May 23, 1961

A. E. BAAK

SWITCH

2,985,738

Filed Oct. 7, 1959

2 Sheets-Sheet 1

FIG. 1.

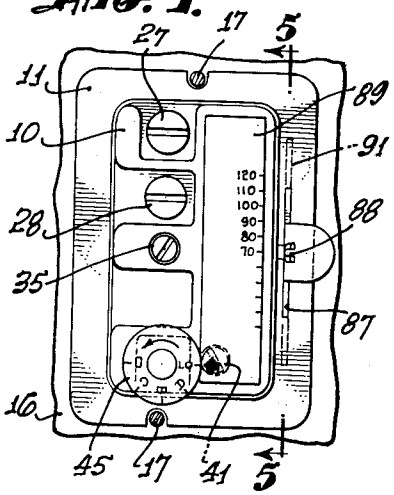

FIG. 2.

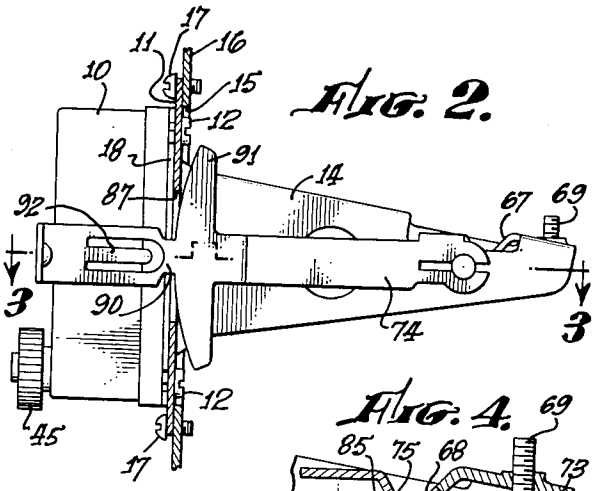

FIG. 4.

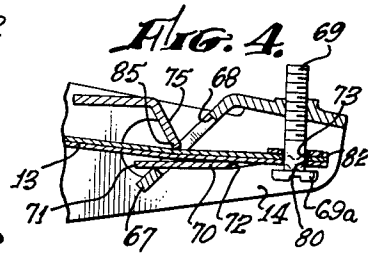

FIG. 3.

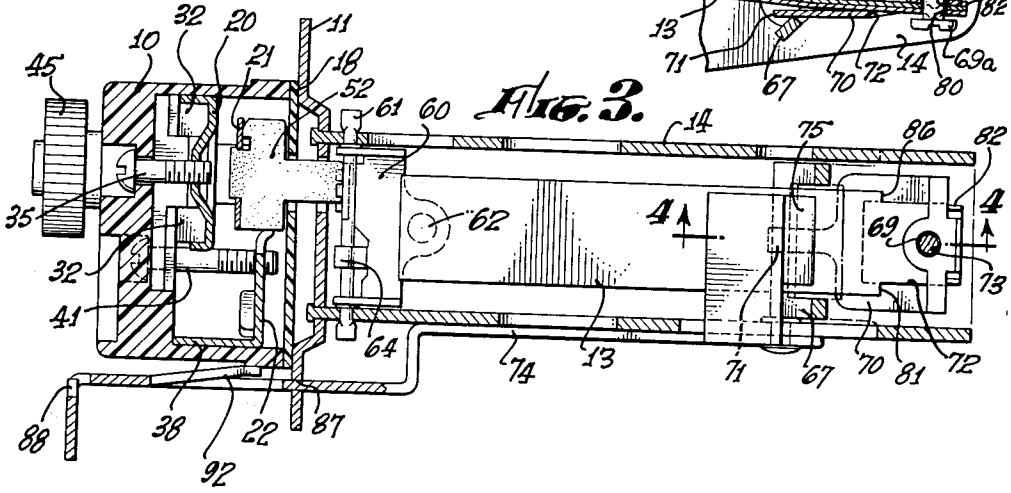

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FIG. 5.

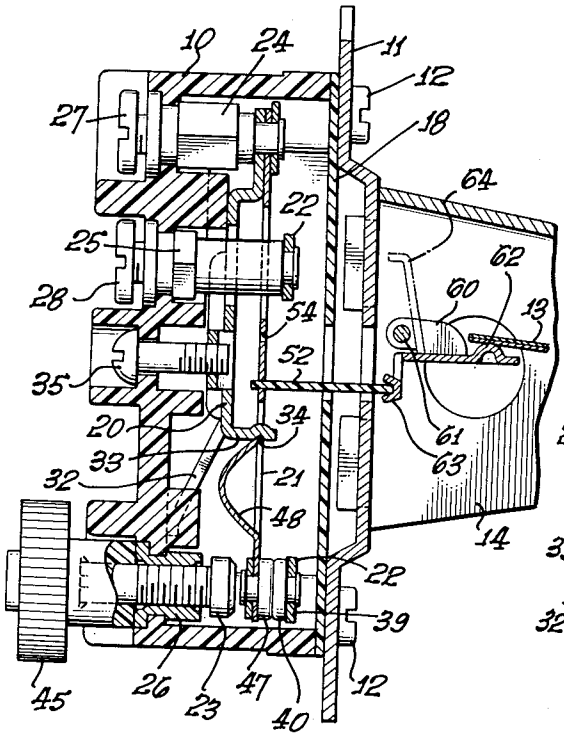
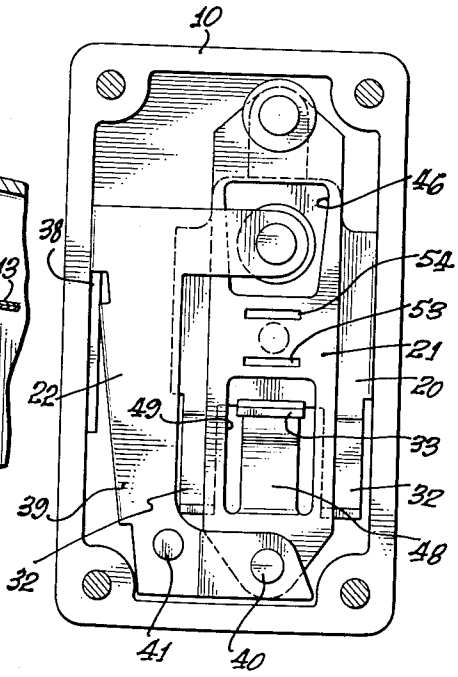


FIG. 6.



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SWITCH

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5 Claims. (Cl. 200—138)

This invention relates to switches for furnace controls and the like and, in particular, to a snap action switch adapted for mounting on a furnace wall with a bimetal element projecting into the furnace.

It is an object of the invention to provide a switch that is sensitive, accurate and rugged and inexpensive to manufacture and install. A further object is to provide a snap action type of switch having a new and improved spring and pivot arrangement. A further object is to provide such a switch that can be biased either in the off or on positions and in which the magnitude as well as the state of bias can be controlled.

It is an object of the invention to provide a new and improved snap action type of switch having a control of the contact gap that may be actuated independently of or in conjunction with the bias control. A further object is to provide such a switch having control of the position of the moving contact in the off position thereby providing control of the differential operating temperature of the mechanism.

It is an object of the invention to provide a new and improved bimetal element support so that the bimetal operation and the snap action operation may be set independently. A further object is to provide such a switch structure wherein the bimetal element is cantilever supported at three closely adjacent points with at least one of the points being variable to set the normal condition of the bimetal. Another object of the invention is to provide such a switch wherein another pivot point of the cantilever suspension is manually adjustable by means of a lever carried on the switch and projecting to the face of the device for varying the set point of the mechanism. Another object is to provide such a device having a mounting plate for mounting on a furnace wall with the set point control lever projecting through a slot in the plate and having a large arcuate segment located at the plate for substantially blocking the slot for any position of the lever.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. The drawings merely show and the description merely describes preferred embodiments of the present invention which are given by way of illustration or example.

In the drawings:

Fig. 1 is a front view of a preferred embodiment of the switch of the invention shown installed in a furnace;

Fig. 2 is a side view of the switch of Fig. 1;

Fig. 3 is an enlarged sectional view taken along the line 3—3 of Fig. 2;

Fig. 4 is a partial sectional view taken along the line 4—4 of Fig. 3;

Fig. 5 is an enlarged sectional view taken along the line 5—5 of Fig. 1; and

Fig. 6 is a back view of the snap switch with the mounting plate removed.

The switch of the invention includes a snap switch mechanism carried in a housing which supports a bimetal element for projection into the furnace or other device which is to be controlled. The housing includes a case 10 preferably molded of electrical insulating material and carried on a mounting plate 11 with screws 12. A bimetal element 13 is carried in a bracket 14 fixed to the mounting plate 11, the bracket projecting through an opening 15 in a furnace wall 16 when the switch is mounted thereon by screws 17. An insulator 18 is ordinarily placed between the case and the mounting plate.

The snap action switch mechanism includes a pivot plate 20, a leaf spring 21, a contact plate 22, and a contact stop 23. Terminal posts 24, 25 and a stop post 26 are fixed in the case, preferably by being molded in place (Fig. 5). A screw 27 provides for connecting a wire to the terminal post 24 and a screw 28 provides for connecting a wire to the post 25.

The pivot plate 20 and the spring 21 are mounted in the case by being riveted to the terminal post 24 (Fig. 5), which construction also provides an electrical connection between the post 24 and the spring 21.

The pivot plate 20 has a pair of resilient arms 32 which engage the case 10 and an arm 33 that is indented to provide a pivot edge 34. A screw 35 is positioned in an opening in the front of the case 10 and threadedly engages the pivot plate 20 so that manual rotation of the screw will move the pivot plate and hence the pivot edge 34 against the urging of the arms 32.

The contact plate 22 is mounted in the case 10 by being riveted to the terminal post 25, this construction also providing an electrical path between the terminal post and the contact plate (Fig. 5). The contact plate 32 has an arm 38 which rests against a side and front wall of the case 10 (Fig. 3) and an arm 39 which extends substantially parallel to the front of the case and carries an electrical contact 40. A screw 41 is positioned in an opening in the front of the case and threadedly engages the contact arm 39 adjacent the contact 40. Manual rotation of the screw will position the contact 40 relative to the case and the pivot edge 34, the contact plate being made of a relatively stiff material such as half hard brass so that the position of the contact 40 is determined by the screw 41.

The contact stop 23 may be fixed in the case 10 but is preferably threadedly mounted in the stop post 26 with a knob 45 fixed to the external end for manual rotation of the stop in the stop post (Fig. 5). The knob 45 is preferably made of an electrical insulating material so that it may be manually actuated at any time without risk of electrical shock.

The spring 21 is made of a suitable spring material that is a good electrical conductor, such as beryllium copper. An opening 46 in the spring adjacent the terminal post 24 permits passage of the terminal post 25 and also provides relatively small spring cross section between the moving portion of the spring and the fixed portion. A contact 47 is mounted on the spring at the end away from the terminal post 24 and a toggle tongue 48 is provided intermediate the ends for engaging the pivot edge 34. The tongue is preferably formed by piercing a U-shaped opening 49 in the spring leaving the tongue between the arms of the U with the arm 33 of the pivot plate 20 projecting into the opening for engaging the free end of the tongue.

The switch mechanism is a snap action or toggle switch with the spring 21 being actuated by application of forces perpendicular to the plane of the spring. In the preferred embodiment illustrated herein, the switch actuating forces are applied to the spring by a link 52 mounted in a slot 53, the link projecting through the mounting plate 11. Another slot 54 may be provided in the spring to vary the lever arm of the force exerted by the link. The switch moves between the contact closed or on position as seen

in Fig. 5 with the contacts 40, 47 in engagement, and the contact open or off position with the contact 47 resting against the stop 23. The magnitude of the force required to operate the switch, i.e., the spring bias, may be controlled by means of the screw 35 to change the position of the pivot edge 34. The switch may be biased in either the open or closed position by this means. The position of the moving contact in the off condition is controlled by the stop 23 and the position of the moving contact in the on condition is controlled by the arm 39 of the contact plate 22, thereby providing independent control of the force required to move the switch to the on and off conditions, respectively. These forces are directly related to the differential temperature at which a furnace blower control goes off and on and it is often desirable to provide the home owner with control of this variable. Hence, the screws 35 and 41 are ordinarily adjusted during assembly of the switch and may be covered by a suitable sealing material. The stop 23 is usually made accessible as by means of the knob 45 which may have a suitable marking thereon as seen in Fig. 1.

One end of the bimetal element 13 is mounted in the bracket 14 while the other end is free for movement substantially parallel to the mounting plate. A crank arm 60 is mounted on a shaft 61 in the bracket 14 and has a dimpled plate 62 for engaging the free end of the bimetal element and a channel portion 63 for engaging the link 52 to transfer the bimetal motion to link motion (Figs. 3 and 5). The crank arm 60 includes a stop 64 for engaging the mounting plate and limiting counterclockwise motion of the crank arm as viewed in Fig. 5.

The bracket 14 includes a turned-in tab 67 having an opening 68 therethrough (Fig. 4). A screw 69 is threadedly positioned in the bracket and has a retaining head 69*a*. A plate 70 has a tongue 71 projecting through the opening 68 of the tab 67, an opening 72 through which the bimetal element passes, and an opening 73 through which the screw 69 passes. A lever 74 is pivotally mounted on the bracket 14 and includes an arm 75 which projects substantially into the opening 68.

The bimetal element 13 passes through the opening 68 of the tab 67, through the opening 72 of the plate 70, and has an opening 80 through which the screw 69 passes. The bimetal element may be notched as at 81 where it passes through the plate 70 and may be crimped as at 82 to better maintain the alignment of the parts (Figs. 3 and 4).

The bimetal element 13 is supported at a first pivot point 85 where the element contacts the arm 75, at a second point 86 where the element contacts the plate 70, and at the retaining head 69*a* of the screw 69. The normal position of the element may be varied by manually setting the screw 69 with respect to the bracket 14. The setting of the bimetal element may also be controlled by the lever 74 which varies the location of the pivot point 85.

The lever 74 passes through a slot 87 in the mounting plate 11 and terminates with an indicator 88 adjacent the front of the case 10. A label 89 carrying a temperature scale may be applied to the face of the case to provide temperature indications for the lever position. Then when the switch of the invention is used as a furnace control, the temperature set point can be varied by manually moving the lever to position the indicator 88 opposite the desired temperature. For switches which are to have a fixed operating temperature, the lever 74 may be omitted and the tab 67 can be used to provide the pivot point 85.

The slot 87 in the mounting plate 11 has to be relatively long to provide a wide range of temperature settings for the lever 74. In the preferred embodiment of the invention shown herein, the lever includes a relatively narrow section 90 positioned in the slot 87 and a relatively wide arcuate section 91 immediately adjacent the section 90. The arcuate section 91 substantially blocks the slot 87 for any position of the lever thereby preventing air flow through the slot and substantially eliminating heat transfer by this means. A finger 92 of the lever 74 bears against the case 10 to provide a friction load on the lever so that the lever will remain in its set position.

Although an exemplary embodiment of the invention has been disclosed and discussed, it will be understood that other applications of the invention are possible and that the embodiment disclosed may be subjected to various changes, modifications and substitutions without necessarily departing from the spirit of the invention.

I claim as my invention:

1. In a switch for a furnace control or the like, the combination of: a housing adapted for mounting on a furnace wall; a pivot plate mounted in said housing, said pivot plate having a pivot edge; a leaf spring carrying an electrical contact adjacent one end and mounted to said housing adjacent the other end, said spring having a toggle tongue projecting from said one end toward said other end into engagement with said pivot edge; a contact plate mounted in said housing, said contact plate having an electrical contact positioned for engagement with the contact of said spring, said spring being operable by forces substantially perpendicular thereto to move between contact open and contact closed positions, with said tongue biasing the spring to one of said positions; a bracket mounted on said housing for projection into the furnace; a crank arm for converting motion parallel to the wall to motion perpendicular to the wall; a coupling linked between said crank arm and said spring; a bimetal element having one end mounted in said bracket remote from said housing and the other end in engagement with said crank arm for transferring motion of said bimetal element to said spring; means defining a first pivot point fixed to said bracket; a retaining head fixed to said bracket; a plate mounted between said head and said bracket and providing a second pivot point located between said first point and said head, with one side of said bimetal element contacting said first point and the other side contacting said second point and head; means for moving said head relative to said bracket to vary the normal position of said other end of said element; and means for moving said pivot edge substantially perpendicular to said spring to vary the bias force and position independently of the bimetal element force and position.

2. In a switch for a furnace control or the like, the combination of: a housing adapted for mounting on a furnace wall; a snap action switch mechanism carried in said housing, said mechanism including a switch member that moves toward and away from the furnace wall; a bracket mounted in said housing for projection into the furnace; a crank arm for converting motion parallel to the wall to motion perpendicular to the wall; a coupling linked between said crank arm and said switch member; a bimetal element having one end mounted in said bracket remote from said housing and the other end in engagement with said crank arm for transferring motion of said bimetal element to said switch member; means defining a first pivot point fixed to said bracket; a retaining head fixed to said bracket; a plate mounted between said head and said bracket and providing a second pivot point located between said first point and said head, with one side of said bimetal element contacting said first point and the other side contacting said second point and head; and means for moving said head relative to said bracket to vary the normal position of said other end of said element.

3. In a switch for a furnace control or the like, the combination of: a housing adapted for mounting on a furnace wall; a snap action switch mechanism carried in said housing, said mechanism including a switch member that moves toward and away from the furnace wall; a bracket mounted in said housing for projection into the furnace; a crank arm for converting motion parallel to the wall to motion perpendicular to the wall; a coupling linked between said crank arm and said switch member; a bimetal element having one end mounted in said bracket

remote from said housing and the other end in engagement with said crank arm for transferring motion of said bimetal element to said switch member; means defining a first pivot point fixed to said bracket, said means including a lever pivotally mounted on said bracket and projecting parallel to said bracket through said furnace wall, with pivoting movement of said lever varying the position of said first pivot point relative to said bracket; a retaining head fixed to said bracket; a plate mounted between said head and said bracket and providing a second pivot point located between said first point and said head, with one side of said bimetal element contacting said first point and the other side contacting said second point and head; and means for moving said head relative to said bracket to vary the normal position of said other end of said element.

4. In a switch for a furnace control or the like, the combination of: a mounting plate adapted for mounting on a furnace wall; a case fixed to one side of said plate, said plate having a slot therethrough adjacent said case; a snap action switch mechanism carried in said case, said mechanism including a switch member that moves toward and away from the furnace wall; a bracket mounted on the other side of said plate for projection into the furnace; a crank arm for converting motion parallel to the wall to motion perpendicular to the wall; a coupling linked between said crank arm and said switch member; a bimetal element having one end mounted in said bracket remote from said mounting plate and the other end in engagement with said crank arm for transferring motion of said bimetal element to said switch member; means defining a first pivot point fixed to said bracket, said means including a lever pivotally mounted on said bracket and projecting parallel to said bracket through said slot, with pivoting movement of said lever varying the position of said first pivot point relative to said bracket, said lever having a relatively narrow section disposed in said slot and a relatively wide arcuate section adjacent said slot whereby said slot is substantially blocked for any position of said lever; a retaining head fixed to said bracket; a retaining plate mounted between said head and said bracket and providing a second pivot point located between said first point and said head, with one side of said bimetal element contacting said first point and the other side contacting said second point and said head; and means for moving said head relative to said bracket to vary the normal position of said other end of said element.

5. In a switch for a furnace control or the like, the combination of: a housing adapted for mounting on a furnace wall; a pivot edge mounted in said housing; a leaf spring carrying an electrical contact adjacent one end and mounted to said housing adjacent the other end, said spring having a toggle tongue projecting from said one end toward said other end into engagement with said pivot edge; an electrical contact mounted in said housing for engagement with the contact of said spring, said spring being operable by forces substantially perpendicular thereto to move between contact open and contact closed positions, with said tongue biasing the spring to one of said positions; a bracket mounted on said housing for projection into the furnace; a crank arm for converting motion parallel to the wall to motion perpendicular to the wall, said crank arm including means for engaging said spring in driving relation; a bimetal element having one end mounted in said bracket remote from said housing and the other end in engagement with said crank arm for transferring motion of said bimetal element to said spring; means defining a first pivot point fixed to said bracket; a retaining head fixed to said bracket; a plate mounted between said head and said bracket and providing a second pivot point located between said first point and said head, with one side of said bimetal element contacting said first point and the other side contacting said second point and head; and means for moving said head relative to said bracket to vary the normal position of said other end of said element.

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