

March 22, 1938.

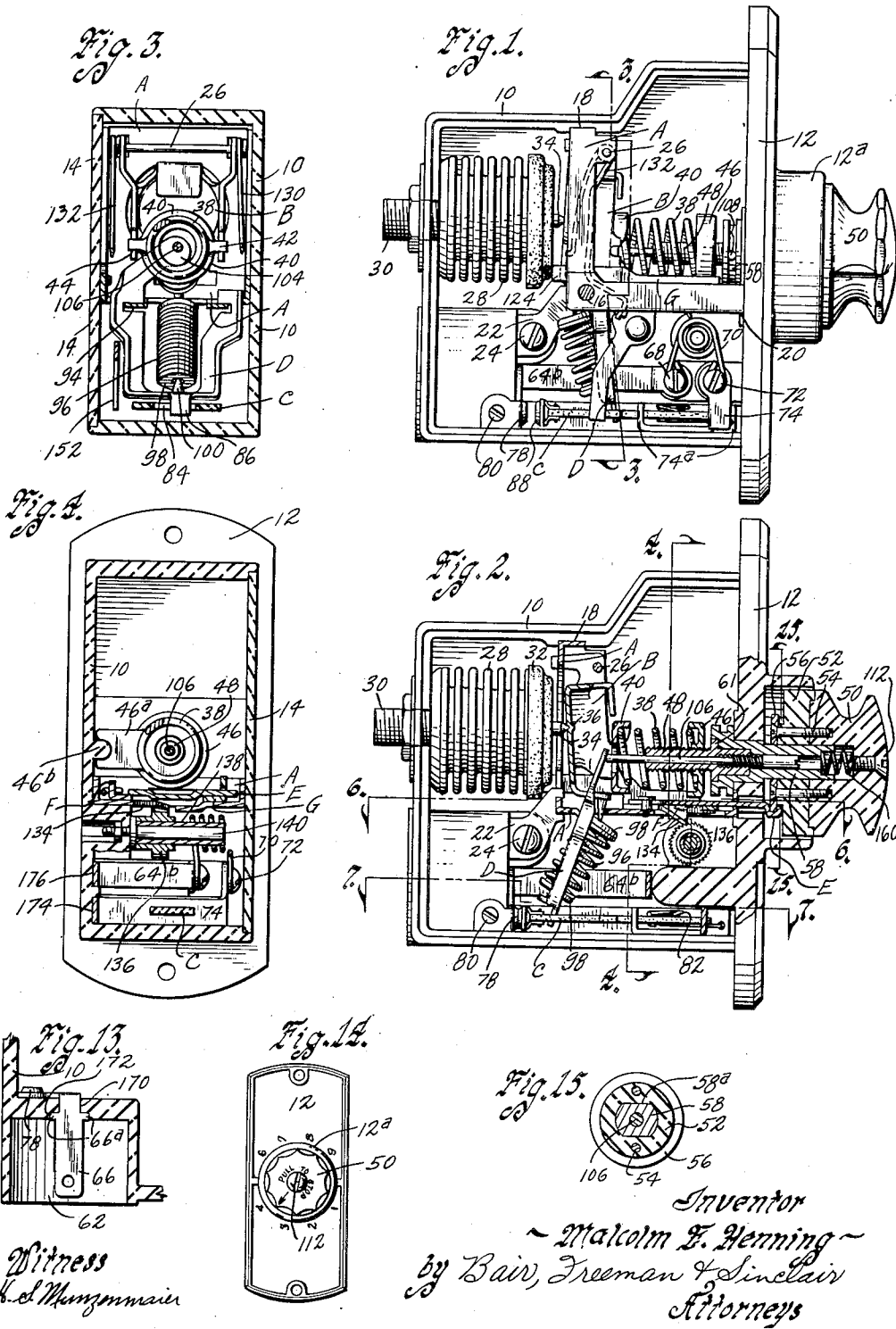
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ADJUSTABLE CONTROL SWITCH

Filed Oct. 3, 1932

2 Sheets-Sheet 1



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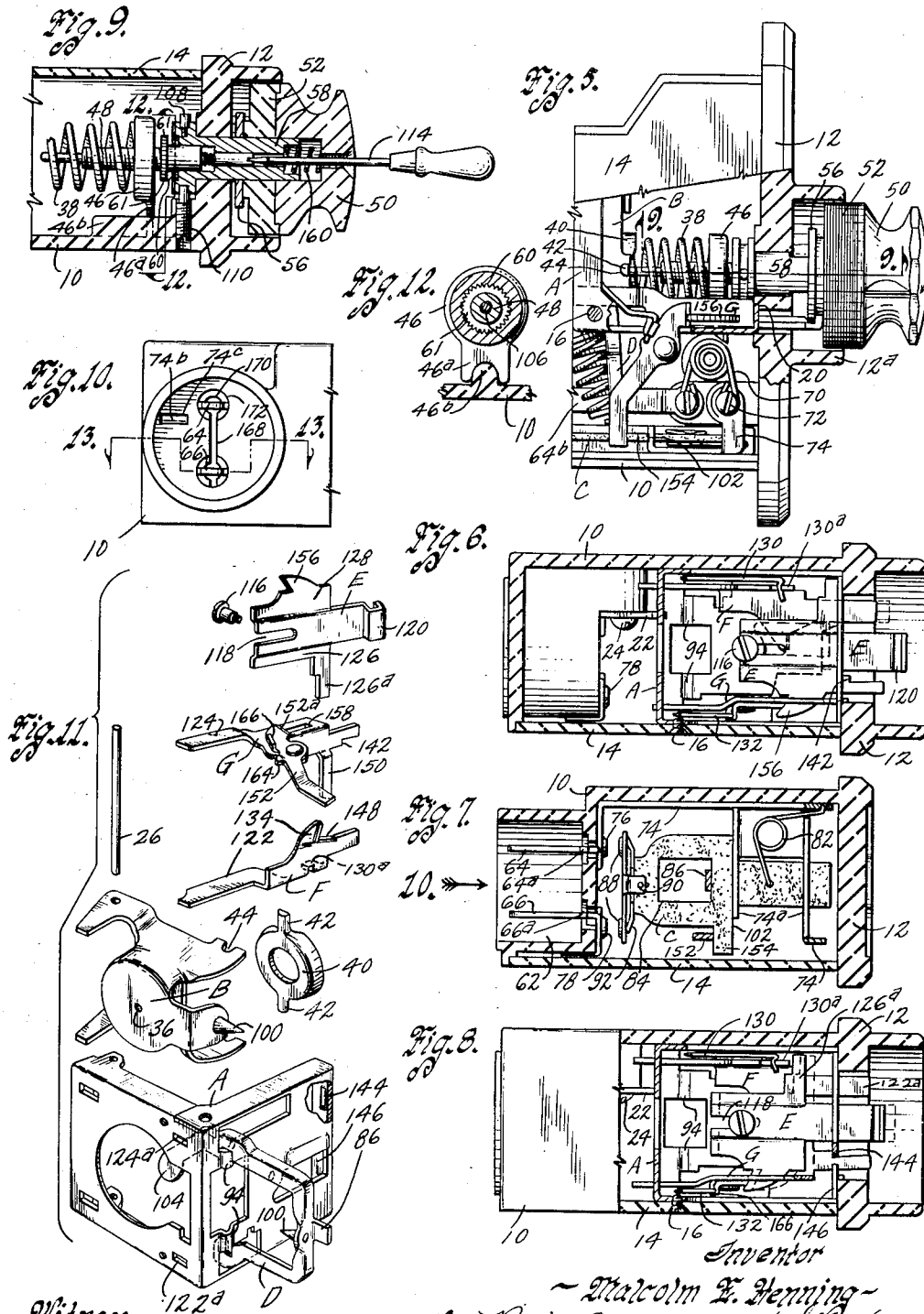
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UNITED STATES PATENT OFFICE

2,111,856

ADJUSTABLE CONTROL SWITCH

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4 Claims. (Cl. 200—31)

The object of my invention is to provide an adjustable control switch which is simple, durable and comparatively inexpensive to manufacture.

A further object is to provide an adjustable control switch having a control knob which may be manipulated for range adjustment, for adjustment of the switch structure to "on" and "off" positions manually and for manual reset of the switch structure after it has been tripped by an overload circuit, the control switch having additional range and differential adjusting mechanism which are accessible through the control knob and thus from the outside of the switch casing without removing the knob, the knob also serving as an indicator of the position of parts of the switch.

Still a further object is to provide an adjustable control switch especially adapted for control of a mechanical refrigerator with a single control knob for effecting "cold" control, turning the switch "off" for defrosting, turning it "on" for starting automatic operation either after it has been turned "off" for defrosting or after it has been tripped because of an overload, differential adjusting and additional range adjusting being effected through an opening in the knob itself so that the switch casing does not have to be removed or opened for any of the adjusting operations.

Still a further object is to provide a control switch having a thermally releasable catch, releasable due to an overload current flowing through the switch and to provide an additional latch which is operated by the catch to release mechanism which moves the switch to open circuit position, the latch being also manually releasable whereby the thermally releasable catch can remain in its caught position when the switch is manually operated to open circuit position.

Still a further object is to provide specific simplified details of construction in the control switch which will appear in the following specification.

With these and other objects in view my invention consists in the construction, arrangement and combination of the various parts of my device, whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawings, in which:

Figure 1 is a side elevation of an adjustable control switch embodying my invention and showing a cover plate removed therefrom.

Figure 2 is a similar view with parts of the

range and differential adjusting mechanism etc. in cross section.

Figure 3 is a sectional view on the line 3—3 of Figure 1.

Figure 4 is a sectional view on the line 4—4 of Figure 2.

Figure 5 is a view similar to the right half of Figure 1 showing the parts in a different position and a few of the parts sectioned.

Figure 6 is a sectional view on the line 6—6 of Figure 2 showing the parts in manually released position.

Figure 7 is a sectional view on the line 7—7 of Figure 2.

Figure 8 is a view similar to Figure 6 showing the parts in latched position.

Figure 9 is a sectional view on the line 9—9 of Figure 5 showing how parts of the switch may be adjusted.

Figure 10 is an end elevation in the direction of the arrow 10 adjacent Figure 7.

Figure 11 is a separated perspective view of control parts of the switch assembly.

Figure 12 is a sectional view on the line 12—12 of Figure 9.

Figure 13 is a sectional view on the line 13—13 of Figure 10.

Figure 14 is a front elevation of the switch structure; and

Figure 15 is a sectional view on the line 15—15 of Figure 2.

On the accompanying drawings, I have used the reference numeral 10 to indicate generally a switch casing. The casing 10 has a front plate 12 and a cover plate 14. The cover plate 14 is held in position by a screw 16 (see Figure 6).

Within the switch casing 10, I provide an L-shaped bracket A for supporting various movable parts of the switch mechanism. The bracket A is confined in position by its ends being positioned in slots 18 and 20 and a clip 22 engaging the central portion of the bracket. The clip 22 is held in position by a screw 24.

The bracket A carries a pin 26 on which a pressure operated element B is pivoted. The element B is adapted to be moved in one direction by pressure within a bellows 28, such pressure being caused by a temperature increase when the switch is used for controlling a mechanical refrigerator.

The bellows 28 has a connection 30 with which a tube and bulb (not shown) may be connected and the tube, bulb and bellows may be suitably charged in the ordinary manner so that when the bulb is located within a refrigerating com-

partment, the bellows 28 will be expanded by a rise of the temperature therein.

Through the medium of a cap 32, the bellows 28 is connected by an engagement type of connection with the pressure operated element B. The cap 32 carries a pin 34 adapted to engage in a depression 36 of the element B.

The bellows 28 is opposed by a spring 38. The spring 38 has one end seated in a cup 40 which has projections 42 adapted to engage in notches 44 of the element B. Thus the cup is pivoted relative to the element. The other end of the spring 38 is seated in a cup 46 which is screw-threaded on a rotatable adjusting sleeve 48. The cup 46 is held against rotation by a forked arm 46a (see Figure 12) engaging a rib 46b of the casing 10.

The sleeve 48 is adapted to be rotated by a control knob 50. The control knob 50 has an indicator disk 52 secured thereto by screws 54. A release disk 56 is also secured thereto by the screws.

A sleeve 58 extends rotatably through the front plate 12 of the casing 10. The sleeve 58 has flattened surfaces 58a, as shown in Figure 15 and the disk 52, as well as the knob 50 have bores which are of the same cross section so that the knob 50 is slidable relative to the sleeve 58 but non-rotatable relative thereto. Thus rotation of the knob will rotate the sleeve.

Rotation of the sleeve 58 is imparted to the sleeve 48 by a non-circular socket 60 of the sleeve 58 receiving a similarly shaped flange 61 of the sleeve 48 (see Figure 12).

Thus far, the pressure operated element B, the range of which can be adjusted by rotating the knob 50, has been described. The element B is for operating a switch which will now be described.

A socket 62 is formed in the casing 10 (see Figures 7 and 10). Prongs 64 and 66 extend from the casing into the socket. The prong 64 has an extension 64b terminating at a screw 68 (see Figure 1). A resistance coil 70 is connected therewith and with a screw 72. The screw 72 is carried by a bracket 74 which terminates at its opposite end in a contact 76. The prong 66 has a contact 78 and terminates at a screw or the like 80 which holds the prong in position.

The bracket 74 (see Figure 7) has arms 74a through which a switch element C is slidable. The switch element C is preferably made of insulating material and constrained to the closed circuit position by a spring 82. It is provided with an opening 84 into which a snap acting arm D, or more specifically a lip 86 thereof, extends.

The switch element C carries a pair of bridging contacts 88. These are carried on a bar pivoted at 90. A spring 92 is interposed between the switch element C and the bar for aiding in a quick opening of the switch contacts, the pivot 90 somewhat loosely connecting the element C with the bar for this purpose.

The snap acting lever D is pivoted in depressions 94 formed in the bracket A. It is adapted to be snapped from one position to another by a spring 96 having heads 98 engaging pointed elements 100 of the bracket A and of the pressure operated element B.

The motion of the lever D to open circuit position is arrested by a shoulder 102 of the switch element C engaging the left extension 74a of the bracket 74 in Figure 7. Its motion in the opposite direction is arrested by an extension 104 of the lever D engaging a differential adjusting

screw 106. The screw 106, as shown in Figure 2, is carried by and threaded relative to the sleeve 48 so that rotation of the screw will adjust it longitudinally relative to the sleeve. This provides a differential adjustment inasmuch as the extension 104 can be stopped at different positions, thereby requiring more or less reduction of pressure in the bellows 28 to start the lever D toward its switch opening position.

From the foregoing description, it will be obvious that I have provided a switch construction in which normal range adjustment may be effected by rotation of the knob 50. The knob 50 is limited in its rotation by a stop pin 108 in the sleeve 58 (see Figure 9) engaging a stop screw 110 carried by the casing 10. Additional range adjustment may be had by removing a closure screw 112 in the knob 50 and inserting a screw driver or the like 114 whereupon the screw 106 can be engaged for pressing the sleeve 48 inward against the action of the spring 38 to the position shown in Figure 9.

As shown in Figure 14, it will be noted that the front wall 12 of the casing 10 has graduations thereon. The arrow shown on the knob 50 can be adjusted any number of points above zero before the parts are moved to the position of Figure 9 and then after they are moved to this position, it can be moved back to zero and the screw driver 114 thereafter withdrawn whereupon the sleeve 48 will again assume a connected position with respect to the sleeve 58, but the range will have been additionally changed to the extent of the number of graduations over which the knob was rotated after placing the parts in the position of Figure 9. Thereafter, the high and low limits of the normal range adjustment as caused by rotation of the knob 50 will be changed by this means of additional range adjustment.

The differential adjustment is effected by rotating the screw 106 by the screw driver 114 inserted as shown in Figure 9. After additional range adjustment and/or differential adjustment has been effected, the screw driver is removed and the screw 112 replaced. It is thus obvious that the mechanism for the two adjustments just mentioned is accessible through the knob 50 without removing it or without opening the casing 10.

It is desirable also to have the knob 50 manually operable for turning the switch "on" and "off" and manually operable for resetting the switch after it has been opened because of an overload condition.

The mechanism for opening of the switch because of overload will now be described. A slide member E is connected with the bracket A by a shouldered screw 116 extending through a slot 118 of the slide member. The slide member has a U-shaped hook 120 to engage the disk 56 of the knob 50 so that the slide member can be pushed or pulled as desired by manipulating the knob.

A thermally releasable catch F and a latch G are slidable in the bracket A, arms 122 and 124 thereof respectively being slidable through slots 122a and 124a of the bracket A. The body portions of the members F and G are confined against the right hand wall of the bracket A in Figure 11 by portions 126 and 128 of the member E.

The members F and G are constrained to move toward the right in Figure 6 by springs 130 and 132. These springs, as shown in Figure 3, extend around the pivot pin 26, their general shape being shown perhaps best by dotted lines in Figure 1. The catch member F is provided with a catch lug

134 adapted to engage a ratchet wheel 136 shown in Figures 2 and 4. The ratchet wheel 136 is soldered to a tube 138 which in turn is supported on a pin 140. The coil of resistance wire 70 surrounds the tube 138 so that upon an excessive flow of current through the coil, the solder will be melted so that the ratchet wheel 136 can be rotated by the catch 134 and the catch member F, which rotation will be caused by the spring 130.

10 The latch member G is adapted to normally assume the position of Figure 3 wherein a latch shoulder 142 thereof engages the edge of an opening 144 in a flange 146 of the bracket A. The spring 132 has a tendency to rotate the member 15 G counterclockwise as viewed in Figure 3, with the extension 124 through the opening 124a acting as a pivot. Thus the spring 132 tends to keep the latch shoulder 142 in latched position.

When the catch 134 however is released by melting of the solder connection between the ratchet wheel 136 and the tube 138, an incline 148 of the member F engages an arm 150 of the member G for swinging the member G clockwise from the Figure 3 position. The member G will then be pushed toward the right to the position of Figure 6 due to the action of the spring 132. This may be termed the unlatched position and is the position for opening the electric circuit.

It will be noted that the member G has an arm 152 carried thereby. This arm (see Figures 5 and 7) is adapted to engage an extension 154 of the switch element C to move the switch to the open circuit position. Thus the circuit is opened when an overload current flows therethrough, the degree of overload being determined by the size of the wire used in the resistance element 70 whereby the heat radiated therefrom in proportion to the current flowing through the coil may be predetermined.

40 The latch of the member G may be manually unlatched from the opening 144. This is accomplished by pulling on the knob 50 which pulls the slide member E.

The slide member E has an inclined lug 156 which is positioned in a slot 158 of the member C. Normally the slide member E is in the dotted line position of Figure 3. In such position, the lug 156 engages the left end of the slot 158, a spring 160 within the knob 50 serving to move the knob to such position. When the knob is pulled out to the position of Figure 6, however, the incline of the lug 156 swings the latch member G downwardly so as to unlatch the latch shoulder 142 from the edge of the opening 144, resulting in the member G being moved to the open circuit position of Figure 6 due to the action of the spring 132. Thus manual control of the circuit to open position is effected.

I have been describing the arm 152 as though it were an integral part of the latch member G. It will be noted, however, that it is pivoted at 162 thereto. It has a lug 164 which engages an edge of the latch member G to limit pivotal movement of the arm 152 in one direction. A lug 166 is provided on the arm 152 with which the spring 132 engages whereby to retain the stop lug 164 engaged with the edge of the member G as well as impart sliding motion to the member and pivotal motion to it tending to retain it latched as hereinbefore described.

70 The purpose of pivoting the arm 152 is so that when the parts are moved to the full in position shown by solid lines in Figure 3 by pressing the knob 50 inwardly for the purpose of re-latching the latch 142 after it has been unlatched either

manually or thermally, the left end of the lug 166 in Figure 11 will engage an edge 152a of the arm 152 to swing the arm counterclockwise from the position shown in Figure 1. This causes the arm to engage the extension 154 of the switch element C to hold the contacts 88 separated from the contacts 76 and 78 during the latching or resetting operation. This is in order to prevent manually holding the switch in closed position after the thermal overload release has automatically operated.

After the resetting operation has been performed, the knob 50 is released whereupon it will move slightly outward to the position of Figure 2 and the slide member E will move to the dotted line position of Figure 3, thereby permitting the arm 152 to be swung to the solid line position of Figure 1 so that it does not thereafter interfere with the automatic operation of the switch element C to open and closed circuit positions.

Referring to Figures 10 and 13, a slot 168 connects a pair of circular openings 170 which are surrounded by circular depressions 172. The prongs 86 and 88, it will be noted, are flat and are provided with lugs 86a and 88a, respectively. The prongs 86 are inserted through the slot 168 from the inside of the casing 10 during the assembling operation. They are then turned a quarter turn so that the lugs 86a and 88a prevent their return into the casing and when the screws 88 and 88a are subsequently inserted, they prevent rotation of the prongs to aligned position with the slots so that a very simple arrangement of anchoring the prongs and preventing their disassembly is thus provided.

The bracket 74 having the contacts 76 has an end 148 adapted to enter a slot 170c in the bottom of the socket 82. This feature in conjunction with a slot 170 in the casing 10 (see Figure 4) keeps the member 74 in its proper position when the screw 78 is inserted. A similar slot 170 is provided for the bar 84.

I have provided a switch structure in which a single control knob performs a number of functions and also permits accessibility for additional adjustment purposes without the necessity of opening the switch casing or removing the switch from any device on which it might be mounted. The knob can be rotated for normally changing the range of the switch and can be pulled out for opening the circuit manually. If the circuit opens thermally due to an overload, the knob will be pushed out so that the indicator disk 82, which may be colored red, for instance, will indicate that the switch has tripped out. The knob may then be pushed in for resetting the overload mechanism. Additional range adjustment, or in other words, a change from the original factory adjustment may be made through the knob after removing the screw 112. Differential adjustment can also be effected while the screw is removed.

The adjustments are not exposed but are inclosed and foolproof. A separate latching mechanism is provided independent of the thermal catch 134 so that when the switch is adjusted manually to the off position there is no wear on the teeth of the ratchet 136. The latch shoulder 142 is of much more rugged construction than the ratchet wheel 136 and thus takes the wear of manual unlatching rather than letting all this wear come on the teeth which are in my construction used only for thermal unlatching and resetting thereafter.

The knob 50 also serves as an indicator when the switch is tripped to "off" position due to an

overload current flowing therethrough. When the solder melts and thereby permits the ratchet wheel 136 to rotate, the member F, or more specifically a lug 130a thereof, (see Figures 6 and 11) moves toward the right and engages an extension 126a of the member E to move it from the dotted line position of Figure 8 to the full line position of Figure 6. This causes the knob 50 to be moved to the position of Figure 5 where the indicating disk 52 will be observable beyond the end of a hub 12a in which the disk 52 is normally concealed.

Although I have illustrated a specific control, changes may be made in the construction and arrangement of the parts of my device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents, which may be reasonably included within their scope.

I claim as my invention:

1. In an adjustable control switch, a pressure operated element, a snap acting element associated therewith for operation thereby, a switch element operated by said snap acting element, resilient means opposing said pressure operated element and means for adjusting said resilient means comprising a rotatable element for changing the adjustment upon rotation thereof, a knob element for rotating said rotatable element, means for preventing removal of said knob and means of operative connection between said knob element and said rotatable element, said means of operative connection comprising a non-circular socket in one of said elements and a similarly shaped portion on the other element to fit therein, said socket and said portion being disassociable against the action of said resilient means while said means for preventing removal of said knob remains operative.

2. In an adjustable control switch, a pressure operated element, a switch element operable thereby to make and break an electric circuit, spring means opposing said pressure operated element, a range adjusting element for changing the tension of said spring means, overload means also

operable to break said electric circuit, said overload means comprising a thermally responsive member and a releasable catch which is released upon the thermally responsive member operating and a latch releasable by said catch engaging therewith after such operation, said latch being operable to break said circuit, said range adjusting element being operatively connected with said latch to manually release it.

3. In an adjustable control switch, a pressure operated element, a switch element operable thereby to make and break an electric circuit, spring means opposing said pressure operated element, a range adjusting element for changing the tension of said spring means, overload means also operable to break said electric circuit, said overload means comprising a thermally responsive member and a releasable catch which is released upon the thermally responsive member operating and a latch releasable by said catch engaging therewith after such operation, said latch being operable to break said circuit, said range adjusting element being operatively connected with said latch to manually release it and to reset it after either overload or manual release.

4. In an adjustable control switch, a pressure operated element, a switch element operable thereby to make and break an electric circuit, spring means opposing said pressure operated element, a range adjusting element for changing the tension of said spring means, overload means also operable to break said electric circuit, said overload means comprising a thermally responsive member and a releasable catch which is released upon the thermally responsive member operating a latch releasable by said catch engaging therewith after such operation, said latch being operable to break said circuit, said range adjusting element being operatively connected with said latch for movement thereby to a different position after said latch becomes unlatched and means on said range adjusting element to indicate such different position.

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