

[54] **WEEPER IRRIGATION DEVICE**

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[22] Filed: **Feb. 3, 1975**

[21] Appl. No.: **546,218**

[52] U.S. Cl. **239/542; 137/513.5; 239/574**

[51] Int. Cl.² **B05B 15/00**

[58] Field of Search 239/542, 547, 574, 570,
239/571; 137/613, 614, 513.5

[56] **References Cited**

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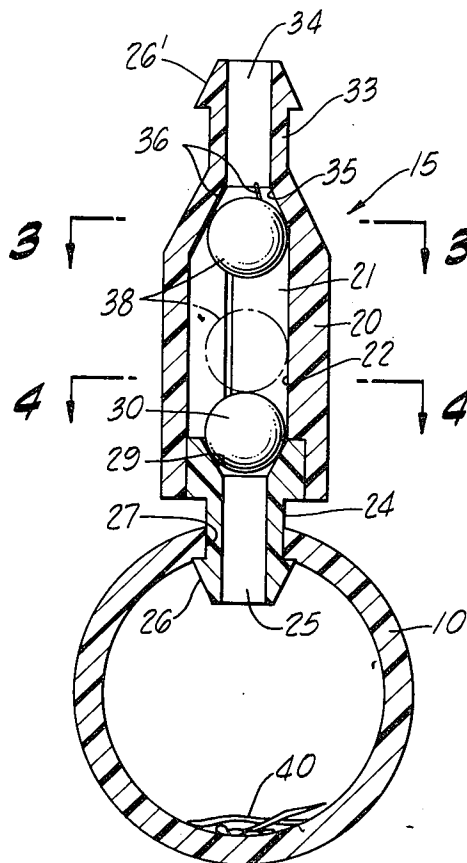
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[57] **ABSTRACT**

A weeper irrigation device having first and second flow responsive valve members, the first valve member being effective in response to the initiation of water flow to seat and restrict water flow therepast to a desired weeper flow, and the second valve member being seatable by gravity in a slightly open position over the inner end of the inlet passage to the weeper device and having several functions. These include preventing foreign matter from entering the weeper device, assuring and expediting seating of the first valve member, preventing gyrations of the first valve member and providing reliable weeper flow control over a wider pressure range of the water supply.

7 Claims, 4 Drawing Figures



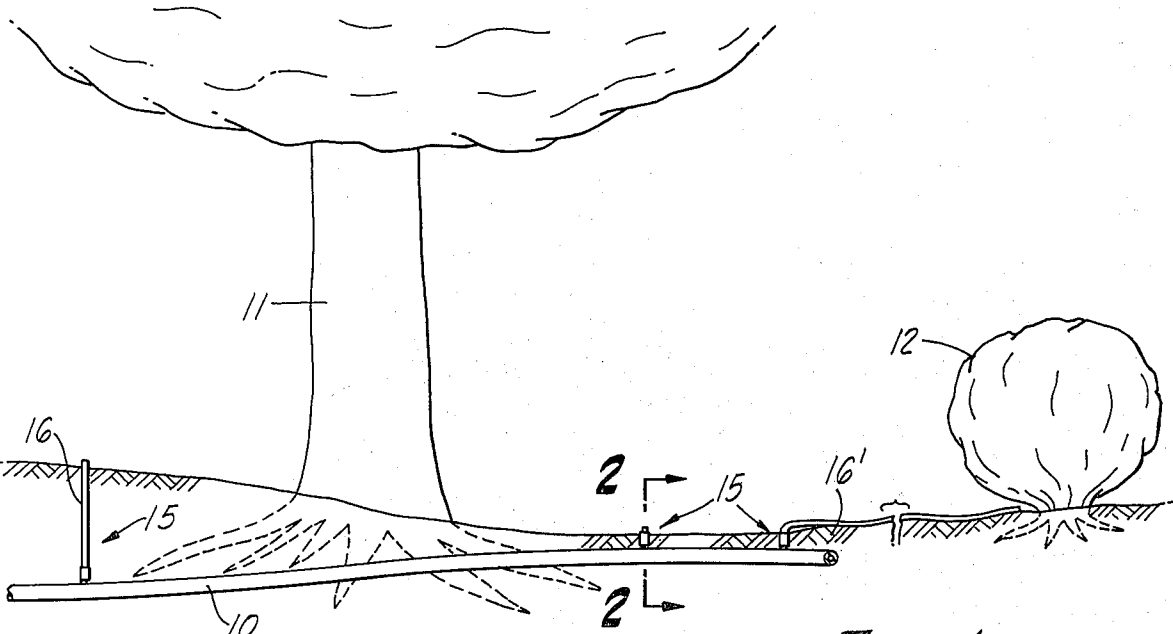


FIG. 1.

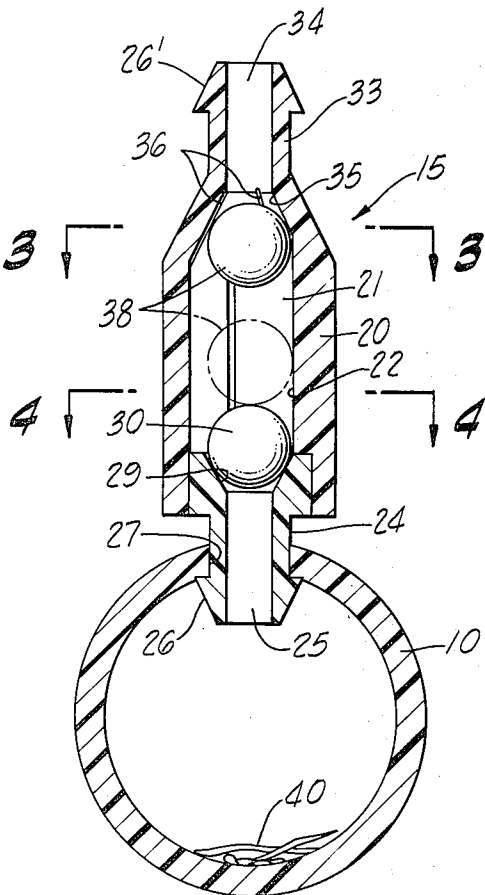


FIG. 2.

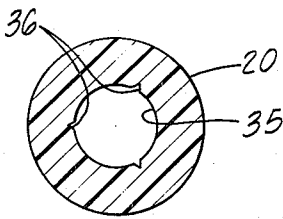


FIG. 3.

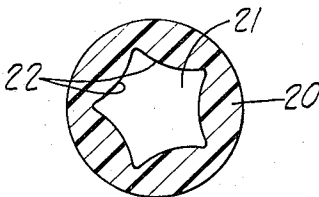


FIG. 4.

WEEPER IRRIGATION DEVICE

This invention relates to weeper irrigation devices, and more particularly to a device of this type having separate independently movable valve members respectively seatable over the adjacent inner ends of the inlet and outlet flow passages.

The present invention embodies certain improvements in a weeper irrigation device disclosed in our copending application for U.S. Pat. Ser. No. 323,638, filed Jan. 15, 1973. The weeper device disclosed in our copending application is being widely and successfully used for its intended purposes but, on occasion, and under certain adverse operating conditions and for reasons not fully understood, the device is subject to certain disadvantages and erratic behaviour avoided by the improved weeper device of this invention. For example, our earlier weeper utilizes a single flow responsive valve member located between a pair of valve seats at the opposite ends of a tubular valve chamber and respectively embracing the inner ends of the water inlet and outlet passages. If the water supply is cut off one valve member rests against the seat of the inlet passage but, upon initiation of pressurized water flow, responds to that flow by seating against the valve seat of the outlet passage while permitting a weeper discharge of water therepast. It sometimes happens that initial flow into the weeper tends to spin this single ball valve about an upright axis and this spinning seriously interferes and can prevent seating of the valve against the inner end of the outlet passage. If the valve does not close against this seat, water escapes from the weeper at a relatively high and undesirable rate. Also, at times foreign material flowing in the main supply manifold enters the weeper valve chamber and becomes lodged in the weeper flow control channels which is undesirable for obvious reasons. Additionally, it is found that the earlier weeper construction is not as reliable and dependable over a wide range of pressure fluctuations or differences are unavoidable owing to the pressure drop occurring along the distribution manifold and resulting in a low pressure condition near the end of the distribution line.

The foregoing and other disadvantages are entirely eliminated in the improved construction disclosed herein. These improvements are accomplished simply by utilizing an additional flow responsive valve member in the valve chamber. This second valve member remains in the close vicinity of the inlet valve seat whereas the other valve member responds to the pressure build-up in the valve chamber on initiation of water flow and moves into seating engagement with the weeper outlet valve seat. Any tendency of the inlet valve to spin or gyrate is confined to this valve member with the result that the other valve member responds quickly to pressure buildup to seat against the weeper outlet and remains firmly seated there until the water supply is cut off. During the brief interval the weeper flow control valve is rising to its operating position a flushing flow of water takes place therepast and this flow is highly effective in removing any sediment which may have collected along the outlet passage. As soon as the weeper valve has seated the flow past both valves is at a desired minimum rate with the result that the inlet valve remains slightly ajar. In this nearly closed position, it is highly effective to prevent the entry of any foreign matter from the main supply duct.

The present weeper also includes a short tubular outlet passage over which either a short or a long extension hose can be readily telescoped with a snug fit. A short tube permits the weeper device to be buried slightly below the ground surface with only the discharge end of the tube exposed. If a longer tube is connected to the outlet passage the bleeder flow can be conducted to a more distant location without disturbing the water supply duct or the bleeder device, thereby adding substantially to the versatility of the bleeder device.

It is therefore a primary object of this invention to provide an improved irrigation bleeder device embodying a plurality of independent flow responsive valve members to control flow into and from the bleeder device in a positive and foolproof manner.

Another object of the invention is the provision of an improved irrigation bleeder device utilizing a pair of flow responsive valve members cooperating to assure positive weeper flow control under a wide range of water supply pressures.

Another object of the invention is the provision of an improved weeper device provided with a valve chamber equipped with two independent flow responsive valve members respectively seatable over the inner ends of the water inlet and outlet passages and cooperating to assure seating of the weeper flow control valve member upon initiation of the supply of pressurized water and utilizing the other valve member to safeguard against the entry of foreign matter into the valve chamber.

These and other more specific objects will appear upon reading the following specification and claims and upon considering in connection therewith the attached drawing to which they relate.

Referring now to the drawing in which a preferred embodiment of the invention is illustrated:

FIG. 1 is a view illustrating a length of a pressurized irrigating duct buried slightly below the ground surface to be irrigated and having an illustrative embodiment of several of the invention weeper devices installed at intervals therealong;

FIG. 2 is a cross-sectional view on an enlarged scale taken along line 2—2 on FIG. 1;

FIG. 3 is a cross-sectional view taken along line 3—3 on FIG. 2; and

FIG. 4 is a cross-sectional view taken along line 4—4 on FIG. 2.

Referring initially to FIG. 1, there is shown a typical pressurized water distributing duct 10 extending from a source of pressurized water supply past vegetation to be irrigated, such as the tree 11 and a plant 12. Mounted at intervals in openings through the sidewall of duct 10 are three of the improved weeper irrigating devices designated generally 15. It will be understood that the distributing duct 10 may lie on the ground surface but, preferably, is slightly buried to protect it as well as to retain the weeper devices 15 in a generally upright position with their outlet ends at a higher elevation than their inlet ends. In some areas, such as in groves of trees 11, duct 10 may be buried several inches to permit tilling the ground without injury to the distributing duct. In this instance and to permit deeper burial of duct 10, a short length of tubing 16 is secured to the outlet end of weeper 15 with its upper end protruding above ground level. In other instances where it is desired to distribute the weeper flow to one or more points removed from a selected weeper 15, a longer

distributing tube 16' is connected to the outlet of the weeper with its other end near the base of the plant life to be irrigated, such as the stalk of a plant 12. If tubes 16, 16' are not used, then the outlet end of the weeper should preferably project above ground level in the manner illustrated in FIG. 1.

Referring now to FIGS. 2-4 it is pointed out that weeper device 15 has a tubular main body 20 formed interiorly thereof with an elongated valve chamber 21. The main body 20 may be molded from any suitable tough, high strength plastic material and valve chamber 21 is preferably provided lengthwise of its interior with inwardly projecting arcuate flutes 22 cooperating to hold the two valve members loosely centered axially of the valve chamber.

Suitably secured to the lower end of main body 20, as by an adhesive or bonding agent, is an inlet tube 24 formed with an inlet passage 25. A low height barb or retainer 26 embraces the exterior inlet end of tube 24. At least the advance end of retainer 26 converges and acts as a pilot to facilitate the insertion of inlet tube 24 into a snug fitting opening 27 formed through the side-wall of the water distributing duct 10. Once the retainer barb 26 has passed through opening 27 the surfaces of the retainer adjacent the inner end of opening 27 cooperate with the inner rim portions of this opening to anchor weeper device 15 snugly assembled to duct 10 in a fluid-tight manner. The weeper can be forcibly withdrawn should it be necessary for any reason but the assembly retaining and water sealing ability of retainer 26 with duct opening 27 is highly reliable and effective to hold the device assembled under all normally prevailing water pressures.

The inner end of water inlet passage 25 is formed with a conical valve seat 29 which cooperates with a flow responsive valve member 30 in performing multiple functions which will be explained more fully presently. Valve member 30, as here shown, comprises a metal sphere having a diameter slightly less than the distance between the innermost surfaces of the arcuate flutes 22 as viewed in FIG. 4.

Molded integral with the upper end of main body 20 is a rigid tube 33 having a water outlet passage 34. Embracing the outer end of tube 33 is a low height barb or retainer 26' of the same or similar construction as barb 26 described above.

The inner end of the outlet passage 34 is formed with a conical valve seat 35 having one or more very shallow grooves 36 forming weeper flow passages. A spherical valve member 38 movable lengthwise of the upper end of the valve chamber occupies the dot and dash line position when the weeper device is not in operation. However, under pressurized water flow conditions, the water pressure is effective to hold valve member 38 firmly seated against seat 35 so that all water flow is that minute amount taking place along grooves 36. It will be understood that the weeper flow rate depends upon the number and cross-sectional area grooves 36. Typically however, these V-shaped grooves have a depth of 5-8 mils and a combined flow capacity of the order of one to three gallons per hour when valve member 38 is seated thereacross.

In a typical installation, the water distributing duct 10 extends along a row of trees or plants to be irrigated and is buried at a suitable depth in accordance with the operating considerations and objectives explained above. Prior to installation the duct is equipped at intervals with generally upright weeper devices 15 each

having a pair of gravity and flow responsive valve members 30, 38 held captively assembled within valve chamber 21 between the two valve seats. If the weeper device is located below the ground surface, outlet tube 33 has forcibly telescoped thereover in a fluid-tight manner a flexible tube 16 long enough to have its outlet end located above ground level. If the outlet end of tube 33 is located above ground level, then an additional hose or tube need not be used unless it is desired to convey the weeper flow to one or more points such as to the base of plant 12. In this event one end of a flexible hose 16' of suitable length is telescoped over the outlet tube 33.

If the water supply is cut off valve members 30 and 38 will gravitate to the lower end of valve chamber 21 with valve member 30 firmly seated in a fluid-tight manner on seat 29 and the upper valve member 38 resting thereagainst as is indicated in dot and dash line in FIG. 2. If portions of the distributing duct 10 distant from the water source are then at a lower level, the water head provided by the presence of water in more elevated portions of duct 10 could unseat the valve of weeper devices in lower portions of duct 10 and allow the water to escape from the duct and to be replaced by air entering the outlet passages 34 of weepers at higher levels. This is undesirable because not only wasting water, but more importantly, permitting foreign matter to enter the system and interfere with its subsequent normal functioning. These undesirable results are avoided since any negative pressure differential which may develop downwardly through the inlet passage 25 of weeper device 15 acts automatically to positively seal valve member 30 against seat 29. So long as valve 30 is seated, chamber 21 remains at atmospheric pressure until weeper flow is resumed.

However, whenever the pressure differential is in the opposite and upward direction with the higher pressure existing in the inlet passage 25, valve member 30 is unseated upwardly allowing the pressurized water to enter valve chamber 21. This rapidly flowing water tends to tilt valve 30 in one lateral direction. This can usually cause a swirling water flow about the axis of the inlet passage and of chamber 21. This helical swirling flow can cause valve 30 to spin about the longitudinal axis of chamber 21 in which event the rise of valve 30 upwardly within chamber 21 occurs slowly, if at all. While this is taking place, valve chamber 21 fills with water which escapes past valve member 38 and floods through the outlet passage 34. This rapid surging flow serves to purge any sediment or foreign matter that has previously collected along the interior sidewalls or in weeper flow grooves 36. While this purging action is taking place the pressure build-up behind valve 38 causes this valve to rise and seat firmly against seat 35. When this occurs all further flow is the minute weeper flow occurring along weeper flow passages 36. The pressure build-up in chamber 21 then remains generally steady and holds the valve 38 firmly seated. When the first or upper valve member 38 seats, the lower or second valve member 30 gravitates back onto its seat 29 but is held slightly ajar therefrom by the weeper flow. Accordingly, there is a very minute pressure differential in an upward direction across the second valve 30 and a relatively high pressure differential across the upper or first valve member 38, the water pressure in chamber 20 being substantially that in duct 20 and the pressure in outlet passage 34 being atmospheric.

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In practice, it is found difficult under field operating conditions to prevent small grains of dirt, small roots, plant growth and the like debris, generally indicated at 40 in FIG. 2, from entering with the water and flowing along the distribution duct 10. This foreign matter can be carried into the valve chamber of any weeper device heretofore constructed. However, when using a weeper device embodying the principles of this invention, the lower valve member 30 normally blocks the inlet passage 25 sufficiently to permit only a trickle flow into the valve chamber. Consequently, surging flow conditions which may occur for any of various reasons along the distribution duct are ineffective in carrying debris 40 into the weeper device where it can accumulate in the weeper passages 36 or elsewhere, or starve or interfere with the proper flow of water from the weeper.

If foreign matter should enter or collect in the outlet passage 34 or elsewhere, the operator can quickly purge this foreign matter without need for cutting off the water supply or interfering with the operation of all other weepers. This purging operation is accomplished by merely holding the finger over the discharge end of outlet passage 34 until this passage fills with pressurized water. Valve member 38 then gravitates to its dotted line position shown in FIG. 2 whereupon the operator removes his finger from the passage to allow a rapid purging flow of water to occur for a short interval which is most effective in removing the foreign matter while valve member 38 is rising to interrupt the purging flow as its seats against seat 35.

While the particular weeper irrigation device herein shown and disclosed in detail is fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that it is merely illustrative of the presently preferred embodiment of the invention and that no limitations are intended to the detail of construction or design herein shown other than as defined in the appended claims.

We claim:

1. A weeper irrigating device comprising a tubular housing having an inlet passage at the lower end thereof connectable to a source of pressurized water at one end and an outlet passage at the upper end thereof, a valve seat embracing the inner end of the each of said passages, said seat on the inner end of said outlet passage having a minute flow passage thereacross, first and second flow responsive freely movable valve members held captive between said valve seats, said first valve

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member being seatable on the valve seat at the inner end of said outlet passage to restrict the escape of water from said weeper device so long as said inlet passage is connected to a source of pressurized water, and said second valve member being held slightly ajar from said valve seat at the inner end of said inlet passage by water flow therepast so long as there is a flow of pressurized water past said first valve member via said minute flow passage.

2. A weeper device is defined in claim 1 characterized in that said second valve is effective in cooperation with the valve seat at the inner end of said inlet passage to exclude the passage of foreign matter therepast.

3. A weeper device as defined in claim 1 characterized in that said first and second valve member comprises separate spheres of smaller diameter than the interior of said tubular housing.

4. A weeper device as defined in claim 3 characterized in that said second valve member is operable to seat against said valve seat at the inner end of said inlet passage and seals off the escape of water backwardly through said inlet passage in response to a reversal of the pressure differential thereacross from that prevailing when the water supply to said inlet passage is pressurized.

5. A weeper device as defined in claim 1 characterized in that said inlet passage comprises a short rigid tube projecting from one end of said tubular housing, said rigid tube adapted to be forcibly inserted through a snug-fitting opening through the sidewall of a water supply duct, and a radial enlargement on the outer end of said rigid tube adapted to engage the rim edge of the inner end of said snug-fitting opening to hold said weeper device assembled to a water supply duct.

6. A weeper device as defined in claim 1 characterized in that said outlet passage comprises a short rigid tube projecting from one end of said tubular housing, and a short length of tubing having a snug but detachable telescopic fit over the outer end of said rigid tube to effectively convey a weeper flow of water from said weeper device to a selected place of deposit.

7. A weeper device as defined in claim 6 characterized in that said weeper device is located below the surface of the ground to be irrigated and with the discharge end of said rigid tube positioned above the adjacent ground surface.

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