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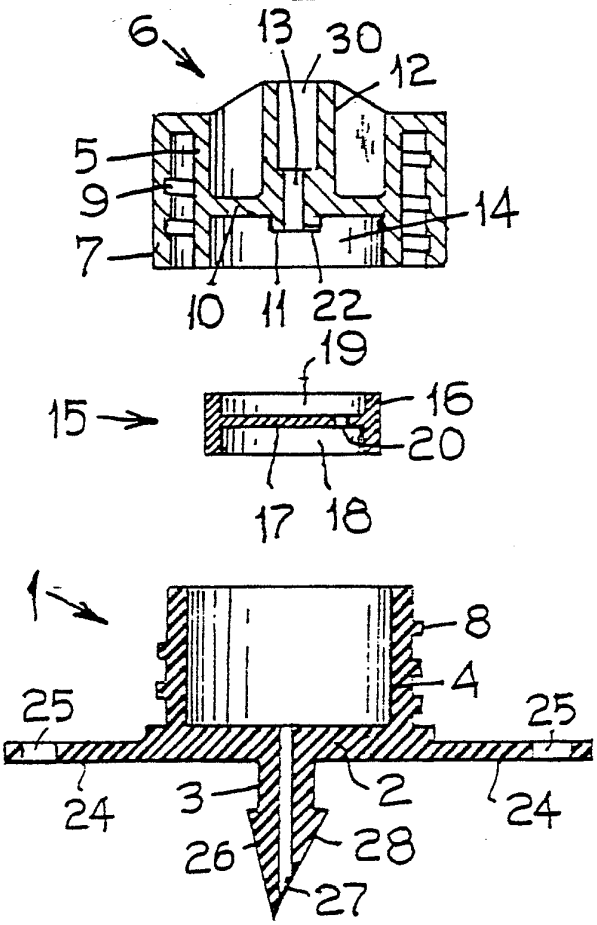
(54) Title: PRESSURE-REGULATED DRIP FEED DEVICE

(57) Abstract

A pressure-regulated feed device for irrigation purposes comprising a body (1) having an inlet (3) on one side and an annular wall (4) on the other, engaged by a cap (6) having an outlet (13) on one side and an annular wall (5) on the other, to engage the annular wall (4) on the body and housing in a chamber (14) formed between them, a button (15) having an annular rim (16) engaging the periphery of the chamber (14) and across it a resilient membrane (10) adjacent the outlet (13), the outlet (13) having at least a groove (22) for flow control when the resilient membrane (10) is urged against it by pressure of fluid flowing through the feed device to control the flow proportionately to the pressure.



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"PRESSURE-REGULATED DRIP FEED DEVICE"

This invention relates to a drip feed device of the general type which breaks down fluid flow from a supply line to an outlet whereby restriction of the flow takes place to allow a steady trickle from the device.

Many forms of devices have been proposed heretofore and usually these have lengthy restricted grooves or paths either of helical or spiral configuration through which the fluid must flow to cause the necessary restriction to achieve the low-flow conditions.

Certain problems exist with this type of device in that where the fluid contains impurities or sediment the flow can be interrupted or hindered by there being a build up of solid material in the elongated flow channels, and for this reason it has been the practice to use relatively long flow paths to enable a reasonable cross-sectional area to be obtained to guard against ready blockage.

Devices are known which use this general principle but in which the design is such that they control the rate of flow in accordance with the pressure existing in the line at the time, and for this purpose resilient discs have been used so arranged that the resilient material of the disc can be pressed into a generally elongated spiral groove as a flow restriction device the spiral itself forming a restriction but flow being varied by reducing the cross-sectional area of the groove effective at

that pressure by causing the resilient disc to bulge in to it.

The present invention relates generally to that type of drip feed device which uses a flexible disc to act to restrict the rate of flow through the device and to control the amount of flow in accordance with the pressure existing on the disc, but as the earlier devices, because of their generally long flow lines, tended to be blocked by sediment, the object of the invention is to provide a simple and effective device which can be simply constructed and assembled and in which blockage by impurities or sediment will be reduced to a low level.

A further feature is the control of fluid flow so that it will be accurately metered in proportion to the pressure existing in the supply line at any time.

The device according to this invention comprises a body having a cylindrical wall closed at one end by a transverse wall having an inlet orifice therethrough communicating with an inlet member projecting from the first wall on the opposite side to the cylindrical wall, and fitting over this body is a cap also having at least one cylindrical wall to engage the cylindrical wall of the body and having a transverse wall across it parallel to the transverse wall of the body to form between them a chamber, the second wall having an outlet orifice through it, and in the chamber a control member having a perimeter wall arranged to engage on one side the transverse wall on the body and on the other side the

transverse wall on the cap and having across it a resilient membrane disposed between the inlet of the first wall and the outlet of the second wall and having a metering orifice through the membrane, the transverse wall on the cap having a raised seat formed around the orifice, and in the seat a metering groove whereby when the membrane is pressed against the outlet orifice the groove meters flow in proportion to the amount the membrane is urged into the metering groove.

In order, however that the invention will be fully understood an embodiment thereof will now be described with reference to the accompanying drawings in which:-

FIG. 1 is a perspective view of such an embodiment,

FIG. 2 is a central transverse section therethrough,

FIG. 3 is an exploded view of FIG. 2,

FIGS. 4 and 5 are respectively an underside view of the cap and a plan view of the control member, and

FIG. 6 shows diagrammatically various shapes of grooves.

The device comprises a body 1 having a transverse disc-like wall 2, on one side of which is a centrally placed inlet member 3 adapted to be inserted through the wall of a supply line, and on the other side of which is an upstanding annular wall 4 adapted

to be engaged by a cylindrical wall 5 of a cap 6. The cap 6 also has an outer annular wall 7 concentric with the inner annular wall 5 to form a space therebetween into which the upstanding annular wall 4 of the body 1 is engaged. A screw thread 8 on the outside of the annular wall 4 engages an internal screw thread 9 in the outer wall 7 of the cap 6 to allow the cap to be readily positioned on the body 1, and when required to be removed therefrom.

The cap 6 has across it a transverse wall 10 which has an annular seat 11 formed on one side of it and an annular outlet member 12, having an outlet aperture 13 therethrough, on the other side of it generally coaxial with the inlet member 3 so that there is formed between the transverse wall 10 on the cap 6 and the transverse wall 2 on the body 1 a chamber 14 into which can be placed the control member 15 to regulate the flow through the drip feed device.

The control member 15 is disc shaped having a perimeter wall 16 and projecting across the opening, defined by the perimeter wall 16, a flexible membrane 17, the perimeter wall 16 being so proportioned that it forms a seal between the transverse wall 10 of the cap 6 and the transverse wall 2 of the body 1, the membrane 17 extending across this chamber 14 at about the centre of the chamber to divide the chamber into a first space 18 and a second space 19, the first space 18 communicating with the inlet member 3 and the second space 19 communicating with the outlet aperture 13 of the outlet member 12.

The membrane 17 has through it a metering aperture 20 near the perimeter wall 16 to allow fluid from the first space 18 to flow into the second space 19 into which the annular seat 11 extends. The membrane 17 is preferably centrally positioned in the perimeter wall 16 to be reversible.

The chamber 14 is thus divided into two parts by the membrane 17, which membrane is normally, when no flow occurs, positioned adjacent to the annular seat 11 but is urged on to the annular seat when fluid pressure in the space 18 exceeds fluid pressure in the space 19.

The flexible membrane 17 of the control member 15 is thus so positioned in relation to the annular seat 11 that when pressure is exerted by the fluid on this flexible membrane 17 the membrane is pushed against the annular seat 11, and if the seat 11 was provided with a planar face over all of its area, fluid flow would be cut off, but to allow a flow through the device at such time the face of the seat 11 is provided with one or more grooves 22, preferably one as shown in the drawings, which groove 22 may be of somewhat rectangular cross-section so that a flow channel is formed through it.

In this way fluid can flow from the space 18 through the metering aperture 20 to the space 19 and thence to the outlet aperture 13 of the annular outlet member 12 but with a restriction caused by the groove 22 through which flow must occur to the outlet aperture 13, the amount of restriction varying in proportion to the force with which the flexible membrane is urged against the annular seat 11 and into the groove 22.

The annular outlet 12 has a socket 30 into which a distributor tube can be engaged if fluid from the outlet aperture 13 is to be piped to a remote area.

Thus there is provided a simple and effective device which has a control member 15 dividing a chamber 14 into a first space 18 and a second space 19 with the perimeter wall 16 of the control member such that it forms a seal between the transverse wall 10 of the cap 6 and the transverse wall 2 of the body 1 around the outside of this space.

As the cap 6 screws on to body 1, it forces the transverse wall 10 of the cap 6 and the transverse wall 2 of the body 1 onto the perimeter wall of the control member 15 to effect a liquid-tight seal, the seal increasing with fluid pressure because pressure acts from the first space 18 and second space 19 outwards against the inside of the perimeter wall 16 to force the perimeter wall 16 against the cylindrical wall 5.

Also the walls 4 and 5 form a seal to prevent fluid leaving the device, and the walls 4 and 5 can be slightly tapered to interengage with an interference fit as the cap 6 is screwed on to the body 1.

The control member 15 can be formed of rubber or a rubber-like substance or a resilient plastic and, as said, while a single groove 22 may be sufficient for the purpose, it would be possible to use more than one groove or channel but the basic principle remains the same in that the membrane 17 is forced against the

annular seat 11 by the fluid pressure and ensures that a control of the flow through the groove 22 exists in proportion to the pressure exerted on the flexible membrance 17.

Variations of this type can readily be effected within the spirit of the invention and it will be realised for instance that the metering aperture 20 through the flexible membrane 17, which allows flow of fluid from the first space 18 to the second space 19, can be of particular shape such as having a conical entrance and a plain bore exit but such variations will be within the spirit of the invention. Generally it is preferred to have a plain metering aperture 20 to allow the button 15 to be inverted.

Similarly the cross-sectional shape of the groove or grooves 22 can be varied as shown in FIG. 6 where at A is shown a rectangular groove 22, at B a Vee shaped groove 22' and at C a rectangular groove 22'' having curved lead-in edges for the groove 22 to allow flow rates to be selected for different fluid pressure changes.

The body 1 has lugs 24 projecting outwardly from it to allow it to be locked to a line or hose through the wall of which the inlet member 3 is inserted, the lugs having apertures 25 therethrough.

In the embodiment shown the inlet member 3 is formed as a spear having an expanded conical end 26 which has its axis inclined to the axis of the inlet member 3 as shown to allow the inlet channel 27 to break

through the side of the conical end 26, a flat 28 being conveniently formed on the conical end 26 to give greater protection against blockage of the inlet channel 27 during piercing of a flow line to which the device is to be fitted. The inlet member 3 can be positioned to have the inlet channel 27 face the direction of movement of fluid in a line or hose, or the device can be turned to have the flat 28 turned out of the direction of flow. The flat 28 is preferably in line with the two lugs 24 to allow easy selection of the position of the flat but could be at a different orientation.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A pressure-regulated feed device for irrigation purposes having a body (1) and a cap (6) adapted to form a chamber (14) between them in which is housed a flow control button (15) which is fluid pressure actuated to restrict flow proportionally to the pressure exerted on the button (15) characterised by

a body having a cylindrical wall (4) closed at one end by a transverse wall (2) having an inlet member (3) projecting from that side of the transverse wall (2) opposite to the cylindrical wall (4)

a cap (6) having at least one cylindrical wall (5) to engage the said wall (4) of the body and having a transverse wall (10) across it parallel to the transverse wall (2) of the said body (1) to form between them a chamber (14), the said wall (10) having an outlet aperture (13) through it, and

a control member (15) in the said chamber having a perimeter wall (16) arranged to engage on one side the transverse wall (2) on the said body (1) and on the other side the transverse wall (10) on the said cap (6), and having across it a resilient membrane (17) disposed between the inlet member (3) of the said transverse wall (2) on the said body (1) and the outlet aperture (13) of the transverse wall (10) of the said cap (6) and having a metering aperture (20) through the said membrane (17) remote from the said outlet aperture (13),

a seat (11) on the transverse wall (10) of the said cap (6) formed around the outlet aperture (13) of the said cap (6) and disposed within the said chamber (14), and in the said seat (11) a metering groove (22) whereby when the membrane (17) is pressed against

the said seat (11) by fluid pressure the groove (22) meters flow in proportion to the amount the said membrane (17) is urged into the said metering groove (22).

2. A pressure-regulated feed device according to claim 1 further characterised in that the said cap (6) has an outer wall (7) concentric with the wall (5) to form a cavity therebetween to accommodate the cylindrical wall (4) of the said body (1), said wall (7) of the said cap (6) having an internal screw thread (9) engaging an external screw thread (8) on the said cylindrical wall (4) of the said body (1) to allow the said cap (6) to have its transverse wall (10) urged down on to the said perimeter wall (16) of the said control member (15) and to urge the perimeter wall (16) of the said control member (15) on to the transverse wall (2) of the said body (1) whereby to prevent fluid flow around the said perimeter wall (16).

3. A pressure-regulated feed device according to claim 1 or 2 further characterised in that the outlet aperture (13) has an annular outlet member (12) communicating with the said outlet aperture (13) having in its outer end a socket (25) to receive a distributor tube.

4. A pressure-regulated feed device according to claim 1, 2 or 3 further characterised in that the said inlet member (3) has a conical end (26) expanded rearwardly from its point having its axis inclined to the axis of the said inlet member (3) whereby to cause the inlet channel (27) to open through the side of the expanded end (26) remote from the point.

5. A pressure-regulated feed device according to claim 4 further characterised in that the said inlet channel (27) is arranged in line with lugs (24) extending from two sides of the said body (1).

6. A pressure-regulated feed device according to claim 1 further characterised in that the said control member (15) is made of natural or synthetic rubber or a resilient plastic.

7. A pressure-regulated feed device according to claim 1 further characterised in that the said control member (15) has its flexible membrane (17) positioned centrally in the said perimeter wall (16) to be reversible.

8. A pressure-regulated feed device according to any preceding claim further characterised in that the said membrane (17) is positioned clear of the annular seat (11) when no pressure fluid is present whereby to give a flushing action of the said groove (22) during at least the start of fluid flow through the said chamber (14), said groove (22) in the said seat (11) being of rectangular cross-section.

9. A pressure-regulated feed device according to any one of preceding claims 1 to 7 further characterised in that the said membrane (17) is positioned clear of the annular seat (11) when no pressure fluid is present whereby to give a flushing action of the said groove (22) during at least the start of fluid flow, the said groove (22') in the seat (11) being Vee shaped in cross-section.

10. A pressure-regulated feed device according to any one of preceding claims 1 to 7 further characterised in that the said membrane (17) is positioned clear of the annular seat (11) when no pressure fluid is present whereby to give a flushing action of the said groove (22) during at least the start of fluid flow through the said groove (22) in the said seat (11), the said groove (22'') being contoured to have inwardly curved faces to selectively progressively regulate flow in relation to fluid pressure.

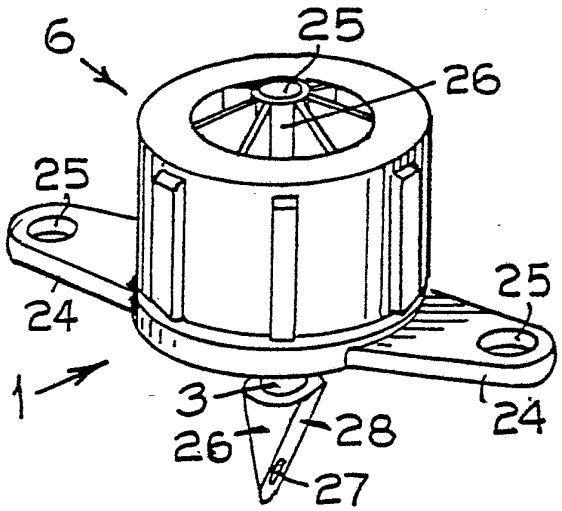

FIG. 1

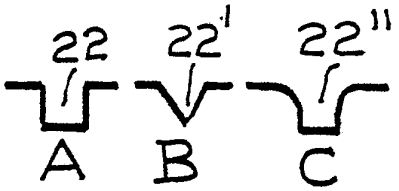

FIG. 6

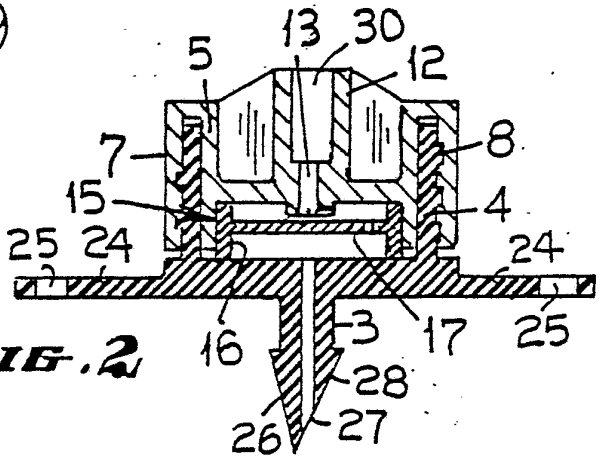

FIG. 2

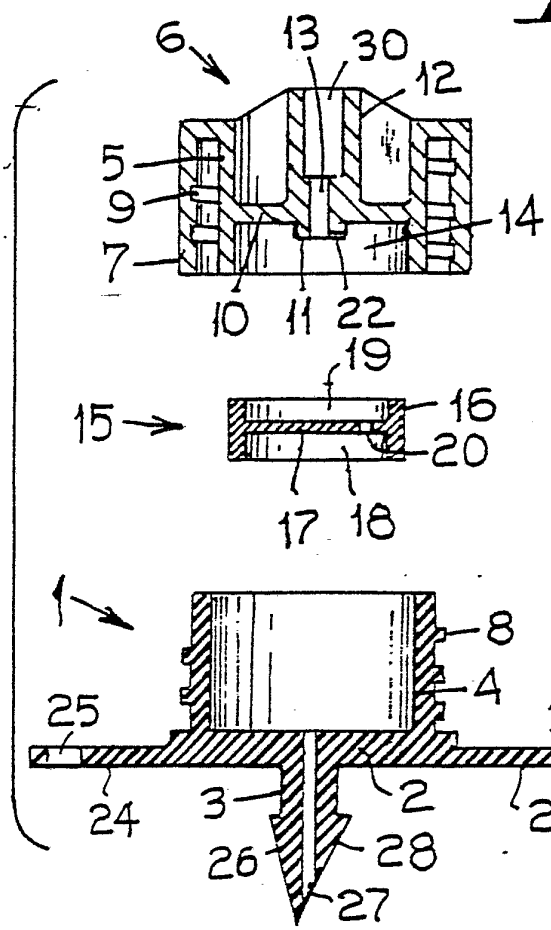

FIG. 3

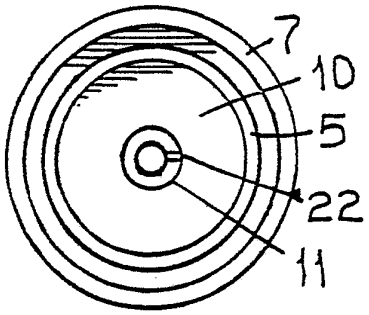

FIG. 4

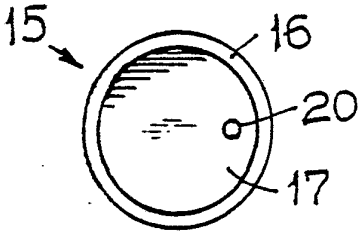

FIG. 5

INTERNATIONAL SEARCH REPORT

International Application No PCT/AU82/00100

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl[3] A01G 25/16

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC	A01G 25/16, 25/02, 25/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

AU: IPC as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
A	AU,A 37128/78 (DEUTSHER) 20 December 1979 (20.12.79) (& DE 2829013)	(1)
A	AU,B, 65283/74 (483758) (IPLEX PLASTIC) 7 August 1975 (07.08.75)	(1)
Y	AU,B, 40918/72 (471125) (TODD) 11 October 1973 (11.10.73)	(1-10)
X,Y	AU,A, 51408/79 (SUB TERRAIN IRRIGATION) 14 August 1980 (14.08.80) (& G.B. 2018113)	(1-10)

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IV. CERTIFICATION

Date of the Actual Completion of the International Search [1]	Date of Mailing of this International Search Report [2]
6 August, 1982 (06.0882)	16 August 1982 (16.08.82)
International Searching Authority [1]	**Signature of Authorized Officer [20]**
Australian Patent Office	R.E.W. May

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