

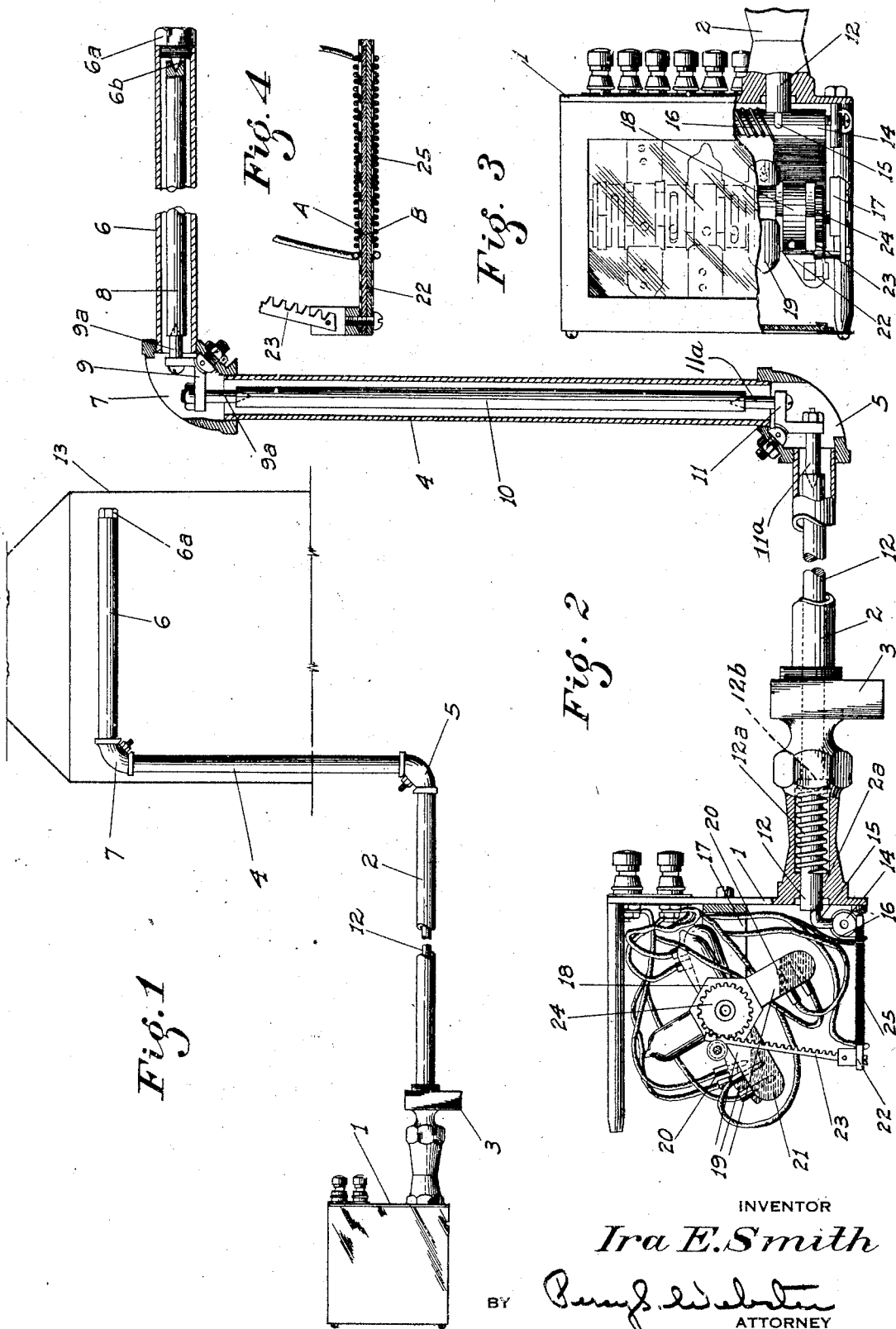
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FURNACE THERMOSTAT SWITCH

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FURNACE THERMOSTAT SWITCH.

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This invention relates to improvements in thermostat switches for controlling the operation of electrically driven oil burning systems, and particularly represents an improvement over the switch shown in my copending application for patent, Serial No. 32,901 filed May 26th, 1925. Such previous switch fundamentally comprised a plurality of mercury containing tubes, having contacts mounted at varying angles and arranged as a unit to be rotated upon the expanding of the thermostatic element. I retain this fundamental construction but have provided, however, certain important changes in the thermostatic means for operating said switch contact unit.

In the previous switch the initial movement of the switch tube unit which controlled the closing of the switch starting the sparking and electric heating devices of the burner, was had by electrically heating the thermostatic element itself to a degree necessary to impart the desired rotation to the tube unit. This consumed considerable current and an appreciable time elapsed before such rotation took place.

The principal object of my present invention therefore is to provide a more simple and quicker operating means for initially rotating the tube unit, so that less current is used and there is less delay between the initial turning on of the current and the functioning of the burner.

I have also redesigned the arrangement of the main thermostat relative to the switch tube unit, so that much shorter lengths of the expansible and nonexpansible elements may be used, while at the same time I arrange for ample movement of the member which controls the major rotation of said tube unit.

A further object of the invention is to produce a simple and inexpensive device and yet one which will be exceedingly effective for the purpose for which it is designed.

These objects I accomplish by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings similar characters of reference indicate corresponding parts in the several views:

Fig. 1 is a side view of my improved type

of thermostat switch, showing the same as mounted in connection with a furnace.

Fig. 2 is a side view of the device detached, partly broken out and in section with the parts in their normal or cold positions.

Fig. 3 is a top plan view of the device with the cover partly broken out to better show the interior mechanism.

Fig. 4 is a longitudinal section of the bimetal control arm and heating element detached.

Referring now more particularly to the characters of reference on the drawings, the numeral 1 denotes a supporting plate for the switch structure hereinafter described. From the lower end and adjacent one side of said plate a horizontal pipe 2 projects, having a bracket 3 by means of which these parts may be supported in a fixed position. At the outer end of the pipe 2 another pipe 4 extends upwardly, an elbow 5 connecting the adjacent ends of both pipes. Another length of horizontal pipe 6 extends from beyond the upper end of the pipe 4, with an elbow 7 connecting the adjacent ends of these pipes.

A rigid rod 8 is mounted in the pipe 6 and is supported therefrom only at the outer end of the latter. At its opposite end the rod 8 is supported from one arm of a bellcrank 9 which is mounted in the elbow 7. Another rod 10 is supported from the other arm of the bellcrank 9 and extends downwardly inside the pipe 4 to a connection with one arm of a bellcrank 11 mounted in the elbow 5. The opposite end of the bellcrank 11 is connected to a rod 12 which is mounted in the pipe 2 and projects through the same to a termination just inwardly of the plate 1.

The various rods are supported from the bell cranks and pipe 6 in the following manner:

In the outer end of pipe 6 is a nut 6^a having a needle point 6^b on its inner end engaging a socket in the corresponding end of the rod 8. The bell cranks 9 and 11 have pointed stems 9^a and 11^a respectively projecting from their opposite arms, which engage sockets provided in the respective ends of the rods 8, 10 and 12.

The member 2, adjacent the plate 1, has a shoulder or bushing 2^a in which rod 12 is

slidable, and a compression spring 12^a about said rod beyond the shoulder and bearing thereagainst and against a collar 12^b on the rod tends to retract the rod away from the inner face of the plate 1, and serves to hold all the needle point bearings in firm engagement with each other, regardless of the expansion or contraction of the pipe 6.

The device is mounted in connection with a furnace box 13 in which an oil burner is located, so that the pipe 2 enters the furnace at the ash box, the pipe 4 extends upwardly along the inside of the furnace, and the pipe 6 projects across the furnace above the burner.

The pipe 6 is therefore located so as to be subjected to the direct heat of the burner, the other pipes being heated to a much lesser degree.

The pipe 6 and rod 8 form the main thermostatic elements of my device. The pipe 6 is preferably made of nichrome steel—an element capable of expanding under heat but offering considerable resistance to disintegration by reason of such heat. The rod 8 is preferably made of fused silica—an element of practically non-expansible nature. It will therefore be seen that if the pipe 6 expands relative to the rod 8, relative movement between the bellcrank end of said rod 8 and the adjacent end of the pipe 6 will be had. This causes the turning of the adjacent bellcrank on its pivot, and consequently a longitudinal movement of the rod 10; a turning of the bellcrank 11; and a longitudinal movement of the rod 12 will be had in their respective enclosures. The parts are so arranged that when the pipe 6 is heated, the outer end of the rod 12 will recede in the pipe 2.

Owing to the use of bellcranks whose arms may be designed to give any desired leverage, the length of the elements 6 and 8, and consequently the amount of relative movement therebetween, may be very short, and still provide for considerable movement of the free end of the rod 12. The pipes 2 and 4 and the corresponding rods are made of ordinary steel so that expansion and contraction, if any, will be the same throughout and will not affect the result.

Turnably supported from the plate 1 and disposed below the plane of the rod 12 and at right angles thereto is a horizontal shaft 14. A short arm 15 projects upwardly from said shaft and is bent at its upper end to extend toward and abut against the adjacent end of the rod 12.

A spring 16 about said shaft acts to hold the arm 15 in engagement with the rod 12 and to rotate said shaft when the rod recedes.

Brackets 17 project horizontally from the plate 1 adjacent the sides thereof a certain distance above the rod 12, in which brackets

is turnably mounted a supporting structure 18 having a plurality of switch-contact members.

These members are in the form of tubes 19, set at different angles relative to each other, and having contacts 20 projecting thereinto, certain ones of which contacts are normally immersed in mercury 21 sealed in the tubes but not filling the same.

This switch structure, its mounting, functioning and connection with the oil burner circuits, has been fully set forth in the co-pending application before mentioned, and therefore does not need to be enlarged upon here. It is believed to be sufficient to state that after a rotation of the structure 18 in a certain direction from a normal or cold position, the contacts will be broken or opened one after the other, by a change of level of the tubes, and a consequent flowing of the mercury away from the contacts.

Rotation is imparted to the structure 18 to effect such movement of the tubes in the following manner:

Projecting tangentially from and affixed to the shaft 14 adjacent one end thereof is an arm 22 to whose outer end is pivoted a rack 23 which engages a gear 24 fixed on the corresponding end of the structure 18. The arm 22 is in itself a bimetal thermostat element, consisting of two superimposed metal strips A and B, the lower strip B expanding to a greater extent than the other. A wire 25 is wound about the strips to form a coil heating element, and is electrically insulated from said strips. When this coil is heated the arm 22 is heated also, causing the arm to assume a curved form from end to end with the upper face concave. Since the shaft 14 is stationary the arm 22 can only move up at its other end, which will cause the rack 23 to move up and consequently impart rotation to the structure 18. The wires 25 of the heating coil are connected in series with the wires of the contacts of that tube 19 whose contacts will be first broken with the rotation of the structure 18. These contacts are also in the circuit of the main starting switch of the system.

In operation therefore when such starting switch is closed, the arm 22 is heated, the structure 18 is rotated to break the first contact as above stated, which breaks the heater circuit. At the same time, as stated in the previous application, such rotation of the structure 18 has closed electric heating and sparking devices of the oil burner, and the latter is then set in operation. The heat from the burner immediately and directly affects the thermostat elements 6 and 8 so that by the time the arm 22 has cooled off and returned to its normal shape, the elements 6 and 8 have been heated sufficient to cause the rod 12 to recede so that the shaft

14 will be rotated a distance enough to compensate for the retracting tendency of the rack had with the cooling off of the arm 22.

5 Thereafter with the further heating of the main thermostat elements in the furnace, the arm 22 is rigid and inactive, and merely serves as an operating means for the rack 23 with the rotation of the shaft.

10 The arm 22 being small, the current and time necessary to cause the same to be heated and to function as above stated, are very small, and a quick starting of the burner into actual operation results from the use
15 of this device.

Owing to the use of a gear on the switch structure, a complete revolution of the latter may be had without damage or strain to any part should the shaft 14, by the re-
20 ceding of the rod 12, rotate to the extent necessary to impart such rotation to the structure.

From the foregoing description it will be readily seen that I have produced such
25 a device as substantially fulfills the objects of the invention as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to
30 as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described my invention what
35 I claim as new and useful and desire to secure by Letters Patent is:

1. A thermostat switch including expansive and nonexpansive elements mounted together for relative longitudinal movement
40 when subjected to the influence of heat, a shaft, means whereby said shaft will be rotated upon the expansion of said element, an arm projecting substantially radially from the shaft, a rotatable switch contact structure whose axis of rotation is located
45 in a plane parallel to but vertically spaced from said shaft, means whereby the contacts will be opened when said structure is rotated from a predetermined position, a
50 gear fixed on said structure axially thereof and a rack projecting from the outer end of the arm at an angle thereto and engaging the gear, whereby the shaft when rotated
55 will cause an arcuate movement of the arm and a consequent longitudinal movement of the rack and a rotation of the gear and switch structure.

2. A structure as in claim 1, in which said arm is of bimetal construction, and means
60 is applied thereto for heating the same; said arm being so arranged as to cause the same when heated, to move the rack and rotate the gear and switch structure regardless of any movement of the shaft.

3. A thermostat switch including expan-

sive and nonexpansive elements mounted together for relative longitudinal movement when subjected to the influence of heat, a rotatable switch contact structure mounted
in connection with said elements, means 70 whereby the contacts will be opened when said structure is rotated to a certain extent from a predetermined position, means between the elements and the structure for
causing the latter to be rotated when said 75 elements are heated, and thermostatic means for enabling said structure to be rotated independent of heat applied to the said elements.

4. Operating means for a thermostat 80 switch which includes a movable member whose movement causes the contacts to be opened, comprising expansive and nonexpansive elements mounted together for rela-
85 tive longitudinal movement when subjected to the influence of heat, the expansible element being in the form of a tube of nichrome steel, and the nonexpansible element being in the form of a rod of fused silica
90 disposed within the tube; said elements being operatively connected to the movable member of the switch to impart movement thereto with the relative movement between
the elements.

5. A thermostat switch including expansive and nonexpansive elements mounted together for relative longitudinal movement when subjected to the influence of heat, a rotatable switch contact structure mounted
in connection with said elements, means 100 whereby the contacts will be opened when said structure is rotated to a certain extent from a predetermined position, a relatively movable rod, means between the rod and
105 the structure for causing the latter to be rotated when said elements are heated, and connections between said rod and the elements for enabling the extent of movement of the rod to be greater than the movement
between the elements themselves. 110

6. A structure as in claim 5, in which said last named means comprises a pipe surrounding the rod, another pipe extending
at an angle to the first pipe, hollow connections between the adjacent ends of the
115 pipe and between the opposite end of the last named pipe and the expansible element, the latter being tubular and containing the non expansible element therewithin, a rod
120 in the last named pipe, and bell cranks pivoted in the connections, and to which the adjacent ends of the rods, and the adjacent ends of one rod and the non-expansive element are connected.

7. A thermostat switch including expansive and nonexpansive elements mounted together for relative longitudinal movement when subjected to the influence of heat, a
125 shaft, means whereby said shaft will be rotated upon the expansion of said element, 130

an arm projecting from the shaft, a rotatable switch-contact structure mounted in connection with the shaft, means whereby the contacts will be opened when said structure is rotated to a certain extent from a predetermined position, means between the arm and structure for causing the latter to be rotated with a movement of the arm caused by the rotation of the shaft, and means provided in connection with the arm for causing the same to move to rotate the structure independent of any rotation of the shaft.

In testimony whereof I affix my signature.

IRA EDWARD SMITH