May 10, 1938. H. KELLY 2,116,605

SNAP ACTION MECHANISM

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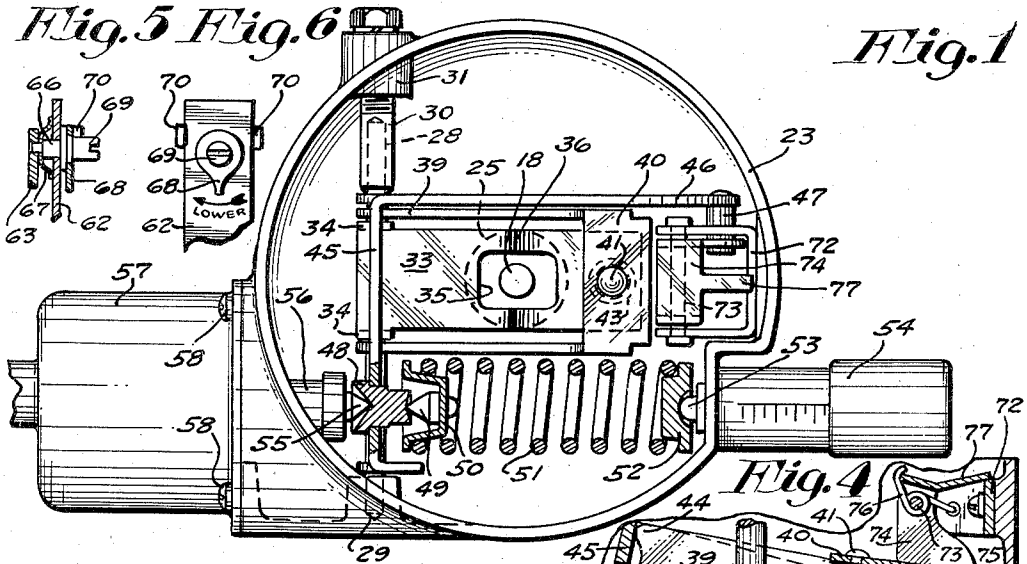


Fig. 5 Fig. 6

Fig. 1

Fig. 4

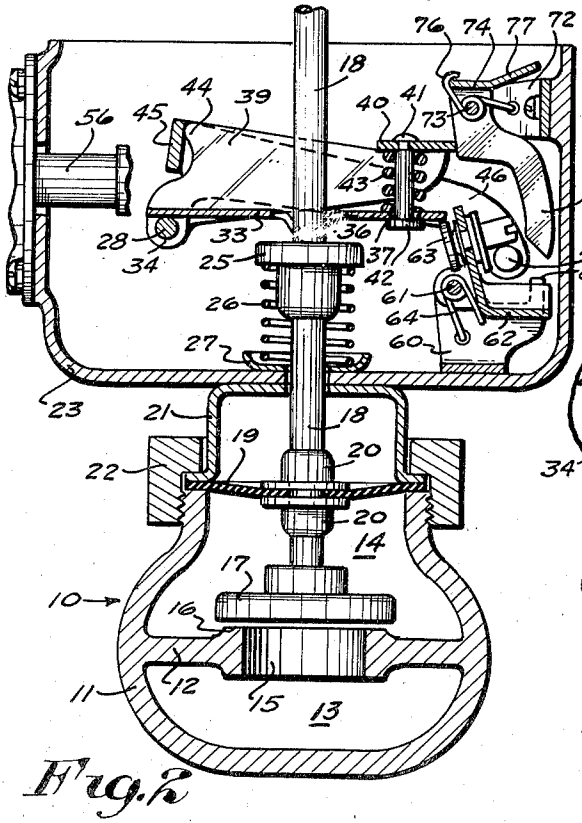


Fig. 2

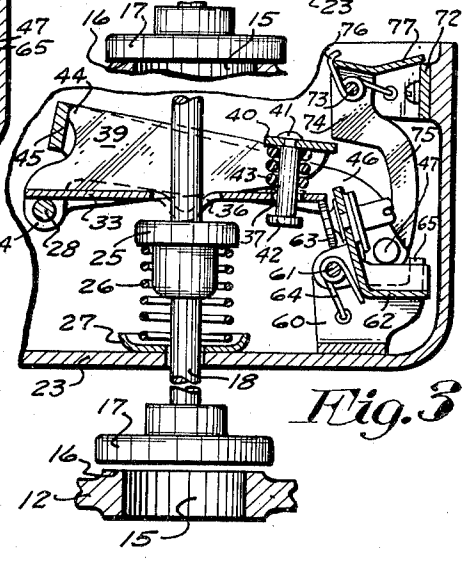


Fig. 3

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SNAP ACTION MECHANISM

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This invention relates to snap action mechanisms and more particularly to that type of mechanism wherein the element to be moved is moved through a portion of its movement by a modulating action and through the remainder of its movement by a snap action.

It is an object of this invention to provide a snap action mechanism for an element which is adapted to be moved between two extreme positions wherein gradual movement of the element from one extreme position to some intermediate position is obtained and wherein the element is snapped from this intermediate position to the other extreme position.

Another object of this invention is to apply this snap action mechanism to a valve means whereby the valve means may be modulated from a full open position to a partially open position and snapped from the partially open position to a closed position, and wherein the valve means may be snapped from a closed position to a partially open position and modulated between this partially open position and the full open position.

Another object of this invention is the provision of latch means in the snap action mechanism, the latch means being adjustable whereby the intermediate position from which the element is snapped may be adjusted.

The specific details of construction disclosed hereinafter also form objects of this invention.

For a complete understanding of this invention reference is made to the accompanying description and drawing, in which drawing:

Figure 1 is a plan view of my snap action mechanism with a portion thereof shown in section;

Figure 2 is a vertical sectional view of the mechanism shown in Figure 1;

Figure 3 is a view similar to Figure 2 but showing the parts in another position;

Figure 4 is a view similar to Figure 2 but showing the parts in still another position;

Figure 5 is a sectional view of an adjustable latch used in my invention; and

Figure 6 is an elevational view of the latch shown in Figure 5.

Although the snap action mechanism of my invention is of general utility it is shown as operating a valve generally designated at 10. The valve 10 may comprise a casing 11 having a transverse partition 12 dividing the casing into an inlet chamber 13 and an outlet chamber 14. The transverse partition 12 is provided with an opening or port 15 and an annular seat 16 around the opening. A valve 17 is adapted to move toward and away from the seat 16 to open or close the port 15. The valve 17 is secured in any suitable manner to a valve stem 18 extending upwardly out of the casing 11. A diaphragm sealing means 19 is secured to the valve stem 18 by means of nuts 20 and the diaphragm 19 and a support 21 are secured to the valve casing 11 by means of a nut 22.

Secured to the support 21 is a casing or housing 23 enclosing the snap action of my invention. The casing 23 and the support 21 are provided with openings to accommodate the valve stem 18. Located within the casing 23 and secured to the valve stem 18 in any suitable manner is an abutment member 25. A spring 26 is located between the abutment member 25 and a spring retaining cup 27 located on the casing 23, the arrangement being such that the spring 26 biases the valve 17 towards an open position.

One end of a shaft or pin 28 is journalled in the housing 23 at 29 and the other end of the shaft 28 is carried by a journal or bearing 30 screw-threaded into the housing 23 as at 31. A lever 33 having down-turned ears 34 is mounted on the shaft 28. The lever 33 is provided with an opening centrally thereof to accommodate the valve stem 18 and adjacent this opening the lever 33 is provided with detents 36 adapted to engage the abutment member 25 mounted on the valve stem 18. Adjacent the end of the lever 33 opposite the shaft 28 is an opening 37.

Also mounted on the shaft 28 is a second lever 39 having a horizontally extending portion 40. A pin 41 is secured to the horizontally extending portion 40 and extends downwardly through the opening 37 in the lever 33 and this pin 41 is provided at its lower extremity with a shoulder 42. Located between the horizontally extending portion 40 of the lever 39 and the lever 33 is a spring 43, the spring 43 being stronger than the spring 26. The spring 43 is adapted to maintain the levers 39 and 33 separated to the extent allowed by the pin 41 and the shoulder 42 thereof. By reason of this construction a spring pressed lost motion connection is provided between these two levers. The lever 39 is also provided with abutments 44 which are adapted to engage a lever 45, the lever 45 also being pivoted on the shaft 28. The lever 45 is provided with a longitudinally extending arm 46 which carries a pin 47.

The lever 45 as shown in Figure 1 is provided with a member 48 which is adapted to receive a conical abutment member 49 mounted on a spring retaining member 50. One end of a compression spring 51 engages the spring retaining member 50 and the other end of the spring 51 engages a

second spring retaining member 52. The spring retaining member 52 is in abutting relation with a reciprocable member 53 which is adapted to be reciprocated upon rotation of a handle 54 in a manner known in the art. By reason of this structure the spring 51 is made adjustable and the amount of adjustment thereof is indicated by means of the indications cooperating with the rotatable handle 54.

The member 48 is also adapted to be engaged by a conical abutment member 55 carried by a plunger 56. The plunger 56 is operated by a bellows contained in a casing 57 in a manner well known in the art. The casing 57 is secured to the housing 23 by means of screws 58. The bellows contained within the casing 57 may be operated by changes in pressure transmitted to the casing 57 or the casing 57 may contain a volatile fluid or be connected to a source of volatile fluid which expands and contracts to move the bellows therein in accordance with temperature changes. The bellows within the casing 57 is adapted to rotate the lever 45 in a clockwise direction about its pivot 28 and the spring 51 is adapted to rotate the lever 45 in a counter-clockwise direction. Therefore, by adjusting the tension of the spring 51 the amount of pressure or temperature required to move the lever 45 may be accurately determined.

Mounted on the bottom wall of the casing 23 is a support 60 which carries a pivot pin 61. Mounted on the pivot pin 61 is a latch lever 62 having secured thereto an adjustable latch member 63. The latch member 62 is biased in a counter-clockwise direction by means of a spring 64 and the amount of clockwise movement thereof is limited by means of a stop 65 secured to the support 60.

Referring now to Figures 5 and 6, the structure of the adjustable latch member is shown in detail. The adjustable latch member 63 is mounted on a pin 66 carried by the latch lever 62 and is frictionally held against rotation by means of a friction spring 67 located between the adjustable latch member 63 and the latch lever 62. The adjustable latch member may take the form of an eccentric. The pin 66 also carries a pointer 68 adapted to co-act with indications on the latch lever 62 and the adjustable latch member 63 and the pointer 68 may be rotated with respect to the latch lever 62 by means of a screw head 69 integral with the pin 66, the amount of adjustment being indicated by the pointer 68 with respect to the indications on the latch lever 62. The lever 62 is provided with limiting lugs 70 to limit the adjustment of the adjustable latch member 63 to substantially 180° rotation.

Mounted on the side wall of the casing 23 is another support 72 carrying a pivot pin 73. Mounted on the pivot pin 73 is a second latch member 74 having a downwardly extending arm 75. The latch member 74 is biased in a clockwise direction by means of a spring 76, and the amount of clockwise movement is limited by a lug 77 carried by the latch member 74 which engages the support 72.

With the parts in the position shown in Figure 2 the valve 17 is in a partially open position. Upon a decrease in pressure affecting the bellows within the casing 57 the spring 51 moves the lever 45 in a counter-clockwise direction and the spring 26 urges the levers 33 and 39 also in a counter-clockwise direction and permits opening movement of the valve 17. Upon an increase in pressure affecting the bellows within the casing 57 the lever 45 is moved in a clockwise direction and by reason of the abutting relation between the levers 39 and 45 and the spring pressed lost motion connection between the levers 39 and 33 the valve 17 is moved towards a closed position against the action of the valve opening spring 26. In this way the valve 17 is modulated between a full open position and a partially open position in accordance with changes in pressure affecting the bellows within the casing 57.

Upon a further increase in pressure affecting the bellows within the casing 57 the lever 33 is moved into engagement with the adjustable latch 63, whereby further closing movement of the valve 17 is prevented, as shown in Figure 2. Further clockwise movement of the lever 45 causes compressing of the spring 43 and when the spring 43 has been sufficiently compressed the latch arm 74 is moved in a clockwise direction to overlay the horizontal portion 40 of the lever 39 and the parts assume the position shown in Figure 3.

Upon a further increase in pressure in the casing 57 the lever 45 is moved further in a clockwise direction and the pin 47 carried by the lever 45 engages the latch arm 62 to pull the adjustable latching mechanism 63 from under the lever 33. Since the spring 43 is stronger than the spring 26 releasing of the lever 33 in this manner causes closing movement of the valve 17 with a snap action.

Upon a decrease in pressure in casing 57, the lever 45 is moved in a counter-clockwise direction and since the spring 43 urges the lever 39 into engagement with the lever 45, the horizontal portion 40 of the lever 39 engages the latch 74, the valve 17 still being held closed by the action of the spring 43 as shown in Figure 4.

Upon a further decrease in pressure within the casing 57 the lever 45 is moved in a counter-clockwise direction and this counter-clockwise movement causes pin 47 to engage the downwardly extending lever 75 of the latch member 74 to move the latch member 74 out of engagement with the horizontal portion 40 of the lever 39. When the latch member 74 is so moved out of engagement with the horizontal portion 40 of the lever 39 the spring 43 is expanded to take up the lost motion between the levers 39 and 33 and the spring 26 snaps the valve 17 to a partially open position, the amount of opening movement being dependent upon the pressure within the casing 57. Further decrease in pressure within the casing 57 causes further gradual opening of the valve 17 and the valve 17 is allowed to modulate between the full open position and the partially open position in the manner pointed out above.

By reason of the snap action mechanism described above, a means is provided for operating an element or a valve between extreme positions wherein the element or valve may be modulated between one extreme position and an intermediate position and snapped between the intermediate position and the other extreme position. Means are provided in the snap action mechanism whereby the intermediate position from which the snap action takes place may be adjusted, the means in this particular exemplification of the invention being the eccentrically mounted adjustable latch means 63.

Although I have disclosed one form of my invention for purposes of illustration, various forms thereof may become apparent to those skilled in the art and, consequently, the invention is to be

limited only by the scope of the appended claims.

I claim as my invention:

1. In a device of the class described, an element movable between two extreme positions, spring means biasing said element in one direction, a pivoted lever abutting said element, a latch for said lever, a second pivoted lever, a spring pressed lost motion connection between said levers, a latch for said second lever, a third pivoted lever for engaging said second lever and carrying a pin for engaging said latches, means for operating said third lever, the arrangement being such that when said third lever is operated in one direction, the element is moved from one extreme position to an intermediate position, the first lever engages the first latch to stop further movement of the element, the spring pressed lost motion connection is compressed, the second lever engages the second latch, and the pin carried by the third lever engages the first latch to release the first lever whereby the spring pressed lost motion connection snaps the element to the other extreme position.

2. In a device of the class described, an element movable between two extreme positions, spring means biasing said element in one direction, a pivoted lever abutting said element, a latch for said lever, a second pivoted lever, a spring pressed lost motion connection between said levers, a latch for said second lever, a third pivoted lever for engaging said second lever and carrying a pin for engaging said latches, and means for operating said third lever.

3. In a device of the class described, an element biased towards one position, a lever for moving the element toward another position, a latch to be engaged by said lever to prevent complete movement of the element to the other position, a second lever having a spring connection with the first lever, a third lever engaging said second lever for compressing the spring connection and releasing said latch to move said element to the other position with a snap action.

4. In a device of the class described, an element biased towards one position, a lever for moving the element toward another position, a latch to be engaged by said lever to prevent complete movement of the element to the other position, a second lever having a spring connection with the first lever, means for operating said second lever for compressing the spring connection and releasing said latch to move said element to the other position with a snap action.

5. In a device of the class described, an element biased towards one position, a lever for moving the element toward another position, a latch to be engaged by said lever to prevent complete movement of the element to the other position, a second lever having a spring connection with the first lever, means for operating said second lever for compressing the spring connection and releasing said latch to move said element to the other position with a snap action, and means for adjusting said latch for determining the amount of snap action movement.

6. In a device of the class described, an element biased towards one position, a lever for moving the element toward another position, a latch to be engaged by said lever to prevent complete movement of the element to the other position, a second lever having a spring connection with the first lever, means for operating said second lever for compressing the spring connection and releasing said latch to move said element to the other position with a snap action, said latch comprising a pivoted lever, an eccentrically mounted abutment on said lever and means for rotating said abutment whereby the amount of snap action movement may be adjusted.

7. In a device of the class descried, an element movable between two extreme positions, means biasing said element in one direction, a pivoted lever abutting said element, a latch for said lever, a second pivoted lever, a spring pressed lost motion connection between said levers, a latch for said second lever, a third pivoted lever for engaging said second lever and carrying a pin for engaging said latches, spring means for urging said third lever in one direction and pressure operated means for moving said lever in the other direction, the arrangement being such that when said third lever is operated by said pressure operated means in one direction, the element is moved against the action of its biasing means from one extreme position to an intermediate position, the first lever engages the first latch to stop further movement of the element, the spring pressed lost motion connection is compressed, the second lever engages the second latch, and the pin carried by the third lever engages the first latch to release the first lever whereby the spring pressed lost motion connection snaps the element to the other extreme position.

8. In a device of the class described, an element movable between two extreme positions, spring means biasing said element towards one extreme position, a pivoted lever abutting said element, a latch for said lever, a second pivoted lever, a spring pressed lost motion connection between said levers, a latch for said second lever, a third pivoted lever for abutting said second lever and having a pin for engaging said latches, spring means for urging said third lever in one direction and pressure operated means for moving said lever in the other direction.

9. In a device of the class described, an element movable between two extreme positions and biased towards one of said positions, a lever for operating said element, a latch to be engaged by said lever to prevent uninterrupted movement of said element toward the second of said extreme positions, a second lever having a spring connection with the first lever, a third lever engaging said second lever for compressing the spring connection and releasing said latch to move said element to said second extreme position with a snap action.

10. In a device of the class described, an element movable between two extreme positions and biased towards one of said positions, a lever for operating said element, a latch to be engaged by said lever to prevent complete and uninterrupted movement of said element to the other of its extreme positions, a second lever having a spring connection with said first lever, and means for operating said second lever to compress said spring connection, said last named means being operative after compression of said spring connection to release said latch to move said element to said other of its extreme positions.

11. In å device of the class described, an element movable between two extreme positions and biased towards one of said positions, a lever for operating said element, a latch to be engaged by said lever to prevent complete and uninterrupted movement of said element to the other of its extreme positions, a second lever having a spring connection with said first lever, means for operating said second lever to compress said

spring connection, said last named means being operative after compression of said spring connection to release said latch to move said element to said other of its extreme positions, and means for adjusting said latch for determining the amount of snap action movement.

12. In a device of the class described, an element movable between two extreme positions and biased towards one of said positions, a lever for operating said element, a latch to be engaged by said lever to prevent complete and uninterrupted movement of said element to the other of its extreme positions, a second lever having a spring connection with said first lever, means for operating said second lever to compress said spring connection, said last named means being operative after compression of said spring connection to release said latch to move said element to said other of its extreme positions, said latch comprising a pivoted lever, an eccentrically mounted abutment on said lever and means for rotating said abutment whereby the amount of snap action movement may be adjusted.

13. In a device of the class described, a valve, means for actuating the same, and snap action mechanism connecting said actuating means and said valve, said snap action mechanism being effective upon continuous movement of said actuating means in one direction to cause said valve first to move gradually to an intermediate closed position and then to move quickly to full closed position with a snap action, said snap action mechanism being effective upon continuous movement of said actuating means in the opposite direction to cause said valve first to move with a snap action to an intermediate open position and then to move gradually toward full open position, said snap action mechanism comprising means for adjusting the differential between said intermediate open and said intermediate closed positions.

14. In a device of the class described, a valve, means for actuating the same, and snap action mechanism connecting said actuating means and said valve, said snap action mechanism being effective upon continuous movement of said actuating means in one direction to cause said valve first to move gradually to an intermediate closed position and then to move quickly to full closed position with a snap action, said snap action mechanism being effective upon continuous movement of said actuating means in the opposite direction to cause said valve first to move with a snap action to an intermediate open position and then to move gradually toward full open position, said snap action mechanism comprising means for adjusting said intermediate closed position independently of said intermediate open position.

15. In a device of the class described, a controlling element movable between first and second extreme positions and operable to exert a controlling action along the entire range of its movement depending upon its position, means for actuating said element, and snap action mechanism connecting said element and said actuating means, said snap action mechanism being effective upon continuous movement of said actuating means in one direction to cause said element to move gradually from said first position to a first intermediate position and then to move quickly to said second position, said snap action mechanism being effective upon continuous movement of said actuating means in the opposite direction to cause said element first to move with a snap action to a second intermediate position and then to move gradually to said first position, said snap action mechanism comprising means for adjusting said first intermediate position independently of said second intermediate position.

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