Jan. 31, 1933. J. H. CARMEAN ET AL 1,895,650

SNAP MECHANISM

Filed Oct. 20, 1930

Fig. 1.

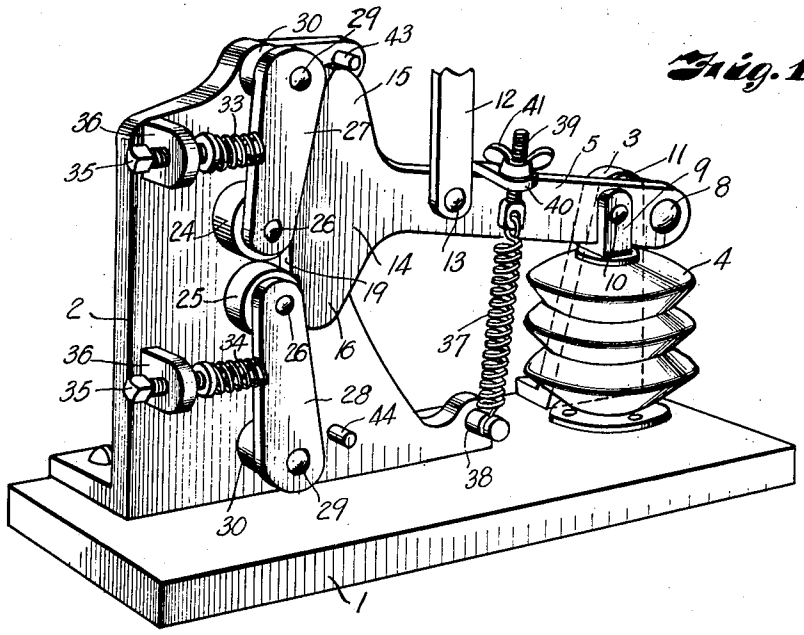
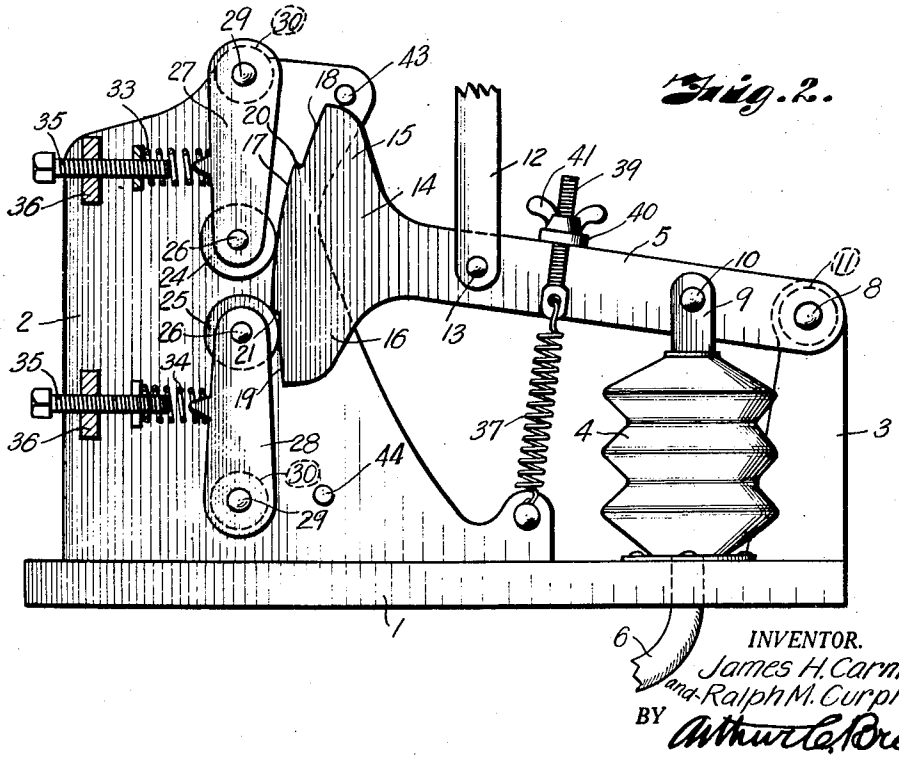


Fig. 2.



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SNAP MECHANISM

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This invention relates to snap mechanism and more particularly to thermostatically controlled mechanisms for operating a device such as a switch in an electrical circuit and a sylphon bellows containing a gas responsive to changes of temperature for operating the mechanism and including means for effecting snap action for rapid movement of the device operated thereby.

In ordinary mechanisms of this character a bellows or other controlling member moves an operating member such as a lever or latch a substantial distance before snap action occurs, and the device operated thereby is ordinarily shifted by a supplementary spring provided for that purpose, thus involving use of a multiplicity of moving parts and wear, requiring numerous movements of parts before the snap action occurs, and reducing the control of the controlling member over the operation of the device when said member is a thermostatically operated bellows.

The principal objects of the invention therefore are to effect snap action directly responsive to application of a predetermined amount of force for moving a switch or the like, to provide snap action for transmitting the influence of a bellows to the switch, and to substantially instantaneously render snap action effective when the actuating power of a controlling member such as a bellows has reached a predetermined high or low value.

Other important features and objects of the invention will be apparent as the description proceeds.

In the accompanying drawing:

Fig. 1 is a perspective view of a snap acting thermostatic device embodying the invention, showing fragmentarily an operating bar.

Fig. 2 is a side elevation of the device.

Referring in detail to the drawing:

The device includes a support comprising in the illustrated example a base 1, a panel or vertical plate 2 mounted on the base and extending from one end thereof, and a post 3 offset from the panel at the opposite end of the base. A sylphon bellows 4 is mounted on the base adjacent the post with its axis perpendicular to the base, for controlling and operating a switch-actuating lever 5 as later described. The device is adapted to be located in a space subject to changes of temperature whereby said changes will effect expansion and contraction of the bellows to bring about tilting of the lever, or as illustrated, a conduit 6 may communicate with the bellows and have an opposite end connected with a temperature responsive element not shown, whereby change in temperature at a point distant from the device will affect the volume of a gas in the conduit to expand or tend to contract the bellows.

The lever 5 has pivotal mounting on a pin 8 projecting laterally from the upper end of the post 3. The bellows has a stem preferably comprising a yoke having arms 9 on each side of the relatively wide lever bar and pivotally connected thereto by a pin 10. A bearing block 11 on the pin 8 spaces the lever from the panel to permit location of the bellows with its axis in the plane of the median line of the lever.

An operating bar 12, adapted for example to operate a device such as a switch in an electrical circuit, is pivotally connected to the lever at a point 13 on the opposite side of the pin 10 from the fulcrum 8 of the lever 5.

The bellows is thus adapted to swing the lever in a plane parallel to the panel.

The free outer end of the lever comprises a vertically enlarged head 14 having wings 15 and 16 extending from upper and lower edges of the lever in the plane of movement thereof, and an end face including an elongated arcuate bearing portion or track 17 extending vertically equal distances on both sides of the axis of the lever. Notches formed in the head at each end of the arcuate central portion produce seats having curved faces completing the end face of the head, and forming stop walls 18 and 19, and shoulders having arris edges 20 and 21 for latching rollers 24 and 25 as later described, whereby snap action of the lever is obtained.

The rollers 24 and 25 are mounted on pins 26 projecting inwardly toward the panel from the free ends of arms or roller levers 27 and 28 having pivotal mounting on pins 29 adjacent upper and lower edges of the panel

and in a line spaced slightly from the path of the curved end edge face of the lever head.

Blocks 30 form bearings to space the arms from the panel and permit free rotative movement of the rollers. The arms are adapted for alignment as shown in Fig. 2, and the length of the arms and the diameters of the rollers are proportioned to permit the peripheries of the rollers to move in slightly spaced paths.

Springs 33 and 34 on bolts 35 threaded in brackets 36 on the panel bear against flanges or washers fixed to the bolts to urge the arms toward the lever fulcrum to constantly engage the rollers with the end face of the lever head.

The several parts are so related that when the lever 5 is in upwardly pivoted position, for example to close a circuit, as in the figures, the lower roller 25 engages the stop wall 19 of the lower wing and arris edge 21, and due to pressure of the associated spring 34 latches the lever against downward movement until sufficient force has been applied to the lever to overcome the resistance of the spring and permit the roller supporting arm to swing laterally away from the head.

When the bellows exercises sufficient influence, due for example to contraction of gas therein and collapse of the bellows by atmospheric pressure, to move the lever downwardly, the lower roller will immediately tend to rotate and is free to roll over the arcuate end face portion of the head and permit operation of the lever by the bellows.

When the lever is in downwardly pivoted or open-circuit position, the positions of the rollers with respect to the head will be reversed and the upper roller will engage the upper stop wall 18 and edge 20 and under pressure of the associated spring will latch the lever.

Means is further provided such as a spring 37 anchored to the support at 38 and connected to a screw 39 in a bracket 40 fixed to the lever 6 and retained by a thumb nut 41, for adjusting the resistance of the lever to upward movement thereof by the bellows, and tending to retract the lever and cause collapse of the bellows.

The pressure of gas in the bellows is thus partly resisted to prevent operation of the lever until a predetermined pressure value has been reached, and retraction of the lever is effected when the gas used has normal pressure above atmosphere, thus permitting the use of the single bellows with expansible gases of different character.

Stops 43 and 44 are provided on the panel to receive respectively the ends of the wings 15 and 16 and limit opposite movements of the lever for effecting location of the rollers at the arris edges 20 and 21.

In using the invention expansion or retraction of the bellows will tend to move the lever in one or the other direction, and when sufficient influence is exerted by the bellows or by the bellows and spring 37 to overcome the tension of the particular roller retaining spring, the roller arm will pivot away from the lever head and the roller will in effect roll over the arris latching edge to the arcuate end face portion of the head and toward the center point thereof.

Attention is called to the depth of the notches whereby the stop shoulders or walls are located at such a distance from the axes of the rollers that a radius from the axis of a roller when in latching position to the adjacent arris edge is inclined sharply from the roller axis to said edge, with reference to the axis of the roller-supporting arm. The result of this relation is that the instant the bellows has developed sufficient energy to raise the roller 25 from the shoulder, as in Fig. 2, the roller will instantaneously pivot on said radius and roll from the latching notch to the arcuate end face of the lever head and in effect roll over said face. A relatively negligible amount of friction is thus incurred in the movements of the latching rollers toward and away from latching position, the latches are effective until sufficient influence is stored or built up to actuate the lever, and when the bellows and/or spring 37 become effective, the first movement of the lever 5 is snap action immediately and directly effective to shift the bar 12.

Attention is called to the adjustable character of the resilient arm-anchors, whereby the tension of either spring 33 or 34 may be adjusted to render one of the rollers operable at any desired pressure irrespective of the pressure at which the other roller operates.

Mechanism is thus provided whereby each latching or loading element is independently adjustable, and it is possible to change the adjustment of one roller arm without affecting the adjustment of the other arm, for example to change the roller arm controlling the cutting in of the circuit while leaving the roller arm which controls the breaking of the circuit unchanged.

As an example of the use of the apparatus, the upper roller may be adjusted to cut in the circuit when temperature affecting the bellows gas is approximately 30° F., and the lower roller is adjusted to open the circuit at 20° F. The range of temperature is controlled by the setting of the roller-controlling springs, and the end points of the range are controlled by the tension of the spring which is incidentally adjusted in accordance with the nature of the gas in the bellows. The spring may thus be adjusted to provide for operation of the upper roller at 40° F., and the lower roller at 30° F. Either of the roller adjustments may then be changed, for example, to close the circuit at 50° F. while the

circuit is opened at 30° F. or to provide for opening the circuit at a lower temperature. The range may thus be increased or shortened and the position of a range on a temperature scale may be altered without changing the range.

Attention is further called to the fact that force is built up in the bellows until the resistance value is reached, and thus all the stored energy is used to release the latch or loading means and snap the lever, as contrasted with ordinary devices of this character in which some energy is used to move a lever toward a snap-acting salient.

Any fluid may be used in the bellows, since the spring 37 provides for adjustment to gases of different character, and if the gas used never gets below atmospheric pressure, the spring will cooperate to collapse the bellows and retract the lever.

The stops 43 and 44 may be located at any desired position in the path of the lever, to limit the distance to which the lever may move in either direction, and also to limit the distance the lever may move from extreme up or down position before the upper or lower latching edge encounters the upper or lower roller as the case may be.

In the illustrated example as particularly clear in Fig. 2, the upper stop 43 is located in the path of the end of the upper lever wing 15 to stop the upward movement of the lever substantially as soon as the lower roller touches the seat 19. Undue pressure on the lever consequent on possible continued increased pressure of the gas in the bellows is thus avoided, the gas may contract to a substantial extent before any pressure is exerted on the roller-controlling spring 34, pressure of atmosphere and/or the spring 37 must be built up to a predetermined value, and the instant the predetermined value is reached, the stored energy acts to displace the latch and move the lever by snap action.

Similarly the lower stop 44 halts the lever to prevent strain on the contracted bellow, and effects location of the upper roller in engagement with the stop wall 18 and edge 20, so that the instant a predetermined amount of energy has been built up in the bellows, sufficient to assure movement of the lever the desired distance, the latch will be released and snap action will occur.

In the case of snap action in either direction, the effect of friction is practically negligible, since a roller rotates on its pivot from latching position for so short a period before passing to the face portion 17 on which it rolls freely.

What we claim and desire to secure by Letters Patent is:

1. In apparatus of the character described, a pivoted lever having a cam face provided with spaced shoulders, loading means including a pair of latches engageable with said shoulders for respectively restraining the lever against movement in opposite directions, and independent means for adjusting said latches.

2. In a device of the character described, a lever having pivotal mounting at one end thereof for movement in a predetermined plane, a head on the lever having an arcuate bearing face provided with a raised portion forming right angularly extending walls respectively parallel with the axis of the lever and perpendicular thereto and producing a pair of salient angles, and means including rollers engageable with said angles for latching the lever.

3. A snap mechanism, a support, a lever having pivotal mounting on the support, a head on the lever having an arcuate elongated end face provided with notches at opposite ends of said face forming offset face portions and latching edges, arms having pivotal mounting on the support adjacent the path of said face, rollers mounted on the ends of said arms to roll over said face upon pivotal movement of the lever, springs urging said arms toward the lever face to retain said rollers in frictional rolling engagement with said face, independent mountings for said roller springs, and means for independently adjusting the tension of said roller springs.

4. A device of the character described including a support, a lever pivoted for oscillation on the support and having a cam face provided with spaced shoulders, stop means on the support for limiting movements of the lever in either direction, a pair of arms pivoted to the support and adapted to operably and respectively engage the shoulders at opposite limits of travel of said lever, and means for yieldingly urging said arms into engagement with the cam face.

5. A device of the character described including a support, a lever pivoted for oscillation on the support and having an arcuate cam face provided with a raised portion producing spaced offset shoulders, a pair of opposed arms having outer ends pivoted to the support and inner ends provided with rollers adapted to respectively engage the shoulders at opposite limits of travel of the lever, yielding means for urging the rollers into engagement with said cam face, means for swinging the lever in one direction, and yielding means for urging the lever to swing in the opposite direction.

6. A device of the character described including a support, a lever pivoted for oscillation on the support and having an arcuate cam face provided with spaced offset shoulders, stop means on the support for limiting movements of the lever in either direction, a pair of opposed arms having outer ends pivoted to the support and inner ends provided with rollers adapted to respectively

engage the shoulders at opposite limits of travel of the lever, adjustable yielding means for independently urging the rollers into engagement with said cam face, means for swinging the lever in one direction, and means for yieldingly urging the lever to swing in the opposite direction.

In testimony whereof we affix our signatures.

JAMES H. CARMEAN.
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