Sept. 25, 1962 L. J. EAGAR 3,055,387

INTERMITTENT FLOW DEVICE

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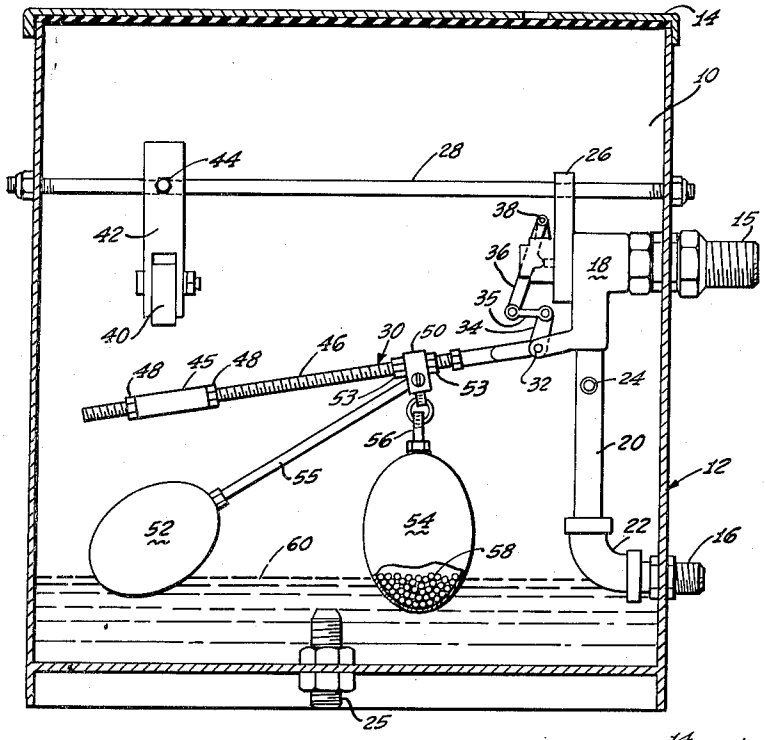


Fig. 1

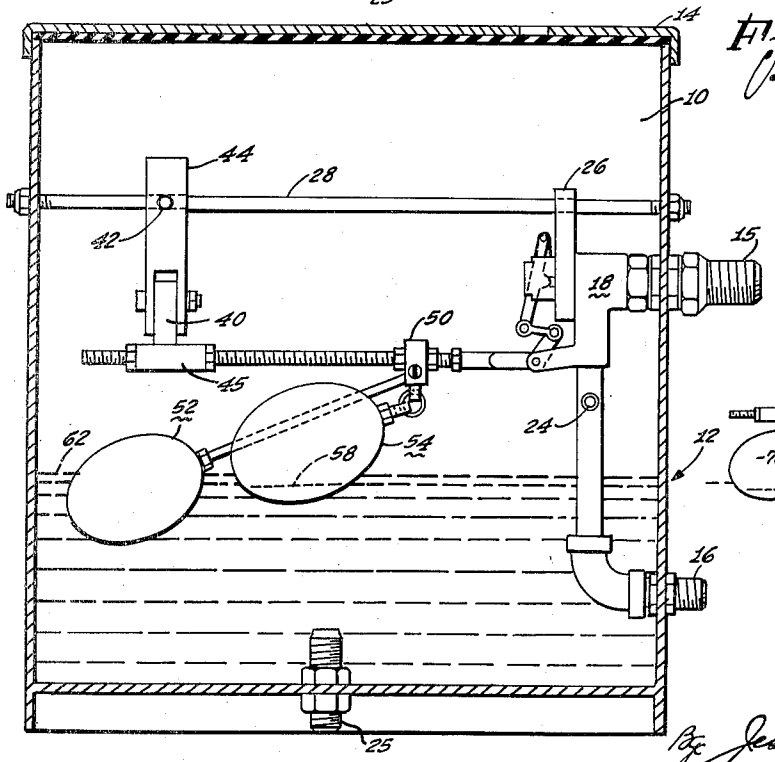


Fig. 2

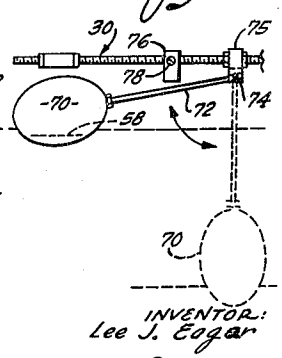


Fig. 3

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INTERMITTENT FLOW DEVICE

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This invention relates to a control device for automatic cyclic operation to release liquid from a source for predetermined time periods at a predetermined frequency. While the invention is widely applicable for intermittent flow control it has been initially embodied as a device for automatic intermittent operation of an irrigation system such as a sprinkling system. This initial embodiment of the invention has been selected for the present disclosure and will provide adequate guidance for those skilled in the art who may have occasion to apply the same principles to other specific purposes.

The broad object of the invention is to provide a wholly mechanical automatic intermittent control means as distinguished from a mechanism employing electrical components and to provide such a mechanical control means of utmost simplicity that is readily adjustable and that may be depended upon for trouble-free operation over indefinitely long service periods.

To achieve this object the invention includes a valve to release the liquid from a source, means to divert a minor portion of the released liquid to a control chamber at a first given rate and means to release the liquid from the control chamber at a second lower given rate. Thus as long as the release valve is open the control chamber fills with liquid at the difference between the two rates and when the release valve is closed, the control chamber empties at the lower rate.

Cyclic filling and emptying of the control chamber for control of the release valve is accomplished by using float means to close the release valve in response to rise of the liquid level in the control chamber to a predetermined high level and by further providing means to delay the opening of the valve until the liquid level in the control chamber drops to a predetermined low level. Thus the release valve is open during the time periods during which the liquid level rises and is closed during the alternate time periods when the liquid level is dropping.

A feature of the invention is the simplicity of the means for delaying the opening of the release valve until the liquid falls to a desired low level. A latch is provided to hold the release valve closed in response to rise of the liquid to a high level. Additional means is provided which is buoyed up by the liquid until the liquid drops to a low level whereupon the weight of the additional means is transferred to the latch to release the latch for opening of the valve. Rather than employ a spring latch or spring pressed detent type of latch, I employ as a primary feature of the preferred practice of the invention a permanent magnet which is overcome by the transferred weight. Such a holding means has no moving parts and may be depended upon for reliable operation indefinitely.

The various features and advantages of the invention may be understood from the following detailed description and the accompanying drawing.

In the drawing, which is to be regarded as merely illustrative:

FIG. 1 is a side elevation of the presently preferred embodiment of the invention with a side wall removed to reveal the control mechanism, the parts being shown with the liquid at the minimum level and with the float means at its lowermost position;

FIG. 2 is a similar view with the float means at its uppermost position and with the liquid at its maximum level; and

FIG. 3 is a fragmentary view illustrating a modification of the invention.

The initial embodiment of the invention shown in the drawings is employed as an automatic control for periodically operating a sprinkler system. For this purpose, a control chamber 10 is formed by a tank 12 having a removable lid 14. An upper nipple 15 is suitably mounted in the wall of the tank for connection to a water supply or pressurized water system. A second lower nipple 16 is also suitably mounted in the wall of the tank for connection to the sprinkler system that is to be operated intermittently.

Inside the tank 12 the upper nipple 15 is connected to the inlet side of a release valve 18 and the outlet side of the release valve is connected in turn to the lower nipple 16 by a short pipe 20 and an elbow 22. The short pipe 20 is equipped with a suitable aperture to divert a small portion of the liquid from the release valve 18 into the control chamber 10 at a first given rate. Preferably such an aperture is adjustable or variable and for this purpose an orifice fitting 24 may be used. Such an orifice member may be replaced whenever desired by an orifice member of a different capacity to change the cyclic operation of the intermittent control.

The tank has a drainage aperture to discharge water from the control chamber at a second lower given rate. Here again, such an aperture is preferably adjustable or variable for the purpose of adjusting the cyclic operation. For this purpose, the drainage aperture of the tank may be in the form of an orifice member 25 which may be replaced by an orifice member of different flow capacity whenever desired.

The release valve 18 is a well known type of float valve that is widely available in commerce. The release valve 18 is secured by a bracket 26 to an upper horizontal support rod 28. In a well known manner, the release valve 18 is operated by a control member in the form of a float arm 30 that is mounted on a pivot 32. In the construction shown, the float arm 30 has an angular extension 34 connected by a link 35 to a lever 36 that is fulcrumed on a pivot 38. Thus when the float arm 30 rises from the lower position shown in FIG. 1 to the upper position shown in FIG. 2, the lever 36 is swung against the release valve 18 to close the release valve and when the float arm drops back to the position shown in FIG. 1, the lever 36 permits the release valve to open.

A permanent magnet 40 is mounted on the previously mentioned support rod 28 by a suitable bracket 42. The bracket 42 is releasably fixed on the support rod by a screw 44 which may be temporarily loosened to permit the bracket to be shifted along the support rod.

A suitable armature 45 is mounted on the float arm 30 for cooperation with the permanent magnet 40. Preferably the armature 45 is adjustable longitudinally of the float arm and for this purpose the float arm is formed with a screw thread 46 and extends slidingly through the armature. The armature 45 is normally immobilized on the float arm by a pair of clamping nuts 48 which may be temporarily loosened for shifting the armature.

A bracket 50 to carry a pair of floats 52 and 54 is mounted on the float arm 30 in the same adjustable manner as the armature 45. Thus float arm 30 extends through the bracket 50 in a sliding manner and the bracket is immobilized on the float arm at a selected position by a pair of clamping nuts 53. The float 52 is rigidly mounted on the bracket 50 by a rigid but adjustable auxiliary arm 55 but the float 54 is carried by an auxiliary arm 56 that is loosely pivotally connected to the bracket by a loose ring 57.

The float 52 may be a conventional float of the type commonly employed in flush tanks. The float 54 may

be a hollow float, the interior of which is accessible to contain a selected quantity of small lead shot **58** to serve as a ballast.

The manner in which the control device functions to serve its purpose may be readily understood from the foregoing description. Considering the operating cycle as starting with the water in the control chamber **10** at the minimum liquid level **60** and with the float arm **30** and the two floats **52** and **54** at their lowermost positions shown in FIG. 1, it is apparent that the release valve **18** is open to deliver water under pressure to the outlet nipple **16** and that a portion of the water from the release valve is diverted to the control chamber **10** by the orifice member **24** in the short pipe **20**. The resulting rise in the liquid level in the control chamber is retarded by the outflow of water through the second orifice member **25** at a lower rate than the rate at which the water is diverted into the control chamber. Thus the water in the control chamber rises from the minimum level **60** to the maximum level **62** at a rate which is determined by the difference between the rate of inflow through the orifice fitting **24** and the lower rate of outflow through the orifice fitting **25**.

When the liquid level in the control chamber **10** approaches the maximum liquid level **62**, the armature **45** is attracted to the fixed permanent magnet **40** and the elevated float arm **30** closes the release valve **18** to terminate the first portion of the operating cycle during which water under pressure from the source is delivered to the sprinkler system through the outlet nipple **16**. The various parts are then in the positions shown in FIG. 2.

In the absence of inflow through the orifice member **24**, the liquid level in the control chamber drops at a rate determined by the rate of outflow through the orifice fitting **25**. The float arm **30** and the rigidly connected float **52** do not follow the lowering of the liquid level, however, because they are held up by the permanent magnet **40**. The loosely connected float **54**, however, does follow the lowering liquid level. Eventually as the receding liquid level approaches the minimum liquid level **60**, the loosely connected float **54** reaches its limit of downward movement relative to the float arm **30** and hangs suspended. Further lowering of the liquid level lowers the buoyancy force exerted on the float **54** and causes the weight of the float to be progressively transferred to the float arm **30** until the transferred weight overcomes the magnetic force of the magnet to permit the float arm **30** and the two floats **52** and **54** to drop back to the positions shown in FIG. 1 for starting a new cycle of operation. The parts are so adjusted that the holding force of the permanent magnet **40** is slightly below the gravitational force of the float arm **30** and the two floats **52** and **54** when the lowering liquid level approaches the minimum liquid level **60**.

It is a simple matter for any person skilled in the art to adjust the various parts to cause the permanent magnet **40** to be overcome automatically as the liquid level drops to the minimum level. Thus the tendency of the permanent magnet to hold the float arm **30** in its uppermost position may be decreased by shifting the bracket **42** and the armature **45** towards the release valve **18** and vice versa. In like manner, the bracket **50** may be shifted on the float arm **30** towards the release valve **18** to reduce the gravitational force of the two floats on the float arm and vice versa. It is also possible to replace the magnet **40** with a stronger or weaker magnet for varying the cycle of operation. The relative durations of the two stages of the operating cycle may be varied by changing the orifice members **24** and **25**. Increasing the size of the orifice member **24** and decreasing the size of the orifice member **25** increases the rate at which the water-level rises in the control chamber and thus reduces the duration of the periods in which water is supplied to the irrigation system. On the other hand, decreasing the size of the orifice member **24** and increasing the size of the orifice member **25** reduces the rate at which the liquid level rises and thus prolongs the periods during which water is supplied to the sprinkler system. The frequency with which the sprinkler system is operated may be reduced by reducing the rate at which the water level falls in the control chamber when the release valve **18** is closed. Thus, reducing the size of the orifice member **25** reduces the frequency of sprinkler operation and vice versa. If the orifice member **25** is reduced in size to reduce the frequency of the sprinkling operations, the size of the orifice fitting **24** must also be reduced if the duration of the periods of sprinkler operation is to remain unchanged. The described embodiment of the invention may be adjusted, for example, to operate a sprinkler system for thirty minutes every twenty-four hours or for a few minutes every four or five hours.

FIG. 3 shows how the described embodiment of the invention may be modified by using a single float **70** instead of the two previously mentioned floats **52** and **54**. The rest of the mechanism including the float arm **30** remains unchanged. The single float **70** is rigidly mounted on the end of an arm **72** which swings about a pivot **74** on a bracket **75** that is adjustable along the length of the float arm in the same manner as the previously mentioned bracket **50**. The pivot **74** permits the auxiliary arm **72** to swing only in a vertical plane that includes the float arm **30**. Thus the float **70** is free to swing between a lower position shown in dotted lines and an upper position shown in solid lines, at which upper position the auxiliary arm **72** swings against a stop member **76**. The stop member **76** is adjustably secured on the float arm **30** by a setscrew **78**.

When the liquid level rises, the float **70** forces the auxiliary arm **72** against the stop **76** thereby to cause the float arm **30** to swing upward and thus eventually close the release valve when the liquid reaches the desired maximum level. During the period in which the liquid level is falling while the float arm **30** is held in its uppermost position by the permanent magnet, the float **70** is free to swing to follow the falling liquid level. Eventually the liquid level drops sufficiently to cause enough of the weight of the float **70** to be transferred to the float arm **30** to overcome the permanent magnet. Thus this modified form of the invention functions in essentially the same manner as the first described embodiment.

My description in specific detail of the selected embodiments of the invention will suggest various changes, substitutions and other departures from my disclosure within the spirit and scope of the appended claims. For example, a spring pressed latch may be substituted for the permanent magnet, the latch being released automatically by the hinged float **70** of FIG. 3 when the float swings downward to approach its vertical position.

I claim as my invention:

1. In a device for releasing a liquid intermittently from a source, the combination of: a valve to release the liquid from the source; a chamber to hold a quantity of the liquid; means to divert a portion of the released liquid to the chamber at a given rate when said release valve is open; means to release liquid from the chamber at a rate less than said given rate so that the liquid level in the chamber rises when the release valve is open and falls when the release valve is subsequently closed; a control member for said valve movable between a valve-opening position and a valve-closing position; float means for contact with the liquid in the chamber to shift the control member to its valve-closing position in response to rise of the liquid to a relatively high level; and means to releasably hold said control member at its valve-closing position in response to shift of the control member to that position, said float means including a float operatively connected to said control member with freedom for a range of movement relative to the control member

to permit the float to progressively emerge from the liquid as the falling liquid level approaches a relatively low level with corresponding progressive transfer of the weight of the float to the control member, said retaining means being releasable in response to said transfer of weight, said holding means being a yielding means in the form of a permanent magnet and a cooperating armature to yield to the transfer of weight of said float.

2. In a device for releasing a liquid intermittently from a source, the combination of: a valve to release the liquid from the source; a chamber to hold a quantity of the liquid; means to divert a portion of the released liquid to the chamber at a given rate when said release valve is open; means to release liquid from the chamber at a rate less than said given rate so that the liquid level in the chamber rises when the release valve is open and falls when the release valve is subsequently closed; an operating member movable between a relatively low valve-opening position and a relatively high valve-closing position; two cooperating elements comprising a permanent magnet and an armature therefor, one of said two elements being carried by said operating member, the other of said two elements being fixed at a position for abutment by said one element at the valve-closing position of the operating member to hold the operating member elevated at its valve-closing position; and responsive means to raise said operating member in response to rise of the liquid level in the chamber and to lower the operating member in response to fall of the liquid level, said responsive means including a movably mounted float to ride on the liquid in the tank and means connecting the float with the operating member to limit the distance

between the float and the operating member thereby to suspend the float from the operating member when the liquid level reaches a relatively low level in the chamber, the weight of said float being sufficient to overcome said permanent magnet, whereby the float means causes the operating member to close the valve when the liquid level reaches a predetermined maximum and the valve then remains closed until the liquid falls to a predetermined minimum.

3. A combination as set forth in claim 2 in which said operating member is a lever and in which said float means is adjustable to vary the moment applied to the lever by the float means.

4. A combination as set forth in claim 2 in which said operating means is a lever and the element thereon is adjustable in position longitudinally of the lever to vary the moment applied to the lever by the permanent magnet.

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