the outer tubular portion 44.

As noted previously the only restraint on such movement, aside from the abutment limits, is at the two regions of sliding contact. However when water under pressure is admitted to the connector tube 48 the water acting on the lower surface of the piston flange 58 forces the intermediate tubular section upwardly. Eventually and

quickly the upper bearing and stabilizing flange 68 will strike the O-ring 72. This prevents further upward movement of the intermediate tubular section but it accomplishes more than this. Due to the frustoconical shape of the upper surface of the flange 68 said flange tends to squeeze itself into the opening defined by the O-ring. Phrased differently, the effect of the upward thrust is multiplied to create a sealing pressure between the flange 68 and the O-ring whereby an extremely good and tight sealing joint is formed so that with this arrangement there is no observable loss of pressure due to leakage of water at the joint. It also should be observed that because the upper surface of the stabilizing flange 68 is symmetrical with respect to the longitudinal axis of the standpipe, as this flange enters the opening defined by the O-ring 72 the flange will tend to centralize itself and the intermediate tubular section 40 with which it is integral. Thereby the intermediate tubular portion 56 is placed and retained in substantial coaxial alignment with the outer tubular portion 44.

Attention further is directed to the fact that despite this extremely good seal and good centralizing and stabilizing action secured by the provision of the upper flange 68, said upper flange in no way interferes with flushing of the space between the outer and intermediate sections during raising of the standpipe, this flushing being necessary to remove debris which may enter the inside of the standpipe.

In FIG. 4 I have shown how the difference in radial dimensions between the lower and upper flanges prevents the upper flange from inhibiting good flushing action as the standpipe is being erected and as the upper flange approaches but has not yet reached the position it will occupy when the standpipe is fully erected. This should be compared with FIG. 5 in which the standpipe is shown erected and in which it will be seen how the upper flange is tightly sealed against the O-ring 72. Thus the upper flange serves no function either in idle position of the standpipe or during its erection and only comes into play when the standpipe is fully erected at which time it seals the standpipe and centralizes and stabilizes the erected standpipe. Also it should be mentioned that in such erected position the upper flange serves as part of a bearing, constituting the upper end of the bearing of which the lower end is the first, i.e. lower (piston), flange 58. These two flanges jointly perform the stabilizing action for the erected standpipe.

The inner tubular portion 66 likewise is provided with a second, i.e. upper, flange 74 dimensioned and configured and functioning in the same manner as the upper flange 68 of the intermediate tubular portion 56.

The upper end of the inner tubular portion 66 is formed with a thread, in this instance, a male thread (not shown), for connection purposes. Screwed on the male thread is a coupling 76 that is internally threaded and that receives the threaded lower end of the sleeve 36 of the sprinkler head.

The inner piston flange 64 is provided with a tooth 78 (FIGS. 4, 5 and 6) slidable in a longitudinal spline groove 80 provided on the inner surface of the intermediate tubular portion 56 in order to prevent relative rotation of the intermediate and inner tubular portions while permitting relative longitudinal movement thereof.

Suitable means is provided to house the sprinkler head 14 when the standpipe 12 is in retracted position. Such means includes the support casing 18 which likewise may be made of the same plastic material and which is in the form of a socket or cup having cylindrical side walls 81 and a downwardly tapering bottom wall 82 in one piece with the side walls. The bottom wall is formed with perforations 84 to permit drainage of any water that may enter the casing.

In accordance with a feature of my invention the protective underground casing also acts to assist nad support, i.e. position and locate, the pop-up standpipe. It might be thought that the mere embedment in the ground of the outer tubular section 38 would suffice for this purpose but the position of the standpipe can be made more secure if the casing is anchored thereto inasmuch as the casing, being of considerably larger diameter, provides a greater area of contact with the ground and thereby can materially assist in fixing the position of the standpipe. To this end the bottom wall 82 of the casing 18 is formed with a central opening which is a snug slidable fit on the outer surface of the outer tubular portion 44. Desirably the interengagement between the casing and said outer tubular portion is made quite firm and to encourage such action I include in the underground casing a downwardly depending sleeve 86 in one piece with said casing and pendant around the central aperture of the bottom wall. This sleeve likewise is a snug slidable fit on the outer surface of the outer tubular portion 44.

Moreover it is desirable that the fit between the sleeve and said tubular portion be such as to discourage relative longitudinal movement of said two parts. One manner in which such movement can be inhibited is, as shown, merely to provide one or more internal grooves in the sleeve 86 in which elastic O-rings 88 are received. These O-rings frictionally embrace the outer tubular portion 44 and tend to prevent any movement between it and the sleeve either in a longitudinal or radial direction. Nevertheless they do permit deliberate longitudinal adjustment when the pop-up sprinkler 10 is being installed at which time the open mouth of the casing must be adjusted to place it at ground level and the pop-up standpipe 12 must have its vertical location so determined as to place the top of the sprinkler head at approximately ground level. Once these positions have been set a plastic cement can be introduced in the top of the sleeve 86 to prevent any further relative movement. It will be found that under such circumstances the casing 18 is of appreciable assistance in fixing the location of the pop-up standpipe.

It is highly desirable to include means to cover the open mouth of the underground support casing 18. Such means constitutes the lid 20. Said lid is attached to the sprinkler head 14, the standpipe being so vertically adjusted that the standpipe is in fully retracted position the lid rests on the open flanged mouth of the casing. It will be appreciated that, if desired, the retracted position of the standpipe can be determined by abutment of the lid against the mouth of the casing rather than by abutment of the coupling 76 against the cap 70 and abutment of the cap 70 against the cap 54.

The provision of a sprinkler head carried lid is not deemed by me to constitute, per se, a feature of my invention; however I wish to point out that the lid 20 is not secured to the sprinkler head by screws or pins which can break or be lost. Rather the attachment between the lid and sprinkler head is effected in such a manner that the engagement can be quickly made or opened and that the attaching means is integral with the lid so that it can not be lost. More particularly the attaching means is in the form of a depending sleeve 90 extending downwardly and in one piece with the undersurface of the lid and centrally located thereon. The lid and its sleeve are made of the same plastic as the other parts of the pop-up sprinkler (exclusive of the sprinkler head which latter is principally of metal). The sleeve 90 is longitudinally split at a few points so as to subdivide it into downward flanges which, due to the fact that their lower ends are free and to the fact that the sleeve and lid are of plastic have some degree of flexibility. This is sufficient to enable the split portions of the sleeve to be flexed by hand pressure. In particular, the sleeve is provided with diametrically opposed slits 92 which are at least as wide as the legs 30, 32. Preferably also the sleeve is formed with at least one additional slit 94 which is midway between the slits 92. The lower ends of the resultant flanges have inwardly protuberant ribs 96.

To mount a lid on a sprinkler head the lid simply is placed over the same with the sleeve aligned with the disc **34** and with the slits **92** aligned with the legs **30, 32**. Thereupon the lid is pushed down. The camming action of the rounded ribs **96** on the rim of the disc **34** will flex the flange portions of the sleeve **90** outwardly and permit them to pass over the rim of the disc. As soon as they pass the rim the flange portions will snap back to dispose the ribs **96** immediately below and in engagement with the undersurface of the disc **34** thereby securely holding the lid **20** to the sprinkler head. It is quite usual in sprinkler heads to find a longitudinal protuberance beneath the disc **34** on one side of and midway between the vertical legs **30, 32**. The slit **94** is designed to clear such a protuberance.

In FIGS. 8 and 9 I have illustrated a pop-up sprinkler **100** which differs from the pop-up sprinkler **10** in that the sprinkler **100** is designed for a short rise whereas the sprinkler **10** is designed for a high rise. The sprinkler **10** can be used, for instance, to secure an erection of the sprinkler head of as little as 3" using only two short tubular sections, or for an erection of as much as 15' where three, four or even more long sections are used. Such extremely high risers are useful, for example, in the irrigation of sugar cane. On the other hand, the pop-up sprinkler **100** is designed for comparatively short rises in the order of less than 6", and therefore this sprinkler customarily will include only two telescoping sections.

Preferably, all the parts of the sprinkler **100**, with the preferable exclusion of the sprinkler head which may be principally of metal, are of a plastic material similar to that used for all the parts of the pop-up sprinkler **10**, except for the sprinkler head. Said pop-up sprinkler **100** includes a pop-up standpipe **102**, a sprinkler head **104** and a support casing **106**.

The standpipe **102** is of the same construction as the standpipe **12** except that it employs only two sections instead of three and except that each of the sections is comparatively short, for example, about 4" long. The pop-up sprinkler **100** is connected to a supply line **110** at a T-fitting **112** into which there is screwed the lower threaded end of an outer tubular section **114**. The upper end of such section receives a centrally apertured cap **116**. An inner tubular section **118** is telescopically received within the outer tubular section. The inner tubular section has a lower piston flange **120** and an upper bearing (stabilizing, sealing and centering) flange **122**. These are the same as the flanges **58, 68** described with respect to the standpipe **12**. The cap **116** is provided with an O-ring **124** similar to the O-ring **72**.

The lands of the various flanges and cap are dimensioned and shaped in the same manner as the corresponding flanges of the standpipe **12** so that they will function in the same manner. Thus, when water under pressure appears in the supply line **110** the standpipe **102** will be erected and when the pressure disappears the standpipe will fall back to retracted position.

The sprinkler head **104** used in the pop-up sprinkler **100** preferably is of the stationary type. It may either discharge water over a full 360° or over a lesser arc. If the discharge is over a full 360°, it is not necessary to key the inner tubular section to the outer tubular section so as to prevent relative rotation of said sections. However, to render the standpipe **102** capable of universal use with both types of stationary sprinkler heads, it is preferable to key the two tubular sections to one another, e.g., with a tooth and spline groove, such as already have been described in detail with respect to the sprinkler **10**.

Said sprinkler head **104** is conventional and constitutes a shell **126** having a downwardly depending internally tapped sleeve which is threaded onto the male threaded upper end of the inner tubular section **118**. The open upper end of the shell also is tapped and in it there is screwed a distributor **128** the bottom of which opens to the inside of the shell **126**. The distributor has a plenum chamber communicating with the interior of said shell. Plural upwardly and outwardly diverging passageways **130** run from the plenum chamber to the upper surface of the distributor. The pattern of these passageways will depend upon the type of water distribution that is desired. The upper end of the shell **126** includes, as is conventional, an outwardly extending annular flange **130** which surrounds the distributor **128**.

The support casing **106** need not be as elaborate, large or deep as the casing **18** since the erected height of the standpipe **103** is so small and since the head **104** is of comparatively slight height. Accordingly, the support casing **106** is in the form of a torus, the lower half of which is missing. To keep the protruding portion of the casing **106** to a low height so that it will set down well into a lawn where it will not interfere with the mowing of the grass, I prefer to have the upper portion of the torus flattened as is shown quite clearly in FIG. 8. Thus, the support casing **106** constitutes a ring generated by a semi-circular generatrix which generatrix has its upper part flattened. Thereby, the upper face of the casing **106** is convex and is flattened and the lower face of the casing is concave. The upper face of the torus is provided with a concentric step **132** the diameter of which is substantially equal to the outer diameter of the flange **130** and the height of which is approximately equal to the height of the flange **130**. Thus, in the lowered position of the head **104** the flange is seated in and received on the step **132** and thereby the flange, in effect, acts as a lid to cover the open top of the support casing **106**.

The inner periphery of the torus has a downwardly depending cylindrical section **133** which terminates at a downwardly sloping conical base wall **134** provided with drain openings **136**. The base wall **134** is formed with a central opening which snugly receives the outer tubular section **114**. Preferably, the casing **106** further includes a sleeve **138** integral with the bottom wall and defining the central opening therein. The sleeve **138** likewise is a snug slidable fit on the outer tubular section **114**. The sleeve **138** is secured to the outer tubular section **114** in the same manner that the sleeve **86** is held to the outer tubular section **38** of the sprinkler **10**. It may be mentioned here that, if desired, the support casing **106** may be permanently secured to the outer tubular section **114** and even made integral therewith at the factory since there is not often occasion for requiring relative longitudinal adjustments of the positions of these two parts of the sprinkler **100**. When the standpipe **102** is embedded in the earth, it and the casing **106** can together be set at any desired height.

It thus will be seen that I have provided devices which achieve the several objects of my invention and which are well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiments set forth, it is to be understood that all matter herein described or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described the invention, I claim as new and desire to secure by Letters Patent:

1. In a pop-up sprinkler, a pop-up standpipe including an outer erect tubular section and an inner erect tubular section telescopically received in said outer section, said outer tubular section having an inwardly directed first flange at its upper end defining an opening, said inner tubular section having a continuous outwardly extending piston second flange at its lower end and an outwardly extending continuous bearing sealing centering and stabilizing third flange spaced from and above said piston second flange, the radial clearance between the inner tubular section and the opening in the first

flange and between the outer tubular section and the second flange being sliding clearances providing annular spaces of sufficiently large radial dimensions to permit during erection of the standpipe a flushing action of water therethrough and the passage of foreign material that may find its way into the interior of the standpipe and the space between the two tubular sections, the radial clearance between the third flange and the outer tubular section being in excess of a sliding clearance and supplying a wider radial space than the first mentioned annular spaces for flushing action and non-scoring passage of foreign material therethrough during the erection of the standpipe, said third flange engaging the first flange in the erected position of the standpipe to center the inner tubular section in its erected position, to form a seal with the first flange, and in conjunction with the cooperation between the second flange and the outer tubular section to stabilize the standpipe in its erected position.

2. A pop-up standpipe as set forth in claim 1 wherein the radial clearance between the inner tubular section and the opening in the first flange and the radial clearance between the outer tubular section and the second flange is about $\frac{1}{32}$ to $\frac{1}{64}$ of an inch, and wherein the radial clearance between the third flange and the outer tubular section is about $\frac{1}{8}$ to $\frac{1}{16}$ of an inch.

3. A pop-up standpipe as set forth in claim 1 wherein the peripheral dimensions of all three flanges parallel to the longitudinal axis of the standpipe are narrow.

4. A pop-up standpipe as set forth in claim 1 wherein a continuous elastic sealing ring is supported on the undersurface of the first flange concentric with the inner tubular section, the inner diameter of said ring being greater than the diameter of said inner tubular section so that the ring does not contact said inner tubular section, said ring protruding downwardly from the inner tubular section, and wherein the upper surface of the third flange which engages said ring in the erected position of the standpipe is downwardly and outwardly flaring so that said flange squeezes into the opening defined by the sealing ring, whereby to create a sealing pressure and thereby form a tight sealing joint.

5. In combination with a pop-up standpipe as set forth in claim 1, a ground support casing defining an upwardly extending hollow into which the upper end of the outer tubular section extends, said casing having a bottom wall with a central opening therein from which a sleeve depends, said sleeve engaging the outer surface of the outer tubular section below the upper end thereof so that the lower end of the outer tubular section projects below said sleeve and ground support casing.

6. A combination as set forth in claim 5 wherein the ground support casing is in the form of a torus having a semi-circular generatrix, the upper face of the torus being upwardly convex and the bottom surface of the torus being downwardly concave.

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