March 3, 1931. P. F. SHIVERS 1,795,149

MASTERSTAT

Filed May 4 1928 2 Sheets-Sheet 1

Fig. 1.

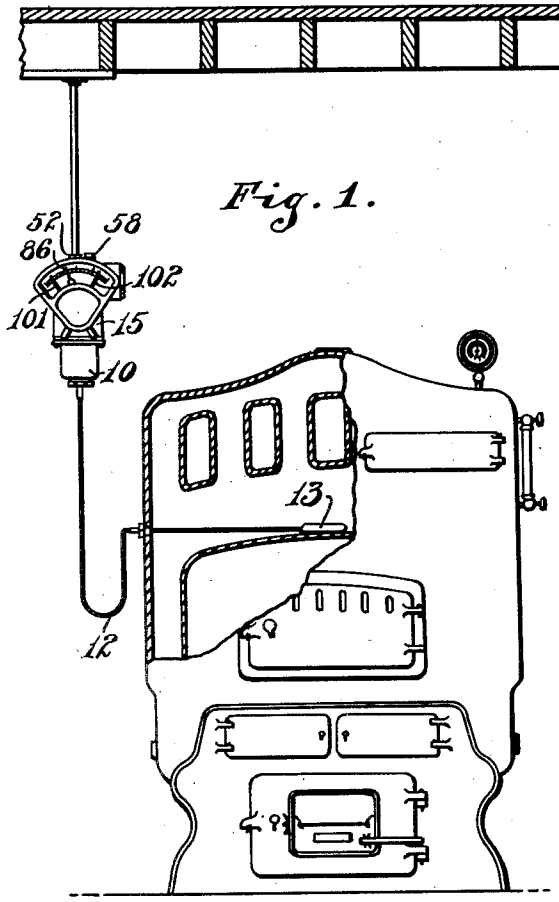


Fig. 4.

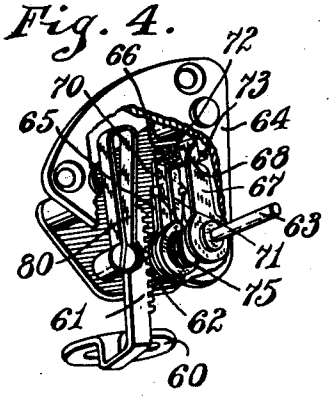


Fig. 5.

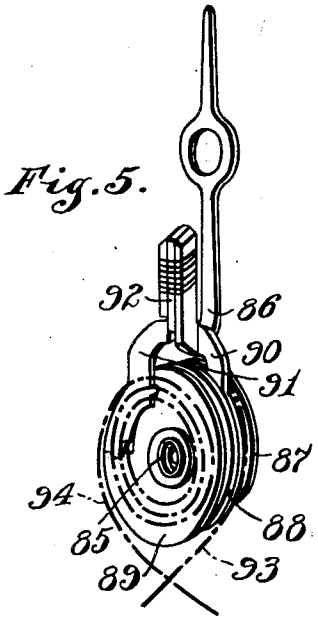
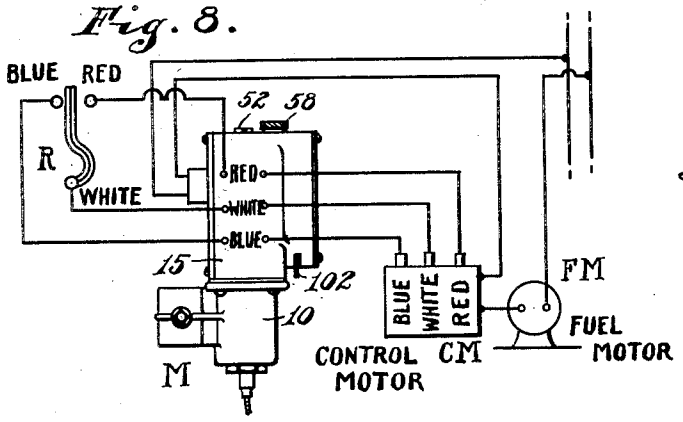


Fig. 8.



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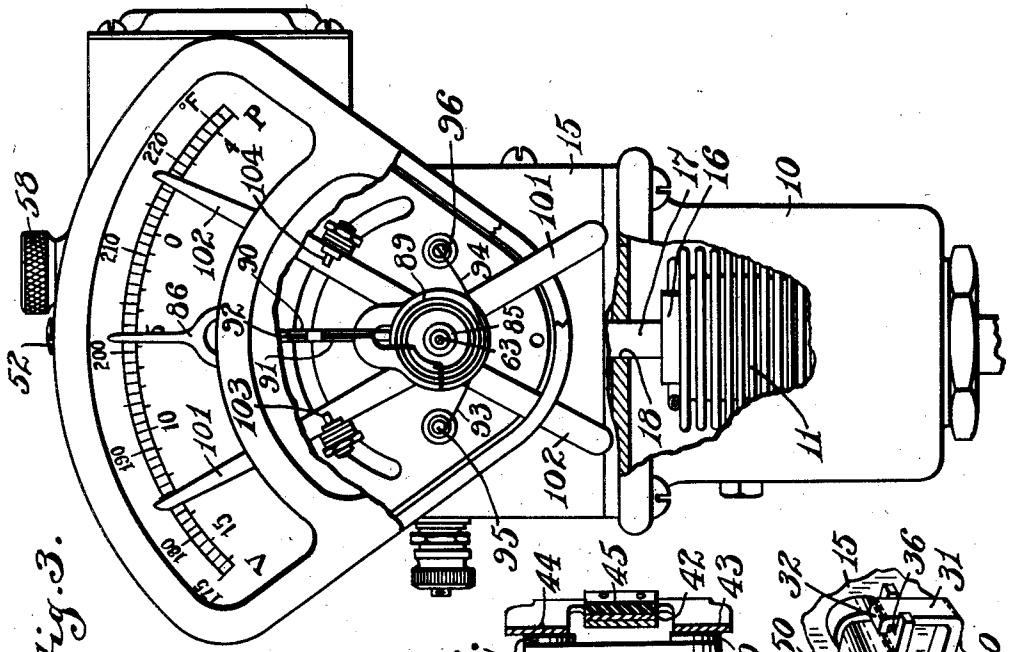

Fig. 3.

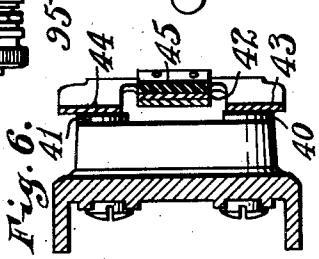

Fig. 6.

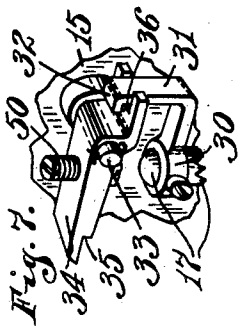

Fig. 7.

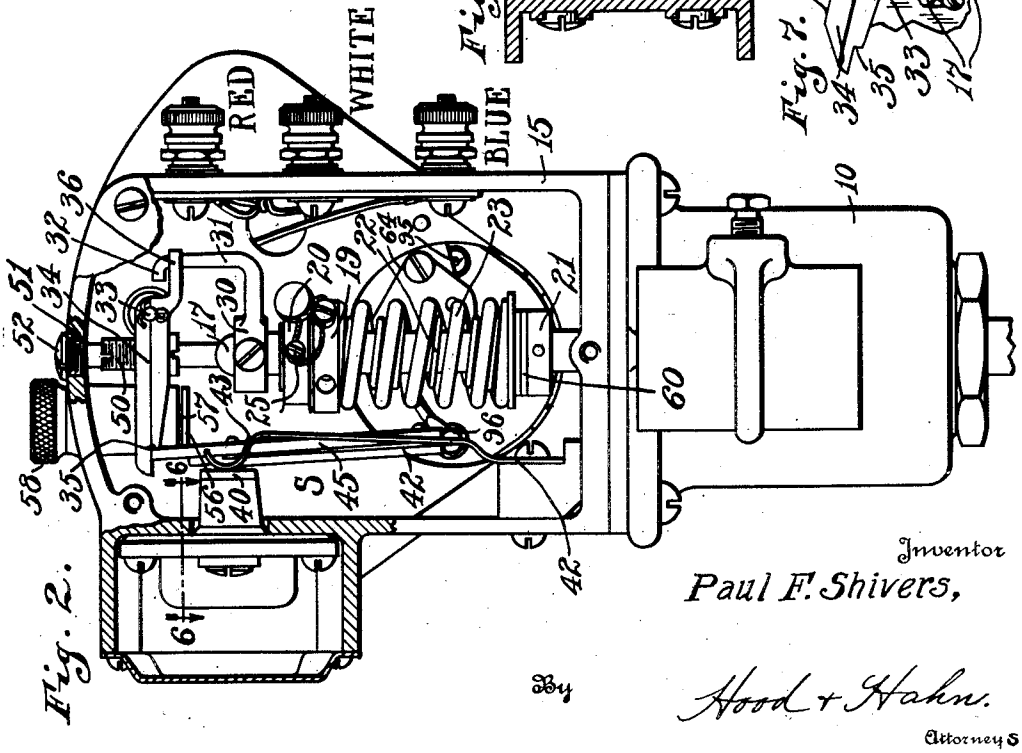

Fig. 2.

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Patented Mar. 3, 1931 1,795,149

UNITED STATES PATENT OFFICE

PAUL F. SHIVERS, OF WABASH, INDIANA, ASSIGNOR TO MINNEAPOLIS-HONEYWELL REGULATOR COMPANY, OF MINNEAPOLIS, MINNESOTA, A CORPORATION OF DELAWARE

MASTERSTAT

Application filed May 4, 1928. Serial No. 275,248.

The primary object of my invention is to provide a single instrument unit for controlling the circuits of the fuel motor and circuit controlling motor of a fuel burning unit control mechanism, to be affected by the condition of the boiler or heating unit, as distinguished from the burner unit, of such character as to be adjustable to predetermined upper and lower operating limits, and also so formed that, in case of the establishment of abnormally high temperature conditions or a failure of the heat affected element, the fuel motor circuit will be broken at an emergency point.

The instrument forming the subject matter of this application is now commonly known in the trade as the Honeywell masterstat and is intended to be used in conjunction with a room thermostat, and a combustion control.

The accompanying drawings illustrate my invention:

Fig. 1 is an elevation in partial vertical section of a heater with my improved masterstat in elevation and slightly exaggerated as to the relative size.

Fig. 2, a rear elevation of my improved instrument with the rear cover removed and a portion broken away.

Fig. 3, a front elevation of the instrument with a portion of the front cover and a portion of the lower casing broken away.

Fig. 4, a perspective view, in partial section, of the yielding driving connection for the indicator finger and movable contacts.

Fig. 5, a perspective of the indicator finger and associated contact fingers.

Fig. 6, a section on line 6, 6 of Fig. 2.

Fig. 7, a fragmentary perspective view of the emergency latch and the associated operating finger.

Fig. 8, a diagram of a control installation including my present improved instrument.

In the drawings 10 indicates a cup-like casing within which is mounted a metallic bellows 11, commonly called a sylphon to the interior of which is connected a flexible tube 12 provided at its end with a bulb 13, the bulb, tube and bellows being filled with an expansible liquid or gas, in the well known manner, to an extent sufficient to cause some elongation of the bellows at normal atmospheric temperatures.

Covering the open upper end of cup 10 is a casing 15 which contains and protects the mechanism now to be described. Resting upon the upper end of the bellows 11 is the head 16 of a vertical stem 17 which is slidable through the bearings 18 and through a bushing 19 which is threaded in a bracket 20 conveniently formed integral with casing 15. Secured to stem 17 is a collar 21 which forms an abutment for two compression springs 22 and 23 which lie between collar 21 and the lower end of bushing 19. Bushing 19 is vertically adjustable in bracket 20 and is held in any desirable position of adjustment by screw 25. Spring 22 is preferably lighter and longer than spring 23 so that, at ordinary atmospheric temperatures spring 23 does not contact with bushing 19.

Secured to the upper end of stem 17 is a collar 30 provided with a radial arm 31 which, at its outer end, is turned upwardly substantially parallel with the axis of stem 17 and its tip 32 turned back toward the stem, for a purpose which will appear. Pivoted at 33, on a horizontal axis, is a latch 34 one arm of which is formed, at 35, to coact with an emergency switch S and its other arm formed, as indicated at 36, to have a one way coaction with finger 32.

The switch S comprises a pair of fixed terminals 40 and 41 intended to be connected in series with the fuel motor, or other motor, to be controlled. A spring plate 42 with spring fingers 43 and 44 is biased away from terminals 40—41 but, when urged against its bias, fingers 43 and 44 will bridge terminals 40 and 41. Secured to the plate 42 is a strip of insulating material 45 the upper end of which is adapted to be engaged by the catch portion 35 of the latch 34 and held by it in such position as to hold the spring fingers 43 and 44 of plate 42 in bridging contact with the fixed terminals 40 and 41.

Threaded through latch 34, in alignment with stem 17 is a screw 50 the head of which is adjustable toward and from the upper end of stem 17 and the cross-slotted upper end of

which is accessible through an opening 51 in casing 15, said opening being normally closed by the screw 52.

The bridging element 42—43—44 may be restored to its operative position, as shown in Fig. 2, against the bias of the spring plate 42, by means of a finger 56 (Fig. 2) carried at the lower end of a stem 57 journalled through the upper wall of casing 15 and provided at its outer end with a knurled head 58 by means of which the finger 56 may be swung into engagement with plate 45 and the structure 42—43—44—45 urged to the position shown in Fig. 2.

Secured to stem 17 is a ring 60 (Figs. 2 and 4) which carries a rack 61 arranged parallel with the axis of stem 17. Rack 61 meshes with a pinion 62 journalled on a shaft 63 which is journalled in a supplemental frame 64 which, in turn, is secured within casing 15. Secured to pinion 62 is a radial arm 65 provided at its end with an axially extending finger 66.

Secured to shaft 63 is a radial arm 67 similar to arm 65 and, at its end, provided with an axially extending finger 68 like finger 66. The two fingers 66 and 68 are projected toward each other with their free ends closely adjacent. Journalled upon the shaft 63 between the two arms 65 and 67 are two similar arms 70 and 71 each having its outer end bent so as to form fingers 72 and 73 respectively lying parallel with shaft 63 and upon opposite sides of the fingers 66 and 68. The two fingers 72 and 73 are urged toward each other and yieldingly held against the fingers 66 and 68 by means of a spring 75 the ends of which are anchored respectively upon the arms 70 and 71, the above described construction and arrangement is such that rotation of pinion 62 in either direction will cause equal rotation of shaft 63 so long as movement of the shaft is unobstructed. The movement of the shaft being accomplished by application of pressure by finger 66 against the fingers 72 or 73 and the transmission of that pressure through spring 75 to the companion fingers 73 or 72 and the transmission of the force by that finger to the finger 68 of arm 67 and thence to the shaft 63. Whenever an obstruction to movement of shaft 63 is encountered arm 65 may continue its movement by displacing one or the other of the arms 70, 71, depending upon the direction of movement of pinion 62.

Rack 61 is held in mesh with gear 62 by means of a spring finger 80.

Secured to shaft 63, most conveniently by frictional engagement, is the indicator and contact finger unit shown in Fig. 5. This unit comprises a central core or hub 85 to which the indicator finger 86 is secured.

Secured to hub 85 are three discs 87, 88 and 89 of insulating material.

Secured to disc 87, on the face adjacent disc 88, is a metallic contact finger 90 and secured to disc 89 on the face most remote from disc 88 is a similar contact finger 91 and these two fingers are bound together upon an intermediate insulation 92, as shown in Fig. 5 the arrangement being such that they are mechanically a unit but electrically independent. Connected to finger 90 is a metal volute 93 and connected to finger 91 is a metal volute 94. These two volutes are shown in Fig. 5 in heavy dotted lines merely for clearness of illustration. They are continuous metal members provided for the purpose of forming a flexible electrical connection between the contact fingers 90 and 91 and the fixed terminals 95 and 96 respectively (Fig. 3). Journaled on shaft 63 behind the indicator finger unit are two contact carrying indicator arms 101 and 102. Arm 101 carries a low temperature contact 103, which is insulated from its arm and connected by a suitable flexible connection with one of the fixed binding posts of the instrument. Similarly arm 102 carries an insulated high temperature contact point 104 which is also connected by a suitable flexible connector to one of the fixed binding posts of the instrument. The two contact points 103 and 104 are so radially spaced from shaft 63 as to be contactible by the fingers 91 and 90 respectively.

One of the uses to which my improved instrument may be put is indicated in the diagram Fig. 8 wherein R is an ordinary room thermostat, FM is the fuel motor of an oil burning device in which the oil is delivered to the nozzle by the action of the fuel motor, M is my improved masterstat which forms the principal subject matter of this application and CM is a switch control motor by means of which the movements of the fuel motor are determined according to the coordinated demands of the room thermostat and the masterstat the arrangement being such that a call for heat by the room thermostat will result in an energization of the fuel only when contact finger 91 is in contact with terminal 103; and that whenever contact finger 90 contacts with terminal 104 the control motor will be energized to cause a deenergization of the fuel motor.

The operation is as follows:

Tube 13 is preferably laid upon the crown sheet of the boiler, as indicated in Fig. 1 and arm 101 is set at a point indicating the lowest temperature which is desired in the boiler under working conditions, while arm 102 is set to indicate the highest temperature which is desired in the boiler. Screw 50 is then so adjusted that whenever the temperature of the crown sheet reaches a point a degree or two higher than the highest temperature which is to be desired in the boiler, at any setting of arm 102, the upper end of stem 17 will come into contact with latch 34 and lift it from the upper end of plate 45 so as to permit

the bridging piece of switch S to move away from engagement with terminals 40 and 41 and thus break the circuit of the fuel motor. So long as the boiler temperatures lie below the desired temperature indicator 86 will lie somewhere between the two arms 102 and 101, with finger 90 out of contact with terminal 104 which will lie over to the left (Fig. 3) with finger 91 in contact with terminal 103. If now there is a call for heat by the room thermostat the control motor will be energized and a circuit established for the fuel motor and when the room thermostat ceases its demand for heat there will be another energization of the control motor to cause a deenergization of the fuel motor. If, however, the fuel motor remains energized long enough to cause the boiler temperatures to rise to the specified maximum before the room thermostat is satisfied finger 90 will be brought into contact with terminal 104, and the control motor will be energized to cause a deenergization of the fuel motor.

The movement of the contact fingers 90 and 91 is produced by the expansion and contraction of the bellows member 11, due to the heat within the boiler and, in the normal range of operation neither the upper end of stem 17 nor the finger 32 will contact with latch 34 sufficiently to release plate 45. If, however, the consumption of fuel continues to a point where the crown sheet is over heated, either to a point of desired maximum water temperature or due to absence of water in the boiler, depending upon the adjustment of screw 50, the upper end of stem 17 will engage with the head of screw 50 and move latch 34 to releasing position whereupon the circuit to the fuel motor will be automatically broken at switch S and the fuel motor can only be restored by manual restoration of switch S. On the other hand, if, for any reason, a leak should be caused in the system 11—12—13, the bellows 11 would become deflated to such an extent as to permit finger 32, under the action of spring 22, to descend into engagement with latch 34 and retract said latch from the plate 45 and thus cause a break in the fuel motor circuit at switch S. When the switch S has been released as a result of deflation of bellows 11 it will not be possible to restore the switch S to normal position without first repairing the trouble in the bellows system because, when plate 45 is swung to the position shown in Fig. 2 by a manipulation of finger 56 it will not be caught by latch 34 because said latch will continue to be held down by finger 32.

It will be readily understood that the stem 17 may be moved by means other than the particular means shown and described without departing from my invention the broad feature of which resides in the combination of a switch biased in one direction, retained against its bias by a latch, and the latch withdrawn by abnormal movement of the stem 17 in either direction.

I claim as my invention:

1. The combination of an electric switch comprising a movable member biased in one direction, a latch cooperating with said movable member to hold the same against its bias, and a reciprocable actuator having two oppositely set one-way connections with said latch whereby movement of the reciprocable element in either direction beyond a predetermined limit will act to withdraw the latch.

2. In a circuit controlling instrument the combination of an arm having an intermediate pivot, and an electric switch so associated with said arm as to be in circuit closing position in one position of the arm and in circuit opening position in another position of the arm, and a reciprocating actuator for said arm said actuator having two one-way connections with said arm respectively upon opposite sides of its pivot whereby movement of the actuator in either direction beyond a predetermined stroke will shift said arm to determine the condition of the switch.

3. A circuit controlling instrument comprising an electric switch having a movable element biased open, a latch for retaining said movable element in circuit closing position against its bias, a thermostatic bellows, a reciprocable stem engaging said bellows, a spring urging said stem toward the bellows, an adjustable abutment for said spring, said stem having two oppositely set one-way contacts with the latch each acting to retract the latch.

4. A circuit controlling instrument comprising an electric switch having a movable element biased open, a latch for retaining said movable element in circuit closing position against its bias, a thermostatic bellows, a reciprocable stem engaging said bellows said stem having two oppositely set one-way contacts with the latch each acting to retract the latch.

5. A circuit controlling instrument comprising a temperature affected element, a reciprocable element associated with said temperature affected element, a contact element operated by said reciprocable element through the medium of a connection yieldable in each direction relative to the contact element whereby the movement of the contact element may be obstructed without objectionable effect thereon or upon the actuator therefor, two contact elements arranged at opposite sides of the first mentioned contact element, and independently adjustable supports for said last mentioned contact elements.

6. A circuit controlling instrument comprising a temperature affected element, a reciprocable element associated with said tem-

perature affected element, a contact element operated by said reciprocable element through the medium of a connection yieldable in each direction relative to the contact element whereby the movement of the contact element may be obstructed without objectionable effect thereon or upon the actuator therefor, two contact elements arranged at opposite sides of the first mentioned contact element, independently adjustable supports for said last mentioned contact elements, a switch having a movable element biased in one direction, a latch for holding said movable element against its bias and two one-way engagements between the reciprocable element and said latch said two engagements being relatively spaced an amount sufficient to move the first mentioned contact element from one of its associated contact elements to the other without affecting the latch.

7. A circuit controlling instrument comprising a temperature affected element, a reciprocable element associated with said temperature affected element, a contact element operated by said reciprocable element and two contact elements arranged at opposite sides of the first mentioned contact element independently adjustable supports for said last mentioned contact elements, a switch having a movable element biased in one direction, a latch for holding said movable element against its bias and two one-way engagements between the reciprocable element and said latch said two engagements being relatively spaced an amount sufficient to move the first mentioned contact element from one of its associated contact elements to the other without affecting the latch.

8. A circuit controlling instrument comprising a group of coordinated contacting elements some of which are relatively adjustable toward and from others and some of which are movable toward and from others by means of an actuator, a carrier for said last mentioned contact elements, an actuator for said carrier, a switch, an intermediate connection between said switch and said actuator whereby said switch will be similarly affected by abnormal movement of the actuator in either direction beyond a predetermined range.

9. A control instrument comprising a shiftable controller element yieldingly biased in one direction, a latch arranged to normally retain said controller in displaced position against its bias, and an actuator for said latch having two spaced portions arranged relative to said latch to shift said latch to release position by movement of the actuator in opposite directions.

10. A control instrument comprising a shiftable controller element yieldingly biased in one direction, a medially pivoted latch arranged to normally hold the controller element displaced against its bias, and an actuator provided with spaced portions arranged to engage the latch upon opposite sides of its pivot, each in one direction only, to shift the latch to release position by movement of the actuator to predetermined positions at opposite sides of its medial position.

In witness whereof, I, PAUL F. SHIVERS, have hereunto set my hand at Wabash, Indiana, this 23rd day of April, A. D. one thousand nine hundred and twenty eight.

PAUL F. SHIVERS.