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AUTOMATIC VALVES

Filed June 3. 1960

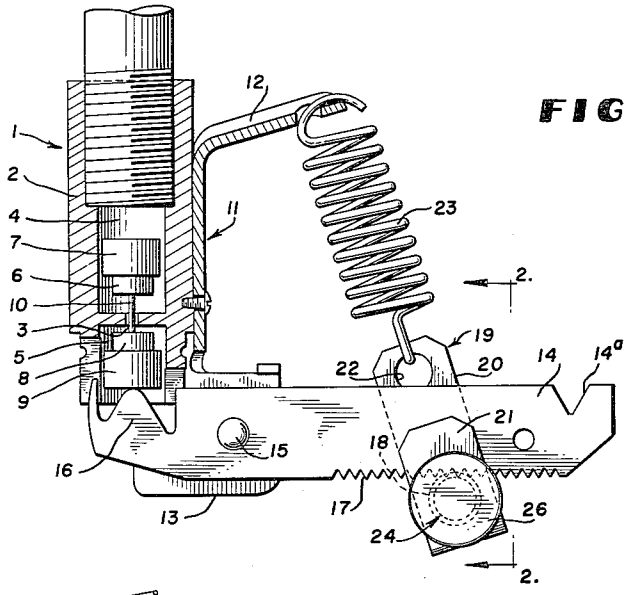


FIG. 1

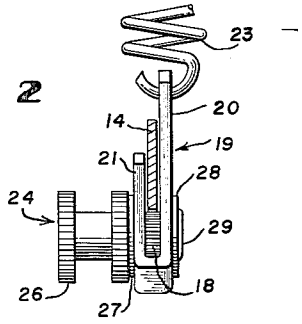
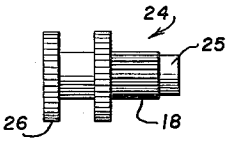


FIG. 2

FIG. 3



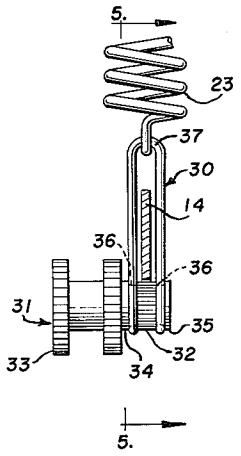
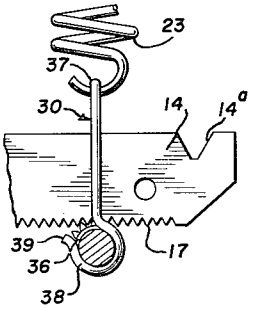


FIG. 4

FIG. 5



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AUTOMATIC VALVES

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This invention relates to improvements in automatic valves and more particularly to valves adapted to maintain a substantially constant level of liquid in a container, such as a poultry watering trough or the like, the invention being especially directed to valves wherein actuation is accomplished automatically and directly in response to changes in the weight of liquid in the container. Valves of this general type are seen, for example, in Reissue Patent 23,447, issued December 25, 1951, to Pruitt.

Automatic valves of this type are normally associated with a container in such fashion that the combined weight of the container and the water therein acts in opposition to a biasing spring to determine the position of the movable element or elements of the valve. Until recent times, such valves have been so designed that the weight of the container when empty was insufficient to open the valve. Accordingly, it was necessary to employ some means, usually a manually set latch, to hold the valve in open position until sufficient water collected in the container to allow automatic operation of the valve in response to the combined weight of container and water. Such prior art arrangements have the advantage that the valve is automatically closed, cutting off the flow of water, in the event that the container should be accidentally displaced or knocked over. On the other hand, such arrangements have the disadvantage that a manual action is required to place the device in operation.

Poultry growers, who make up one of the largest groups presently employing valves of the type referred to, have now adopted watering trough constructions of such nature that the danger of the trough being upset or otherwise accidentally displaced is substantially eliminated, so that the need for a manual starting latch has been largely eliminated. In view of such changes in the requirements of the users of these valves, it is accordingly desirable to employ such valves without the starting latch so that the valve will be self-starting. Insofar as we are aware, however, no commercially satisfactory latchless valve of this type has heretofore been proposed other than that described in copending application Serial Number 747,663, filed July 10, 1958, by James B. Godshalk.

Conventional valves of the type referred to are not capable of proper operation without a starting latch because, if the biasing spring is so made that the valve opens upon application of the weight of the empty container, the valve then closes with too small a quantity of water in the container. On the other hand, if the spring is adjusted so that the valve will not close until the water or other liquid reaches an adequate depth, then the force applied by the biasing spring is so great that the weight of the empty container is inadequate to cause the valve to open. Among poultry growers, the problem is complicated by the fact that, to be thoroughly satisfactory on a commercial basis, such valves must be capable of use with any of various watering troughs differing in weight and water capacity.

A general object of the present invention is to devise an automatic valve of the type referred to which requires no starting latch, yet is capable of satisfactory automatic operation with containers of various designs and weights.

Another object is to provide an automatic valve of the type comprising a pivoted valve-actuating arm biased toward a valve-closing position by a spring and on which the weight of a container, to which the valve delivers liquid, acts to apply a force in a direction opposing the spring, such valve embodying novel means for effecting a very fine, continuous adjustment of the point of connection of the spring to the actuating arm, such adjustment being lengthwise of the arm so that the biasing effect of the spring can be changed by varying the moment arm through which the spring acts.

A further object is to devise a construction as just described wherein the attachment of the spring to the actuating arm is via a member urged into rolling engagement with the actuating arm by the action of the biasing spring, rolling movement of the said member being restrained by frictional means.

In order that the manner in which these and other objects are attained in accordance with the invention can be understood in detail, reference is had to the accompanying drawings, which form a part of this specification, and wherein;

FIG. 1 is a view, partly in vertical section and partly in elevation, of an automatic poultry watering valve constructed in accordance with one embodiment of the invention;

FIG. 2 is a sectional view taken on line 2—2, FIG. 1, with some parts shown in elevation;

FIG. 3 is a side elevational view of a pinion member employed in the device of FIG. 1;

FIG. 4 is a view similar to FIG. 2 illustrating a modified form of the pinion means employed in the valve of FIG. 1, and

FIG. 5 is a view, partly in elevation and partly in vertical section, taken on line 5—5, FIG. 4.

Referring now to the drawings in detail, and first to FIGS. 1–3 thereof, it will be seen that the embodiment of the invention here illustrated comprises a generally tubular housing 1 having an interior partition 2 provided with a central bore 3. There is thus provided, on one side of the partition 2, an upper valve chamber 4, and, on the other side of partition 2, a lower valve chamber 5. Disposed in upper valve chamber 4 adjacent partition 2 is a resilient valve gasket 6 and there is provided, immediately above the gasket 6, a weight 7. Similarly, valve chamber 5 contains a resilient gasket 8 and, below the gasket, a weight 9. Extending through bore 3 is a pin 10 of smaller transverse cross-section than the bore 3 and of a length such as to project beyond the limits of the bore into engagement with the gaskets 6 and 8.

Rigidly secured to the outside of housing 1 is a bracket 11 having at its top a laterally directed projection 12 and at its bottom a laterally projecting ear 13. A valve actuating arm 14 is pivoted at 15 to ear 13 and has one end 16 extending within valve chamber 5 below weight 9. The other end portion of arm 14 is elongated and projects laterally away from valve body 1. The arm 14 is formed, as by stamping, from flat, stiff sheet material, and is provided at its outer end with a notch 14a from which the watering trough is suspended in the usual manner.

The lower edge of arm 14 is straight and is provided over a substantial portion of its length with teeth, as indicated at 17, so that the arm, in effect, presents a downwardly facing rack portion.

Meshed with the rack teeth of arm 14 is a pinion 18 mounted on a pinion carrier 19 for rotation about a horizontal axis extending at right angles to arm 14. The pinion carrier is a sheet metal member including two spaced parallel arms 20 and 21 disposed each on a different side of actuating arm 14, arm 20 extending to a

point about actuating arm 14 and being provided with an opening 22 in which is hooked the lower end of a helical biasing spring 23, acting in tension. The biasing spring extends upwardly from the actuating arm, lying generally in the plane of pivotal movement thereof, and has its upper end hooked in the tip portion of projection 12 of bracket 11, as shown. The upper end of the spring thus being fixed with respect to the valve body, it will be apparent that the tension force of the biasing spring is effective both to maintain pinion 18 in mesh with the rack teeth 17 on the actuating arm and to bias the actuating arm upwardly toward a position in which movable valve gasket 6 will be seated on partition 2 to close the valve. The biasing force of spring 23 is thus applied to the actuating arm via the pinion carrier 19 and the pinion 18.

The two parallel arms 20 and 21 of pinion carrier 19 include portions disposed below the actuating arm and provided with aligned circular bearing openings. As will be clear from FIG. 3, pinion 18 constitutes an integral portion of a pinion member shown in detail in FIG. 3 and indicated generally at 24. The axial length of pinion 18 is greater than the distance between the outer faces of pinion carrier arms 20, 21, and the pinion is disposed directly in the aligned circular bearing openings in arms 20 and 21, the crests of the teeth of the pinion being sufficiently blunt to allow the pinion to turn easily in the bearing openings. At the free tip of the pinion, pinion member 24 includes a plain portion 25. At the opposite end of the pinion, member 24 includes an integrally formed operating knob 26.

The combination of the pinion member and pinion carrier, is assembled by first placing on the pinion a thin, normally cupped, spring washer 27, then inserting the pinion through the aligned bearing openings of the pinion carrier from the side of the carrier presented by arm 21, so that spring washer 27 engages the outer face of that arm. A plain washer 28 is then placed over portion 25 of member 24, it being understood that portion 25 projects beyond the outer face of arm 20 of the carrier. The tip of portion 24 is then belled over by any suitable forming operation, as indicated at 29, FIG. 2, to complete the assembly, this latter operation being so carried out that spring washer 27 is compressed, between knob 26 and arm 21, to establish a frictional force tending to prevent rotation of pinion member 24 relative to pinion carrier 19.

To apply the combination of the pinion carrier and pinion member to the valve, the top end of spring 23 is attached to projection 12, the lower end of the spring is hooked in opening 22, the spring is extended by pulling on the pinion carrier until the actuating arm 14 can be brought between arms 20 and 21 of the carrier, and the spring is then allowed to relax, bringing the pinion into mesh with rack teeth 17. It will thus be apparent that, in addition to carrying pinion member 24, the arms 20 and 21 of the pinion carrier, being each disposed adjacent to a different side face of the actuating arm, serve to effectively center the pinion with respect to the rack teeth.

Manual rotation of knob 26 is of course effective to turn the pinion in either direction desired and, therefore, to cause the pinion, the pinion carrier and the lower end of the biasing spring to travel along the actuating arm. Thus, large or very small adjustments of the effective point of attachment of the spring to the actuating arm can easily be made in continuous, rather than step-by-step, fashion.

From FIG. 1, it will be noted that the combination of biasing spring 23 and pinion carrier 19 may extend at an angle other than 90° with respect to arm 14, in which event the spring force will tend to make the pinion member roll along the actuating arm until the 90° angle is attained. Such action would, of course, make it impossible to maintain the manually adjusted position of the pinion carrier. The frictional force provided by spring washer 27 is effective to prevent this free-rolling action of the pinion.

FIGS. 4 and 5 illustrate an embodiment of the invention employing a wire member 30 as the pinion carrier and eliminating both washers 27 and 28, FIG. 2, as well as making unnecessary the operation of deforming the tip of the pinion member in the manner hereinbefore described with reference to 29, FIG. 2. In this embodiment, the pinion member indicated generally at 31 is an integral element including pinion 32, operating knob 33 and plain cylindrical portions 34 and 35 disposed each on a different side of pinion 32. Each portion 34 and 35 is provided with a peripheral, outwardly opening groove, as indicated at 36, FIG. 5, the two grooves 36 each lying in a plane parallel to and adjacent to a different side face of the actuating arm 14, when the device is in assembled relation, as will be clear from FIG. 4.

Member 30 can be formed, for example, of relatively stiff, highly resilient music wire and has the general shape of a U with hooked ends. As seen in FIG. 4, the base of the U is indicated at 37 and constitutes means for retaining the adjacent end of biasing spring 23. The two arms of U-shaped member 30 extend in parallel relation each adjacent to a different face of actuating arm 14. Each arm of member 30 terminates in a circularly extending hook portion, as indicated at 38 in FIG. 5, the normal or relaxed diameter of each hook portion 38 being materially smaller than the diameter of the grooves 36. Portions 38 do not extend for complete circles but rather terminate in free guide tongues 39, FIG. 5, so that each hook portion 38 can readily be snapped into frictional engagement in a different one of the grooves 36. It will thus be clear that a spring wire member 30 serves all of the functions of pinion carrier 19, FIGS. 1 and 2, and additionally provides a frictional force tending to prevent rotation of the pinion member 31.

While the frictional force applied to the pinion member (by spring washer 27, FIG. 2 and by the resilient hooked ends 38, FIG. 5) is adequate to prevent the pinion member from rolling along the actuating arm under the force applied by the biasing spring, it will be understood that such frictional force can be overcome with relative ease by application of manual force on the operating knob to accomplish adjustment of the pinion along the toothed lower edge of the actuating arm.

In both embodiments of the device, rotation of the pinion is effective to provide continuous, rather than step-by-step, adjustment of the point of attachment of the lower end of the biasing spring in order to change the length of the moment arm through which the biasing spring acts. This, in effect, changes the ability of the spring to oppose the weight of the trough and any water contained therein and allows the valve to be operative with various types of water troughs which the purchaser of the valve may choose to employ therewith. Similarly, it will be understood that such fine continuous adjustment of the point of attachment of the lower end of the spring allows the operator a wider choice of water levels to be maintained automatically by the valve.

To accomplish satisfactory operation of the valve in self-starting fashion, it is necessary to maintain as high as possible the ratio between the "full trough weight," effective to close the valve by pivoting arm 14 downwardly, and the "empty trough weight," effective to pivot the actuating arm downwardly just enough to initiate flow of water through the valve. Under usual conditions, this ratio must be at least 2:1. The greater the capacity of the trough, the higher must be the ratio. This high ratio is necessary to obtain a self-starting action without a starting latch, on the one hand, and an adequate quantity of water in the trough, on the other hand. In view of the relatively low weight of the troughs or other containers involved, as compared to the full weight, it is highly desirable that the effective point of attachment of the biasing spring to the actuating arm be made adjustable to a position such that the biasing spring will be almost completely relaxed at the time the weight of the empty

trough is applied to accomplish initial opening of the valve.

While, for purposes of simplicity of illustration, the invention has been described as applied to a truly "double acting valve" of the general type disclosed in the aforementioned Reissue Patent 23,447, it is to be understood that the invention is equally applicable to all other types of automatic valves in which the actuating arm is movable from a first position, maintaining the valve closed, through an intermediate position, in which the valve is kept open, to a second position in which the actuating arm again maintains the valve closed.

We claim:

1. An adjusting device comprising

an actuating arm adapted to be pivoted to a body and to extend laterally therefrom;

a spring supporting member adapted to be secured to the body and to be spaced from said arm axially of the body,

said arm having an elongated edge on the side thereof opposite from said supporting member;

a tension spring having one end attached to said supporting member,

said spring extending toward said arm and at least generally in the plane of pivotal movement of said arm;

a carrier member including at least one portion disposed beside said arm and directed at least generally toward said spring;

a rotary adjusting member rotatably mounted on said carrier and having a peripheral portion disposed in rolling engagement with said elongated edge of said arm,

said adjusting member being disposed with its axis of rotation extending transversely relative to said arm,

the other end of said spring being connected to said portion of said carrier and said spring being operative to maintain said peripheral portion of said adjusting member in engagement with said elongated edge of said arm and to bias said arm pivotally in one direction;

means operatively arranged to restrain said rotary member against undesired rotation, and

means whereby said adjusting member can be rotated manually to cause said adjusting member, and therefore said other end of said spring, to travel along said actuating arm.

2. An adjusting device in accordance with claim 1 and wherein

said carrier member is of sheet metal and includes two spaced parallel arms provided with aligned openings through which said rotary member extends, one of said spaced parallel arms constituting said portion extending beside said actuating arm.

3. An adjusting device in accordance with claim 1 and wherein

said elongated edge of said arm is provided with a series of teeth extending longitudinally of said arm, and

said adjusting member is a pinion meshed with said teeth.

4. An adjusting device in accordance with claim 3 and wherein:

said pinion includes axially spaced portions disposed each on a different side of said arm,

said carrier member includes a spring wire member of U-shaped configuration with the legs of the U each extending on a different side of said arm and each terminating in a hook portion, said hook portions resiliently and frictionally embracing said axially spaced portions of said pinion member, and

said other end of said spring being connected to the base of the U of said member.

5. An adjusting device in accordance with claim 4 and wherein

each of said axially spaced portions of said pinion member is provided with a peripheral groove, said hook portions of said spring wire member each being resiliently engaged in a different one of said grooves.

6. An adjusting device in accordance with claim 1 and wherein

said means operatively arranged to restrain said rotary member against undesired rotation comprises means to apply a frictional force to said rotary member.

7. An adjusting device in accordance with claim 6 and wherein

said means to apply a frictional force comprises a spring washer operatively engaged between said rotary member and said carrier member.

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