

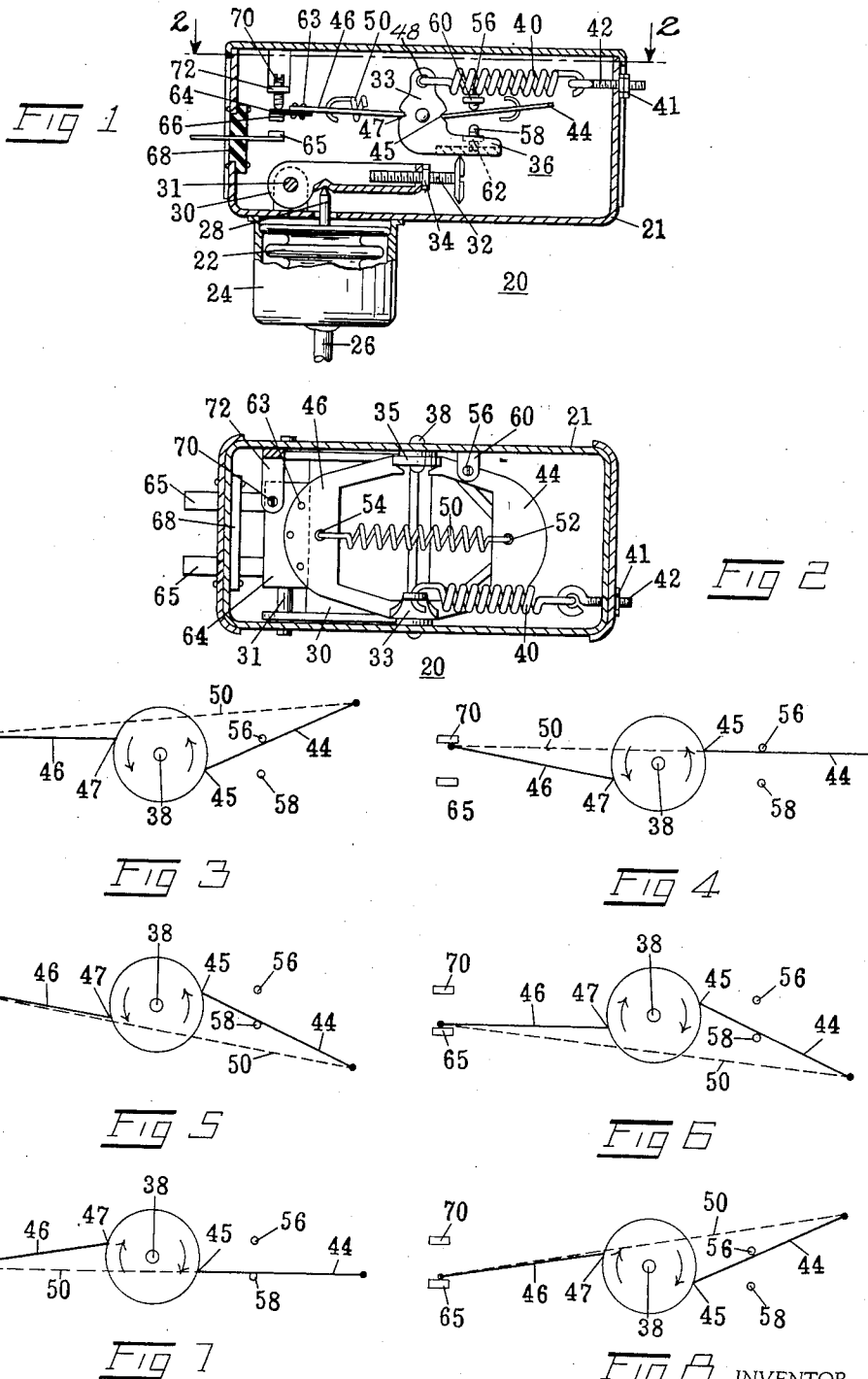
March 26, 1940.

H. A. VAN DYKE

2,194,533

CONTROL APPARATUS

Filed Nov. 10, 1937



BY

INVENTOR.
Henry A. Van Dyke
Wm. H. Schmidt,
ATTORNEY.

UNITED STATES PATENT OFFICE

2,194,533

CONTROL APPARATUS

Henry A. Van Dyke, Columbus, Ohio, assignor to
Ranco Incorporated, Columbus, Ohio, a corporation of Ohio

Application November 10, 1937, Serial No. 173,908

8 Claims. (Cl. 200—83)

This invention relates to control apparatus and more particularly to a snap action mechanism to be used in conjunction with such apparatus.

An object of the present invention is to provide a snap acting mechanism which includes two resiliently connected members, each fulcrumed at one end thereof, and to provide for moving one of the members past its dead center position for causing the same to be snap actuated, and during the snap movement to carry the resilient connection past the dead center position of the second member to snap actuate the same.

Another object of this invention is to provide a snap acting device having a pair of fulcrumed members with a spring connecting the members to cause the members to be spring biased to one side or the other of a dead center, established with respect to the spring and fulcrum of the members, and to provide for causing one of the members to be moved to its dead center position while the other of the members is moved in such a manner as to maintain the biasing tension of the spring on that member substantially constant, until the other member has moved past its dead center position.

It is a further object of the invention to provide a snap acting device of the character described in the preceding paragraph in which the fulcrums of the members are moved concurrently so that while one of the members is moved toward its dead center, the other member is moved to cause the bias of the spring to remain substantially constant until the first mentioned member has moved through its dead center.

Another object of the invention is to provide a snap acting device having two members fulcrumed, each at one end, and connected adjacent the free ends by a spring to bias the members to one side or the other of a dead center position with relation to the spring and fulcrums of the members, and for moving one of the members and the spring to its dead center position while causing such movement of the second member so as to maintain the relative position of the second member and spring substantially unchanged until the first member is moved through its dead center position, the arrangement of the members and fulcrums being such as to cause the first member, after moving through its dead center position, to move the second member through its dead center with a snap action.

In carrying out the above object it is a further object to provide the snap acting mechanism with a rotatable fulcrum carrier disposed so that when the fulcrum for one member is moving

in one direction, the fulcrum for the other member will move in the opposite direction to maintain the component force on one of the members substantially constant until the instant of snap actuation thereof.

Other and further objects and advantages will be apparent from the following description, reference being had to the accompanying drawing wherein a preferred form of embodiment of the present invention is clearly shown.

In the drawing:

Fig. 1 is a view, partly in section, of an electric switch embodying the snap acting mechanism;

Fig. 2 is a view taken on line 2—2 of Fig. 1;

Fig. 3 is a diagrammatic view of a snap acting mechanism with the flippers or members in the upper position;

Fig. 4 is a view similar to Fig. 3, wherein the fulcrum of the right hand flipper has been moved so that the said flipper is at the dead center position;

Fig. 5 is a view similar to Fig. 3 wherein the right hand flipper is snapped to carry the spring past the dead center position of the left hand flipper;

Fig. 6 is a view similar to Fig. 3 wherein the left hand flipper is snapped;

Fig. 7 is a view similar to Fig. 3, wherein the fulcrum carrier is rotated in the opposite direction to cause the fulcrum of the right hand flipper to be moved to the dead center position of the right hand flipper, and,

Fig. 8 is a view similar to Fig. 3, wherein the right hand flipper is snapped upwardly to carry the spring past the dead center position of the left hand flipper.

Referring to Figs. 1 and 2, the snap acting mechanism is shown embodied in a control device 20. The control device comprises a main frame 21, which supports the various parts thereof. A bellows 22, disposed within a supporting cup 24, suitably attached to the frame 21, is provided as the power element for actuating the switch and is connected by a tube 26, to a suitable source of pressure, as for example, a fluid filled thermal element (not shown). The upper end of the bellows 22 carries a vertically extending push rod 28 disposed to engage a pivotally mounted lever 30 adjacent its pivot 31. An adjustable screw 32 is threaded into the lever 30 at the end opposite the pivot 31, and is adjustable horizontally to change the effective length of the lever 30. A lock nut 34 disposed on the screw 32 is used to fixedly position the same

when the desired adjustment is obtained. A lever 36, having two spaced, upturned pivot elements 33 and 35, are pivotally supported on the frame 21 by the bearings 38, which may be a pair of short rivets each extending through one of the members 33 and 35. The lever 36 is biased against the head of screw 32, by a spring 40, which is connected to the lever 36 through the eyelet 48 formed in the element 33. The tension of the spring 40, thus effectively acts upon the lever 36 to oppose expansion of the bellows 22. The tension of the spring 40 may be varied by the threaded member 42 and nut 41.

The pivot elements 33 and 35, are provided with V notches or fulcrums 45 and 47, and are adapted to receive the ends of a pair of U shaped flippers or members 44 and 46, respectively to form fulcrums or pivots for the flippers. A tension spring 50 is connected to the closed ends of the flippers 44 and 46 at the eyelets 52 and 54, respectively. The spring 50 places a tension on the flippers to maintain their ends in the V bearings 45 and 47, and also causes the free ends of the flippers to be biased against stops, which limit movement of the flippers about their pivots or fulcrums 45 and 47. A screw 56 is threaded in a bracket 60, supported by the frame 21, and forms a stop for the upward movement of the flipper 44. A screw 58, threaded in a bracket 62 secured to the frame 21, forms a stop for limiting the downward movement of the flipper 44.

A rectangular strip of insulating material 64, such as Bakelite, is riveted on the free end of the flipper 46 by means of the rivets 63. The Bakelite part 64 is provided with a strip of electric conducting material 66, preferably copper, which is adapted to bridge a pair of spaced contact members 65. The contact members 65 are embedded in a block of Bakelite 68 suitably secured to the control frame, and are adapted to be connected in the power line of an electric translating device to be controlled by the control device, such as for example a refrigerator motor. The circuit of the translating device is adapted to be opened and closed when the flipper 46 is raised and lowered, respectively.

A stop screw 70, threaded in a bracket 72, connected on the frame 21, limits upward movement of the flipper 46. The screw 70 is for adjusting the width of the break of the switch.

The operation of the control device and the snap mechanism is as follows:

When the bellows expands, the lever 36 is rotated counterclockwise. This raises the fulcrums 45 with respect to the pivot 32, and at the same time fulcrums 47 are lowered with respect to the pivot 38. The raising of the fulcrums 45 causes the flipper 44 to be rotated clockwise about the stop screw 56, and swing the spring 50 downwardly toward the fulcrums 45. During the simultaneous downward movement of the fulcrums 47 and the right hand end of flipper 44, the angle between flipper 46 and spring 50 is maintained substantially unchanged (see Figs. 3 and 4). Thus it will be seen that while the flipper 44 is moving toward its dead center position, the biasing effect of the spring 50 on the flipper 46 to maintain it against the stop 70, will remain substantially constant. As the lever 36 continues its counterclockwise rotation, the fulcrums 45 are moved above the center line of the spring 50 which causes the spring 50 to bias the flipper 44 from the stop screw 56 to the stop screw 58. As shown in Fig. 5, this movement causes the spring 50 to be moved below the fulcrums 47 with

a snap action, thereby causing the flipper 46 to be moved against the stop or contacts 65 with a snap movement, as shown in Fig. 6.

The reverse movement of the lever 30 produces the same actuation of the parts, except in the reverse direction. In the reverse action the fulcrums 45 move downward, causing counterclockwise rotation of flipper 44 and consequent upward movement of the spring 50 toward the pivot 38 and fulcrums 45. Simultaneously, the fulcrums 47 move upward thereby maintaining the angle between the flipper 46 and the spring 50 substantially constant, as shown in Figs. 6 and 7, until the spring 50 moves above the fulcrums 45 and the flipper 44, and snaps the flipper 44 to the stop 56, as shown in Fig. 8. This action snaps the spring 50 above the fulcrums 47 and causes the free end of the flipper 46 to be snapped to the stop 70.

It will be seen that the position of the stops 56 and 58 relative to the pivoted ends of the flipper 44, determine the rate at which the spring 50 moves toward the fulcrums 45 and 47. Thus if the stops 56 and 58 are nearer the free end of the flipper 44 than shown in the drawing, fulcrums 47 would move faster than the spring 50 during movement of the lever 36, and consequently increase the angle between the flipper 46 and the spring 50. Likewise placing the stops 56 and 58 nearer the fulcrums 45 than shown in the drawing, would increase the speed of the free end of flipper 44 so that the spring 50 will be moved in the same direction as the fulcrums 47 faster than the fulcrums 45 are moved, thereby decreasing the angle between the flipper 46 and spring 50 as the flipper 44 approaches its dead center position. In the present embodiment I prefer to space the stops 56 and 58 so as to cause the fulcrums 47 and the spring 50 to move at substantially the same rate as the movement of the fulcrums 45 to maintain the angle between the flipper 46 and the spring 50 substantially constant until the flipper 44 is snapped past its dead center.

It will be observed that the contact pressure, or component of force of the flipper 46 against the contacts 65 or the stop 70 is always substantially the same until the instant of snap actuation thereof. The stop 70 may be in the form of a contact so as to control a circuit which is independent of the circuit controlled by contacts 65. Thus the present snap acting device 20 is particularly practical when embodied in a control switch having two sets of contacts, one of which is bridged in either direction of movement of the flipper 46.

It will be observed that the fulcrums 47 move toward and away from the contacts 65 during the oscillation of lever 36 and therefore the contact 66 wipes contacts 65 during each opening of the switch to maintain the contacts clean.

While the form of embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adapted, all coming within the scope of the claims which follow.

I claim:

1. In a snap acting device, a pair of flippers each having a fulcrum therefor; a spring connecting the flippers, each of the flippers having a dead center position with respect to its fulcrum and the spring, the said spring acting to bias the flippers to a position on one side or the other of their dead center position; means for moving one of the flippers and the spring to establish the

dead center position of the flipper and for concurrently moving the fulcrum of the other of the said flippers in the same direction as movement of the spring to maintain an angle greater than zero between the said other flipper and the spring.

2. In a snap acting device, a pair of movable members each having a fulcrum therefor; a spring connecting the members, each of the members having a dead center position with respect to its fulcrum and the spring, said spring acting to bias the members on one side or the other of their dead center position; means for rotating one of the members in one direction about its fulcrum to cause the spring to bias the member to a position on the opposite side of the dead center position and for concurrently rotating the other of said members about its fulcrum in the said one direction for maintaining a substantial biasing effect of the spring on the last mentioned member until the other member has been moved past its dead center position.

3. In a snap acting device, two movable members each having a fulcrum; a spring connecting the movable members, each of said members having a dead center position relative to its fulcrum and the spring, the spring acting to bias the members to one side or the other of their dead center position; means for rotating one of the members about its fulcrum to decrease the angle between the spring and the member and for concurrently rotating the other of the members about its fulcrum in a direction to prevent the latter flipper from reaching its dead center position by maintaining an angle between the said members and the spring greater than zero until the first mentioned member is moved through its dead center position.

4. In a snap acting device comprising in combination a flipper, a fulcrum for the flipper, a spring, the aforementioned elements having a dead center position and said spring being biased to snap the flipper from one position to another when the spring moves beyond the dead center position, snap acting mechanism including said spring, means for moving the snap acting mechanism toward snap acting position and for simultaneously shifting the position of the spring, said snap acting mechanism being disposed to move the spring through said dead center position during the snap action of the said mechanism and means for preventing a decrease in the tension of said spring on said flipper while the snap acting mechanism moves toward snap acting position.

5. In a snap acting device comprising in combination a flipper, a fulcrum for the flipper, a spring, the aforementioned elements having a dead center position and said spring being biased to snap the flipper from one position to another

when the spring moves beyond the dead center position, snap acting mechanism including said spring, means for moving the snap acting mechanism toward snap acting position and for shifting the position of the spring, said snap acting mechanism being disposed to move the spring through said dead center position during the snap action of the said mechanism, and means for moving the flipper about its fulcrum in a direction to prevent diminishing of the angle between the said spring and the flipper while the snap acting mechanism moves to snap acting position.

6. In a snap acting device, two movable members, each pivoted at one end thereof; stops for limiting rotation of the free ends of the members about their pivots; resilient means connecting the elements for yieldingly maintaining the members against said stops, each of said members having a dead center position with respect to its pivot and the resilient means; and means for displacing one of said members with respect to the resilient means to move it to its dead center position and for displacing the other of said members with respect to the first member to move the second member away from its dead center position to maintain a component of force on the second member by the resilient means while the first mentioned member is moved through its dead center position.

7. In a snap action device, a pair of flippers each fulcrumed at one end thereof; resilient means connecting the flippers adjacent their free ends; a support for carrying the fulcrums of the flippers, said support being adapted to rotate around a fixed pivot, the fulcrums being located on opposite sides of said pivot, each of said flippers having a dead center position relative to its fulcrum and the resilient means, said support during the rotational movement thereof carrying the fulcrum of one of said flippers past the dead center position thereof, to cause the said flipper to be snap actuated, said snap actuated flipper moving the resilient means past the dead center position of the second flipper to cause the same to be snap actuated; and means for rotating the support.

8. In a snap acting device comprising in combination a snap member, a pivot for the member; means for snap actuating the member including a spring connected to the member and a mechanism for snap actuating the spring, said member, pivot and spring having a dead center position, said mechanism being adapted to cause the spring to move toward the dead center position and then snap through the said position; and means for moving said snap member away from said dead center position as the spring is moved toward the said position.

HENRY A. VAN DYKE.