Nov. 25, 1930. C. P. DOUGHERTY 1,782,530

COMBINATION CONTROL SWITCH

Original Filed April 23, 1929

Fig. 1

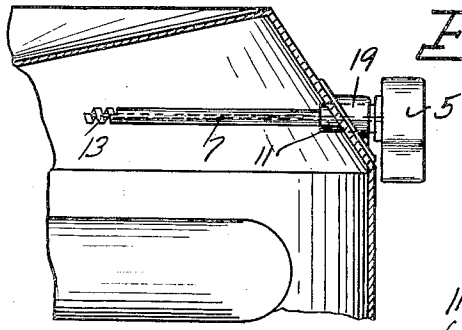


Fig. 2

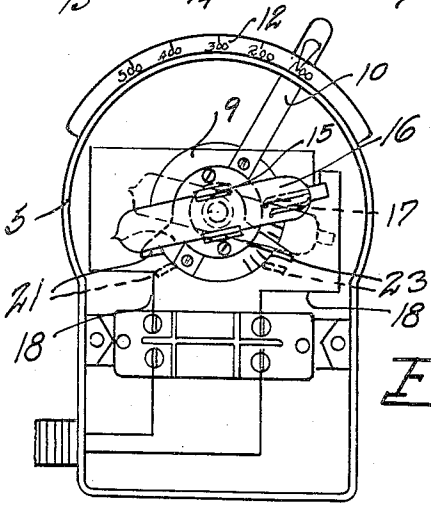


Fig. 3

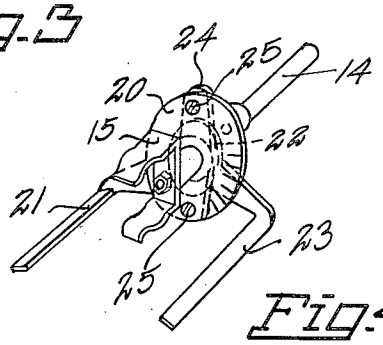


Fig. 4

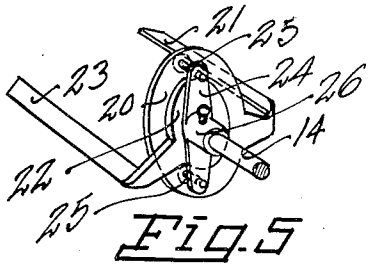


Fig. 5

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UNITED STATES PATENT OFFICE

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COMBINATION CONTROL SWITCH

Application filed April 23, 1929, Serial No. 357,547. Renewed July 23, 1930.

My invention relates to combination control switches and the primary objects of the invention are to provide a switch that may be set at any desired number of degrees on a scale and which is actuated by the expansion and contraction of a helical spring whereby it will tilt a tube of mercury to one side or the other and cause the mercury to make or break the circuit between the terminals within the tube. The device is particularly adapted to be used in connection with furnaces equipped with motor fans and may be interposed between the fan and motor in an electric circuit for the purpose of automatically turning the fan on and off. The adjustable switch provides a positive means whereby the circuit may be opened or closed at whatever point or number of degrees it may be set, and thus materially increases the efficiency of the heating unit.

With the above and other objects in view which will appear as the description proceeds, the invention consists of the novel construction, adaptation, combination and arrangement of parts hereinafter described and claimed. These objects are accomplished by devices illustrated in the accompanying drawings; wherein:—

Figure 1 is a view in vertical section of the upper portion of a furnace and showing the device installed therein;

Fig. 2 is a view in longitudinal vertical section of the device with parts shown in elevation;

Fig. 3 is a diagram view in front elevation with the front of the casing removed;

Fig. 4 is a detail view in front perspective of the switch; and

Fig. 5 is a similar view in rear perspective of the switch.

Referring to the drawings throughout which like reference numerals designate like parts, the numeral 5 indicates a casing having a removable front 6. A tubular member 7 extends rearwardly from the casing and is provided with an annular flange 8 adjacent the casing. A disc 9 together with a hand lever 10 is secured to the flange of said tubular member. Said disc member is set snugly in a corresponding opening in the rear wall of the casing and a flanged sleeve 11, secured to said rear wall, serves to retain the disc in place. The hand lever may be moved back and forth thus turning the disc 9 and tubular member 7 as desired. A scale 12 is mounted on top of the casing adjacent the exteriorly projecting handle end of the lever which may thus be set to indicate any desired number of degrees on the scale.

The outer end of the tubular member 7 has a helical spring 13 secured thereto and a torsion rod 14 secured to the outer end of said spring extends back through the tubular member and into the casing 5. A clamp 15 has its hub loosely mounted on the casing end of said rod and a mercury tube 16 is held between its jaws. Terminals 17 extending into one end of said tube have circuit wires 18 which may lead to a motor (not shown). Now, it will be obvious that when the mercury moves to the terminal end of its tube the current will be closed and when the mercury moves to the other end the circuit will be broken, it being understood that the pivotal movement of the mercury tube beyond its level or horizontal position on either one side or the other controls the make and break of the circuit.

Referring to Fig. 1 of the drawings, the device is ordinarily used in connection with a furnace or the like and is mounted with the tubular member 7 projecting into the furnace and the casing 5 disposed on the exterior thereof. A bearing 19 usually forms the connection between the furnace and the device and the sleeve 11 passing through said bearing provides means whereby the device may be axially adjusted with respect to the level of the mercury tube 16 and its predetermined relation with the scale 12 and indicator lever 10. The furnace heat will expand or contract the spring 13 and thus turn the torsion rod 14. Although the clamp 15 is loosely mounted on said rod, its weight, together with the weight of the mercury and its tube, will cause sufficient frictional engagement between the rod and clamp to carry said mercury tube past the level or horizontal position, and the weight of the mercury upon its movement in either direction will tip the

tube to either the position shown in full or dotted lines in Fig. 3, thus making or breaking the circuit as will be understood.

This means of making and breaking the circuit is not entirely satisfactory and reliable for the reason that it depends on frictional engagement of the clamp and rod together with other factors which cause a wider variation in the number of degrees at which the circuit is closed and opened. Heretofore the clamp 15 was securely fastened to the torsion rod 14, thus causing a slight variation in the number of degrees between the make or break of the circuit and was not adjustable in the field. This operation is entirely unsatisfactory, due to starting and stopping of the motor too frequently. My improvement is designed to overcome these irregularities, and provides direct and positive means for controlling the throw or movement of the mercury tube together with means for regulating the same. Referring particularly to Figs. 4 and 5, the improvement comprises a relatively large disc 20 which has a stop arm 21 projecting at right angles therefrom. A smaller disc 22 placed against said larger disc, is provided with a projecting arm 23 and is held in frictional engagement between said larger disc and a crosshead clamp 24 whose ends are secured to said large disc by bolts or screws 25. The hub 26 of said clamp is fixedly secured to the torsion rod 14 which passes loosely through said larger and smaller discs. A scale 27 is provided on the larger disc whose graduations correspond in all respects with the scale 12.

To illustrate the operation of my device, the lever arm 10 is moved to say three hundred degrees on the scale 12, and the arm 21 being controlled by the lever 10, through its various connections is moved to the dotted position shown in Fig. 3. The arm 23 is then adjusted to the desired variation, say one hundred and twenty degrees on the scale 27, for the purpose of establishing a definite number of degrees between the make and break of the circuit.

When the temperature in the casing reaches the desired three hundred degrees, the mercury tube 16 has reached its horizontal or level position, and being free on the torsion rod 14, is carried over center by the flow of the mercury causing said tube to tip and rest on the arm 23. This action makes the circuit thus starting the motor. After the fan has lowered the temperature one hundred and twenty degrees the mercury tube 16 has returned to its horizontal position through the contraction of the helical spring 13. The weight and flow of the mercury again tips the tube onto the arm 21 thus opening the circuit.

The arm 23 can be adjusted to make or break the circuit from a few degrees to a number of degrees. For example, the adjustment of the arm 23 can range from five to five hundred degrees, a difference between the make and break, and can be adjusted to the degrees desired by raising or lowering the arm 23. My improvement therefore provides a positive means whereby the throw of the mercury tube is definitely established.

Having thus described my invention, it being understood that minor changes may be resorted to in its construction without departing from its scope and spirit, what I claim and desire to secure by Letters Patent of the United States is:—

1. A combination control switch comprising a disc loosely mounted on a thermostat torsion rod, a mercury tube loosely mounted on the torsion rod, an arm for said disc adapted to engage an end portion of the mercury tube, another disc mounted on the torsion rod in engagement with the first named disc, means for clamping said discs in frictional engagement with each other, said means secured to said torsion rod, and an arm for the second named disc arranged to engage an end portion of the mercury tube.

2. A combination control switch comprising a disc loosely mounted on a thermostat torsion rod, a mercury tube loosely mounted on the torsion rod, an arm for said disc adapted to engage an end portion of the mercury tube, another disc mounted on the torsion rod in engagement with the first named disc, means for clamping said discs in frictional engagement with each other, said means comprising a crosshead clamp bolted to the first named disc and secured to the torsion rod, an arm for the second named disc arranged to engage the other end portion of the mercury tube, means for adjusting said last named disc and arm, and terminals for the mercury tube.

3. In combination in a thermostatic switch, a movably mounted member, thermostatic means for moving said member, switch actuating means controlled by said member, said switch actuating means including a plurality of switch moving members mounted to be moved by said first mentioned member, adjusting means therefor, whereby said members may be adusted in unison and adjusting means whereby said members may be adjusted with relation to each other, each of said switch moving means adapted to move a switch.

4. In combination, a movably mounted element, thermostatically controlled means for moving said element, a plurality of switch operating means carried by said element, adapted to operate the switch to make a contact and to operate it to break a contact, a switch movably positioned to be engaged by said switch operating elements, means for varying the position of said switch operating elements together whereby the switch operating means may be adjustably posi-

tioned to operate the switch at a given temperature, and additional means for varying their relative positions, whereby to provide a lag interval of time of adjustable length, after the switch operating means has operated, before the switch is effectively moved to break the contact.

5. In combination with a mercury switch, an operating means therefor, a thermostatically responsive means for moving said operating means, means for adjusting the switch operating means as a whole to vary the temperature at which the switch will be operated, said means including a pair of switch operating members adjustably positioned with respect to the switch, and additional means whereby the interval of time required to operate the switch is variable, said means including an adjustment between said switch operating means, so that they may be adjusted with relation to each other.

6. A combination control switch, comprising a thermostat torsion rod, a mercury tube freely mounted on said rod, a member adapted to engage a portion of said mercury tube, a second member mounted on the torsion rod in engagement with the first named member, means for clamping said first and second members in adjusted relation with each other, said means mounted on said torsion rod, and a projection from said second named member arranged to engage a portion of the mercury tube.

7. In combination, a mercury switch and means for operating it, including a member movably mounted, a thermostatic element adapted to move and control the movement of the said movably mounted member, a pair of switch operating members positioned on said movably mounted member, means for adjusting their position together, means for moving them relatively with respect to each other, a switch freely positioned for movement adjacent said switch operating means, and adapted to be contacted and moved thereby, there being an amount of play between said switch and said switch operating means, whereby an adjustable quantity of excess movement is necessary to move the switch in a reverse direction after it has once come to rest.

8. In a control switch mechanism, a member mounted for rotation, thermostat means for rotating said member in response to temperature changes, a switch operatively associated with said member and mounted for rocking movement about a relatively fixed pivot positioned beneath the center of gravity of the switch, a pair of switch operating arms carried by said member, there being one arm on each side of the fixed switch pivot and below said switch, means for adjusting the arms angularly about the axis of rotation of said member and relatively to each other to vary the angle included between said arms whereby to define the rocking movement of the switch, and means to adjust said arms as a unit about the axis of rotation of said member whereby to define the temperature at which the switch is actuated.

9. In a control switch mechanism, a mercury tube switch mounted for rocking movement about a relatively fixed pivot, a member positioned coaxially of said switch pivot and mounted for rotational movement, thermostatic means for actuating said member in response to temperature variations, switch operating arms carried by said member, said arms being disposed on opposite sides of the switch pivot and arranged to move the switch to "on" and "off" positions in response to thermostatically controlled movements of said member, and means for adjusting said arms relative to each other and angularly of the axis of rotation of said member whereby to vary the temperature range between "on" and "off" positions of the switch.

10. In a control switch mechanism, a switch, a pivot on which the switch is mounted for limited pivotal movement, a member mounted for rotation, thermostatic means for rotating said member, a lost motion connection between said member and the switch for moving the latter to "on" and "off" positions, said lost motion connection including a pair of arms operatively associated with said member and switch, and arranged to be moved by the member to move the switch, said arms extending substantially radially of and on opposite sides of the pivotal axis of the switch, and means for varying the angle included between said arms whereby to vary the temperature range between "on" and "off" positions of the switch.

In testimony whereof I affix my signature.

CHARLES P. DOUGHERTY.