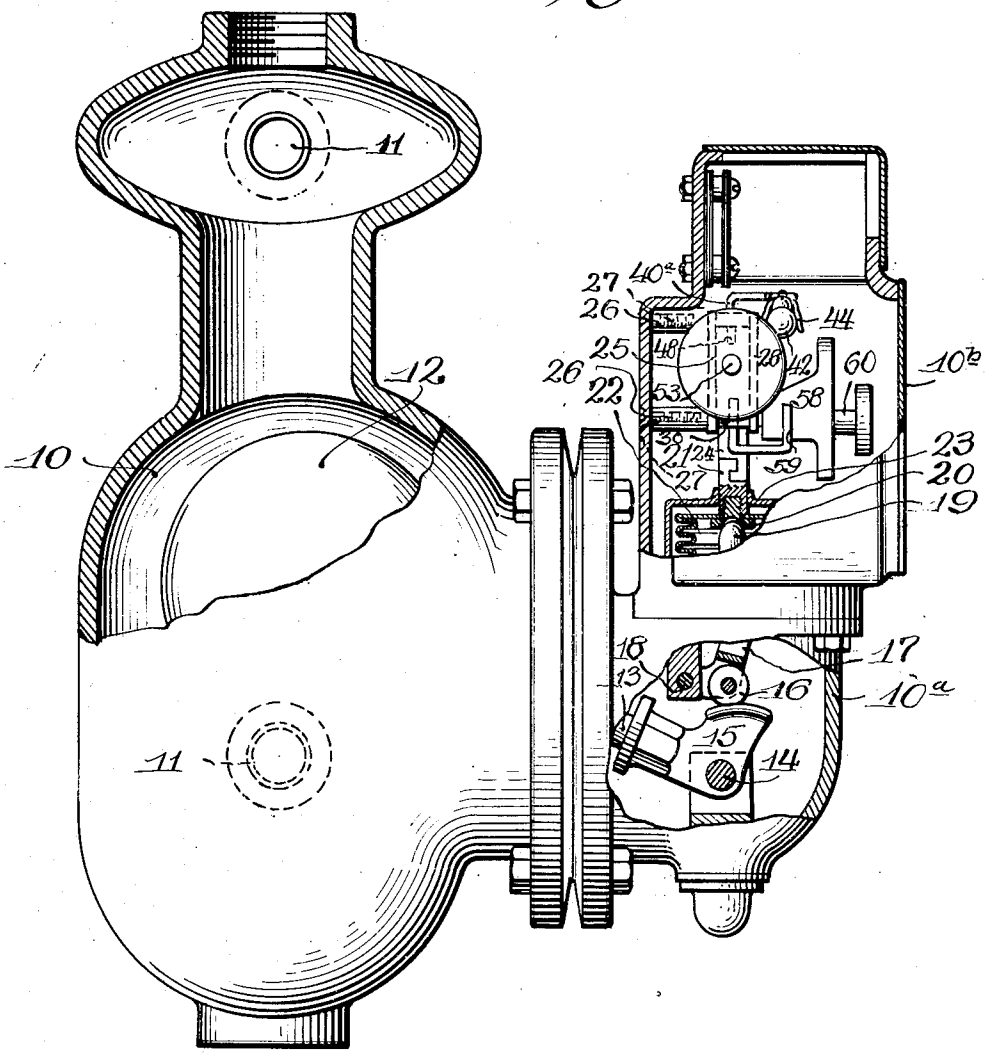
April 19, 1932. O. F. CARLSON 1,854,540

SWITCH ACTUATING MECHANISM

Original Filed Nov. 22, 1926 2 Sheets-Sheet 1

Fig. 1



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Original Filed Nov. 22, 1926 2 Sheets-Sheet 2

Fig. 4

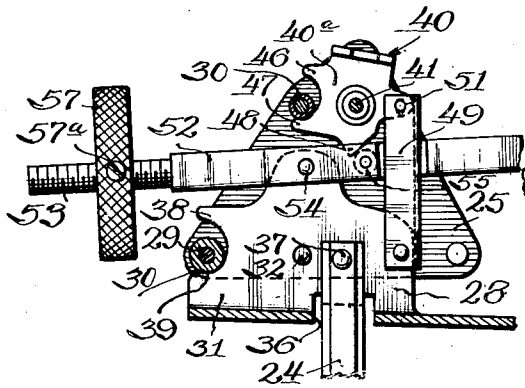
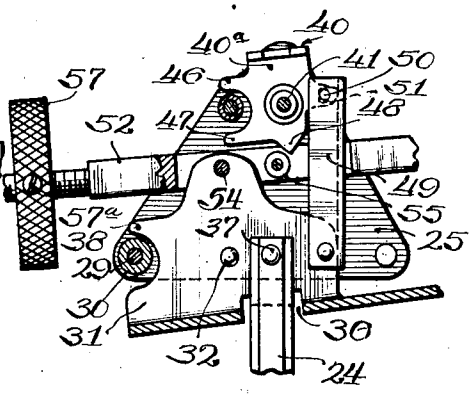


Fig. 5



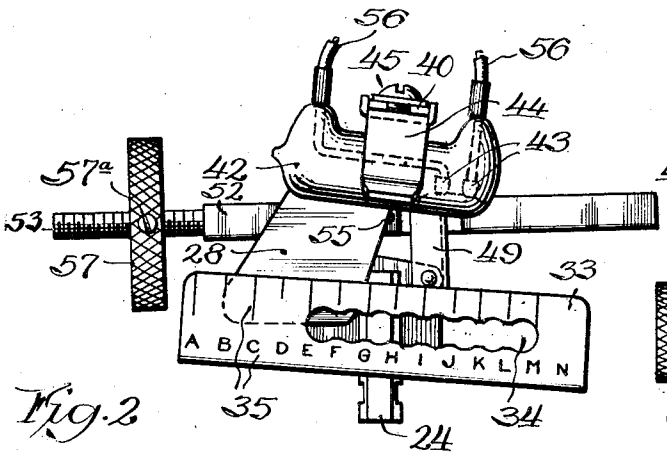


Fig. 2

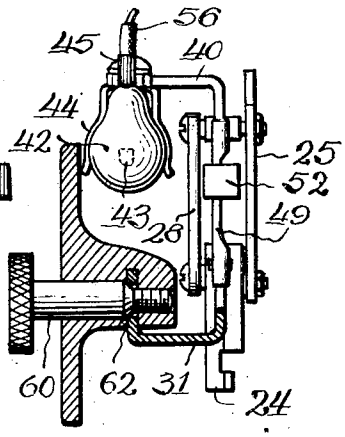
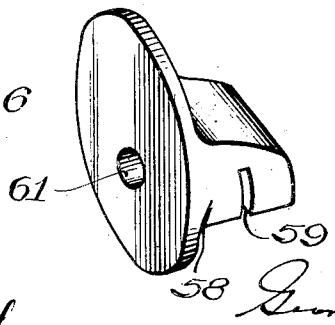


Fig. 3

Fig. 6



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UNITED STATES PATENT OFFICE

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SWITCH ACTUATING MECHANISM

Application filed November 22, 1926, Serial No. 149,868. Renewed October 1, 1931.

My invention relates to improvements in switches and particularly to switches for controlling the pump motor of an oil burning heating plant in accordance with the steam pressure, vacuum conditions and water level thereof.

The principal object of my invention is to provide a switch mechanism adapted to be actuated by means responsive to boiler conditions for effecting a quick non-arcing opening and closing of an electric circuit such as the circuit of a motor of an oil burning heating apparatus.

A further object of the invention is to provide such a switch which may be so adjusted as to open or close the motor circuit at various predetermined steam pressure or vacuum conditions, depending on the principle of the heating apparatus with which the improvements are used.

Further objects of the invention relate to various features of construction and arrangement of parts which will become apparent from a consideration of the following specification and accompanying drawings, wherein

Figure 1 is a side elevation showing an embodiment of my improvements associated with apparatus responsive to boiler conditions, parts of said figure being shown broken away and in section for the purpose of clearness.

Fig. 2 is a detailed front elevation of the switch mechanism.

Fig. 3 is an end elevation thereof partly in section.

Fig. 4 is a sectional view taken on line 4—4, Fig. 3 showing the mechanism in "on" or circuit closing relation.

Fig. 5 is a view similar to Fig. 4 showing the mechanism moved to "off" position.

Fig. 6 is a detail view of one of the adjustable weights.

In the drawings, 10 is a float casing which is attached to a boiler of a heating apparatus (not shown), the said casing being attached to the boiler by means of the taps 11, 11, on which the usual water gauge is mounted. The water gauge is attached to the casing 10 by additional taps (not shown) so it will indicate the height of the water in the boiler as before.

Within the casing 10 is a float 12 attached to the lever 13, pivoted at 14, the lever carrying a cam 15 which contacts with the roller 16 secured to the lever 17. Up and down movement of the float 12 will cause the cam 15 to move the lever 17 upon the pivot 18 to thereby raise or lower the plunger 19 which contacts with a nut 20 which engages the lower end of the stud 21. The nut 20 and stud 21 clamp therebetween the top portion of the flexible bellows 22 which is adapted to expand or contract in accordance with steam or vacuum conditions in the boiler and which prevents escape of steam or water from the casing extension 10*a*.

A shell 23 surrounds the bellows 22 and serves also to guide the stud 21 in its reciprocating movement when actuated by the bellows 22. The stud 21, as shown in Fig. 1, is formed for removable engagement with the plunger 24 of the switch mechanism hereinafter described. The features of the apparatus set out above are described more in detail and claimed in the joint application of myself, Leo B. Miller and Everett N. McDonald, filed May 8, 1926, Serial No. 107,649, and constitute no part of the switch mechanism forming the basis of the present application.

Secured to the section 10*a* of the casing is a third section 10*b* within which the switch mechanism is housed. The casing 10*b* is closed to the fluid in casing 10*a* by means of the bellows 22 and shell 24, described above.

The switch mechanism is supported on a back plate 25 which is secured to the three inwardly projecting lugs 26 by means of screws 27. A second plate 28 is secured to, but spaced from plate 25 by means of screws 29 and spacing tubes 30, respectively.

A bracket 31 is pivoted on pin 32 and extends between the plates 25 and 28, the said bracket being provided with an upwardly extending flange 33 provided with an opening 34. The flange is preferably provided with the designated graduations 35, as shown in Fig. 2. The bracket 31 is provided with an opening 36 through which extends the plung-

er 24, previously referred to, said plunger being pivoted to said bracket, at 37, whereby the reciprocating movement of the plunger causes the rocking of the bracket 31 on the pivot 32. The left end of the bracket 31 is shaped to provide the stops 38 and 39 which alternately engage with the spacing tube 30 to limit the movement of the bracket. Adjacent the upper part of the plates 25 and 28 the switch arm 40 is pivoted as at 41, said arm carrying mercury contact tube 42 having contacts 43, 43, and a quantity of mercury therein. The tube 42 is carried by resilient bracket 44 which is secured to the end of arm 40 by screw 45. The vertical pivoted portion 40*a* of the arm 40 is shaped at its left end, as viewed in Fig. 4, to provide the stops 46 and 47 which alternately engage the interposed spacing tube 30, to limit the movement of the arm. The lower portion of the arm section 40*a* is provided with a cam surface 48, hereinafter referred to. A link 49 connects the bracket 31 with the portion 40*a* of arm 40. The pivot 50 passes through an elongated opening 51 in the member 40*a* whereby the latter can move through a predetermined distance about its pivot independently of the link 49, thus providing, in effect, a lost motion connection.

A bar 52, having a threaded portion 53, is pivoted at 54 to the bracket 31, the said bar being slotted and the upper portion of the bracket 31 entering said slot. The bar 52 is cut away, as shown in Fig. 2, to provide clearance for the link 49. A roller 55 is secured in the slot of the bar 52 and bears against one or the other of the inclined faces of the cam 48.

When the device is in the position shown in Figs. 2 and 4, the mercury tube 42 is tilted to cause the mercury to bridge the contacts 43 to close the circuit of the motor through the wires 56. The motor, not shown, will begin to pump fuel into the furnace and as the steam pressure rises the bellows 22 will expand and, if the pressure is sufficient, will force the stud 21 and plunger 24 upwardly. Such movement of plunger 24 will be effected also should the water level of the boiler be lowered permitting the float 12 to recede and the plunger 19 to rise, as will be seen. The upward movement of the plunger 24, if sufficient, will cause the switch mechanism to move to "off" position and open the motor circuit until the steam pressure recedes or until the water supply is replenished, thus preventing damage to the heating equipment. Upward movement of the plunger 24, as viewed in Figs. 2 and 4, will cause bracket 31 to move about the pivot 32 in the counter clockwise direction, thereby moving link 49 upwardly. As the lost motion space provided in the connection between the link 49 and bracket member 40*a* is taken up, the latter member will be rotated counter clockwise also. Such movement of the member 40*a* will not take place, however, until the roller 55 has nearly reached the point of cam 48 due to the moving of the bar 52 to the left by the bracket 31 to which it is pivoted, at 54. As the roller 55 rides over the point of the cam, the force exerted by the roller on the opposite cam face, due to the weight 57 on threaded stem 53, and the motion transmitted by the link 49 will cause the bracket 40 to trip to the position shown in Fig. 5, in which the tube 42 is so tilted as to cause the mercury to flow away from the contacts 43, thus stopping the motor.

A weight 58 is adjustably secured to the front graduated flange 33 of the bracket 31 for setting the switch to open at predetermined boiler conditions. The weight 58 is slotted, at 59, to receive the bracket 33, a knurled bolt 60 passing through the opening 61 and having a tapered portion 62 which engages the edges of the bracket 33 along the opening 34 when the bolt is screwed into the position shown in Fig. 3. By moving the weight farther to the right of the pivot 32 greater pressure will be required to lift the same and trip the switch mechanism, as will be clear. By moving the weight 57 farther to the right or left, the differential range over which the switch will operate can be regulated. For instance, by setting the weight 58 at graduation L, the switch will open at a predetermined pressure in the boiler being reached. By setting the smaller or differential counter weight 57 in any given position, the switch mechanism will be moved to "on" position when the boiler pressure has dropped to the predetermined minimum, or when the supply of water has been replenished. It will be seen therefore that the adjustability of the weights 57 and 58 permits the selection of any one in a range of differentials between maximum and minimum pressures suitable for a particular installation. A set screw 57*a* is provided for securing the weight 57 against unintentional movement.

In heating plants employing the vacuum system the weight 58 is moved to the left of the center position of the bracket 31 whereby the weight tends to move the bracket to the position shown in Fig. 5, or "off" position. As long as the proper vacuum conditions are maintained the weight of member 58 is overcome and the mechanism held in the "on" or circuit closing position, but when the vacuum is lowered, permitting the bellows 22 to expand, the weight 58 trips the mechanism to "off" position.

Although I have shown a particular embodiment of my invention for the purpose of illustration, it will be seen that various changes may be made therein without departing from the scope of the appended claims.

I claim:

1. Apparatus of the class described comprising a pivoted member, a circuit controlling member carried by said pivoted member, a second pivoted member, a link connecting said pivoted members to each other, and means for actuating said first pivoted member by said second pivoted member for effecting a quick snapover of said circuit controlling member, said means comprising a bar movable laterally with respect to said first member upon pivotal movement of said second member.

2. Apparatus of the class described comprising a pivoted member, a circuit controlling member carried thereby, a second pivoted member, a link connecting said pivoted members, and a bar pivoted to said second member, said bar being adapted to co-operate with said link for rocking said first pivoted member whereby said controlling member is moved to circuit opening or closing position.

3. An electric switching mechanism of the class described comprising a mercury electric switch, a pivoted member supporting the same, a vertically movable member, means comprising a second pivoted member operatively associated with said movable member and first pivoted member whereby said electric switch is given a quick snapover action upon predetermined vertical movement of said vertically movable member, and a pair of adjusting members connected to said second pivoted member for controlling the opening and closing movement of said switch.

4. An electric circuit controlling device for use with mechanism comprising an expansible member, said device comprising a mercury contactor, a pivoted bracket supporting the same, a second pivoted bracket, a plunger actuatable by said expansible member and being attached to said second bracket, and means comprising a vertically movable link connecting said brackets and a laterally movable bar operatively interposed between said brackets whereby said first bracket and the associated mercury contactor will be given a quick snapover action upon predetermined movement of said expansible member.

5. An electric circuit controlling device for use with mechanism comprising an expansible member, said device comprising a mercury contact member, a pivoted bracket supporting the same, a cam on said bracket, a second pivoted bracket operatively connected to said expansible member to be moved thereby, a link connecting said brackets, and a bar pivoted to said second bracket and operatively engaging said cam, the arrangement of said link and bar being such that predetermined movement of said second bracket by said expansible member will effect a quick snapover of said first bracket to move said contact member to circuit opening or closing position.

6. A circuit controlling device for use with mechanism comprising a pressure responsive member responsive to the pressures obtaining in a steam boiler, said device comprising a switch for controlling a motor circuit or the like, means for transmitting motion from said responsive member to said switch for actuating the latter to and from circuit closing position, and regulating means associated with said transmitting means for permitting the actuation of said switch only under predetermined conditions of pressure, said regulating means comprising a pair of adjustable weights, one adapted to be set whereby said switch will be moved to open position at predetermined maximum boiler pressure and the other adapted to be set to permit the closing of said switch at predetermined minimum boiler pressure.

7. Apparatus of the class described comprising a supporting plate, a bracket pivoted thereto, said bracket having a cam, a mercury contact member carried by said bracket, a second bracket pivoted to said plate and having a flange, an adjustable weight on said flange, a bar pivoted to said second bracket and carrying a roller in engagement with said cam, a second adjustable weight on said bar, a link pivoted to said second bracket and having a lost motion connection with said first bracket, an expansible member responsive to conditions of pressure in a steam boiler or the like, and a member connecting said expansible member and said second bracket, said mechanism being so arranged that by adjusting said weights said contact member is moved to circuit opening or closing position by the expansion or contraction respectively of said expansible member under predetermined boiler conditions.

8. An electric circuit controlling device for use with mechanism comprising a member responsive to pressure conditions of a steam boiler, said device comprising a liquid contactor for controlling a motor circuit, a pivoted member upon which said contactor is mounted, means for transmitting motion from said pressure responsive member to said pivoted member for actuating the said contactor to and from motor-circuit closing position, regulating means associated with said transmitting means for permitting the actuation of the latter for opening and closing said contactor at predetermined minimum and maximum boiler pressures, said regulating means comprising a pair of members adjustable for varying the differentials between the maximum and minimum pressure.

9. Apparatus of the class described comprising a pair of pivoted members one of which is provided with a cam portion, a link connecting said pivoted members to each

other an electric switch on one of said pivoted members, and a laterally movable device pivoted to the other member having a cam engaging portion to coact with said first cam portion, the arrangement being such that said laterally movable device and said cam portion move in opposite directions upon movement of said pivoted members whereby said cam engaging portion cooperates with said cam portion for moving said switch with a snapaction from on to off position and vice versa.

10. An electric switch comprising two pivotally mounted members one of which is provided with a cam portion, an electric switching mechanism mounted on one of said pivoted members, means for actuating the other of said pivoted members, a link connecting said pivoted members to each other through a lost motion connection, and a member pivoted to said second pivoted member and provided with a portion to engage said cam portion for effecting a quick snap-over action of said electric switching mechanism.

11. An electric switch comprising two pivotally mounted members one of which is provided with a cam portion, an electric switching mechanism mounted on the pivoted member having said cam portion, means for actuating the other of said pivoted members, a member connecting said pivoted members to each other through a lost motion connection, another member pivoted to said second pivoted member and provided with a portion to engage said cam portion for effecting a quick snap-over action of said electric switching mechanism, and adjustable means associated with said second pivoted member for controlling the point of actuation thereof.

12. An electric switch comprising two pivotally mounted members one of which is provided with a cam portion, an electric switching mechanism mounted on the pivoted member having said cam portion, means for actuating the second of said pivoted members, a lost motion connection between said pivoted members, a member intermediate said pivoted members but connected to said second pivoted member and adapted to engage said cam portion for effecting a quick snap-over of said electric switching mechanism, adjustable means on said second pivoted member for controlling the point of response thereof, and adjustable means on said intermediate member.

In testimony whereof, I have subscribed my name.

OSCAR F. CARLSON.