Jan. 23, 1945. G. W. CRISE 2,368,005

CONDITION RESPONSIVE SWITCH

Original Filed June 4, 1941

Fig 1

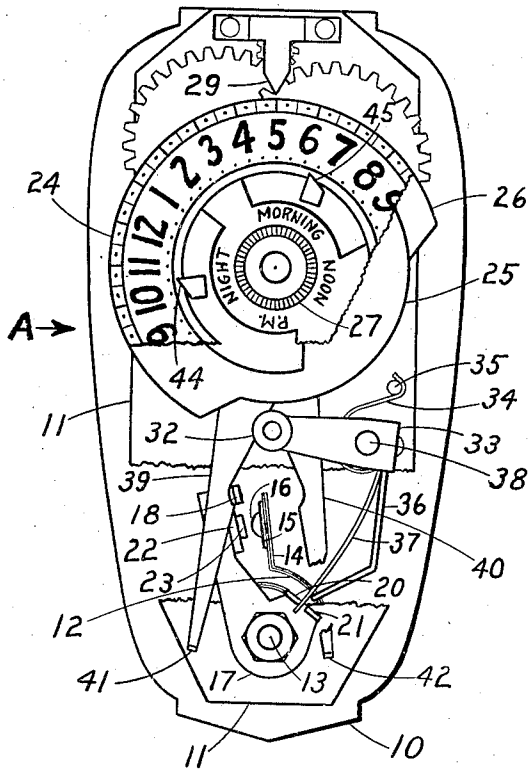


Fig 2

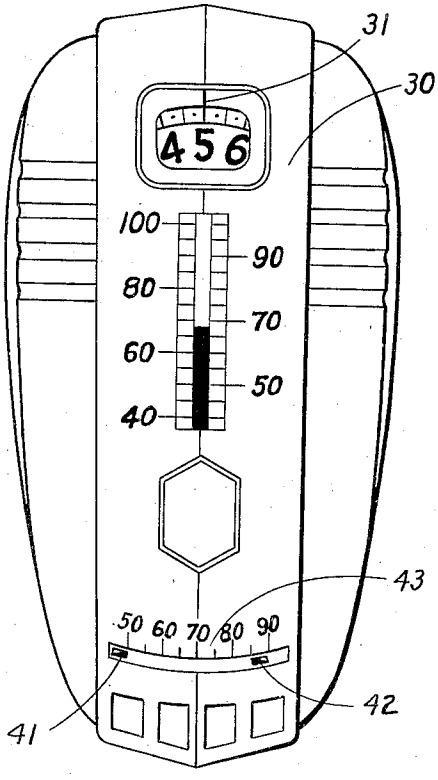


Fig 3

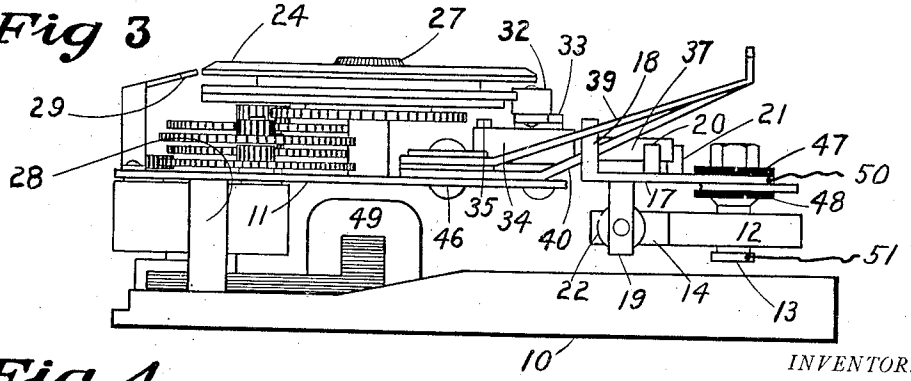
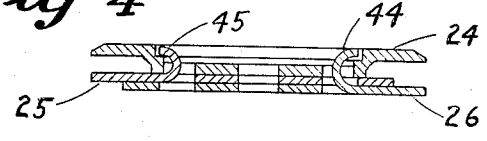


Fig 4



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2,368,005

CONDITION RESPONSIVE SWITCH

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Substituted for abandoned application Serial No. 396,600, June 4, 1941. This application May 18, 1943, Serial No. 487,470

6 Claims. (Cl. 200—139)

This invention relates to a clock controlled condition responsive switch, and more particularly to a switch responsive to changes in temperature of a room or space.

This clock controlled condition responsive switch is of the type in which a clock mechanism changes the condition responsive switch to a lower and back to a higher setting each twenty-four hours by mechanically changing the adjustment of the condition responsive means.

An object of the present invention is to provide means whereby the dial used to indicate the setting of the mechanism that effects the shifting of the condition responsive switch from one setting to the other may also serve as the time-indicating means of the clock.

A further object of the invention is to provide, in a switch of the character set forth, a clock driven cam composed of a pair of disk-like members arranged in side by side order and adapted for rotational adjustment about a common supporting axis to control the effective area of an inset dwell region of the cam.

Still another object of the invention is to provide an automatic clock-governed switch having manually operated controls which are so formed and disposed as to be simple to operate, easily understood and, under ordinary conditions of operation, incapable of being moved out of their operating ranges.

A further object of the invention is to provide means whereby the clock mechanism may quickly and positively move the adjustable member of the condition responsive switch from one setting to the other and at the same time permit a wide range of adjustment of the upper and lower settings of the condition responsive means.

A further object of the invention is to provide a clock-controlled condition responsive switch in which means are provided for adjusting the higher and lower settings of the condition responsive switch by indicators that are located on the face of the instrument, are easily adjusted at any time, and use a single indicating scale.

A further object of the invention is to provide a clock-controlled condition responsive switch in which the heat of the clock motor induces a draft in the switch housing and produces a rapid circulation of air over the thermostatic element of the switch.

Other objects of the invention will be apparent from the accompanying specification, claims and drawing, of which:

Fig. 1 is a front elevational view of the condition responsive switch with the cover removed and a part of the supporting plate and also the dial cut away;

Fig. 2 is a front elevational view of the condition responsive switch with the cover in place;

Fig. 3 is a side elevational view of the condition responsive switch viewed in the direction of arrow A of Fig. 1;

Fig. 4 is a sectional view of the dial and operating cams.

Referring to Figs. 1 and 3 of the drawing, the switch used in my clock-controlled thermostat is shown made up of a bimetallic member 12 bent to form a coil whose center is fastened through post 13 to supporting plate 11 from which it is insulated by insulating washers 47 and 48. The outer end of the bimetallic coil is bent to form the arm 14 to which is attached the iron washer 15 and contact 16.

The bimetallic coil is so formed that arm 14 rotates clockwise under the influence of an increase in temperature. An adjustable switch member 17 is mounted so as to pivot freely around post 13 from which it is insulated and is formed with fingers 18 and 19 and a narrow slot formed by fingers 20 and 21. Finger 19 carries the small washer-shaped magnet 22 and the contact 23 which cooperates with contact 16 to form the contacts of the thermostatic switch. Washer 15 is attracted by magnet 22 giving the switch a snap action. Lead 50 is connected through switch arm 17 to contact 23 and lead 51 through post 13, bimetallic coil 12 and arm 14 to contact 16. These leads serve to connect the clock thermostat to whatever device it is desired to control, such as a damper motor employed in regulating the draft of a furnace.

Dial 24 and the two-section cam 25 and 26 are frictionally locked to clock mechanism 28 by knob 27 and are rotated by the clock mechanism once in 24 hours. This knob is loosened when it is desired to change the setting of the cam sections. The clock dial can be set to read correct time by rotating the dial when knob 27 is loosened or by one of the clock gears being frictionally mounted as is common practice in clock mechanism. Dial 24 has markings as shown and in cooperation with mark 31 on cover 30 and pointer 29 when cover 30 is removed serves as a simple and easily-read clock.

Referring to Figs. 1 and 3 and sectional view Fig. 4, cam sections 25 and 26 cooperate to form an adjustable cam. The cam shown has a range of adjustment varying its operating arc to cover from approximately ten to twenty hours of the circumference of dial 24. Arcuate slots are

formed in the cam sections and in the dial as shown in Figs. 1 and 4. Indicating and adjusting pointers 44 and 45 pass through these slots and serve both to indicate the position of the cam sections and to confine their adjustment to their normal range.

Arm 36 and spring 37 are rigidly fastened to arm 33 as shown in Fig. 1 and cooperate to form shifter arm 33—37. Spring 37 is a substantially straight piece of spring metal held in the position shown by arm 36. Roller 32 is mounted on shifter arm 33—37 and pivots freely around shaft 38, which is fastened to supporting plate 11, and roller 32 is urged toward cam 25—26 by the action of spring 34 which is fastened to arm 33—37 at one end and hooked over pin 35, which is rigidly fastened to supporting plate 11, at the other. The end of spring 37, being supported close to where it passes through the slot formed by the fingers 20 and 21 of the adjustable switch member 17, acts as a substantially rigid member when urging adjustable switch member 17 to rotate in a counter-clockwise direction under the urging of spring 34. When urging adjustable switch member to rotate clockwise under pressure of cam 25—26 against roller 32, spring 37 will act as a substantially rigid member unless the resistance to clockwise motion of arm 17 is greater than the initial tension held in spring 37 by arm 36, in which case arm 37 will act as a spring holding a substantially constant pressure against finger 21 urging switch arm 17 to rotate in a clockwise direction.

Stopping arms 39 and 40 are pivoted to supporting plate 11 at 46 and are frictionally held to plate 11 so as to prevent their movement by the pressure of finger 18 acting under the urging of springs 34 or 37 but so as to be readily moved by hand. These arms limit the movement of adjustable switch member 17 and determine the upper and lower settings of the thermostatic switch. These settings are indicated by the position of pointers 41 and 42 on scale 43, Fig. 2.

Referring to Figs. 1 and 2, the clock now reads 5 o'clock in the morning and if we consider the clock thermostat to be in operation, cam section 26 released roller 32 at 10:30 p. m. as is shown by the position of pointer 44. Roller 32 then permitted shifter arm 33—37 to rotate clockwise under the urging of spring 34, arm 33—37 caused adjustable switch member 17 to rotate counter-clockwise until finger 18 came into contact with stopping arm 39 in the position as shown in Fig. 1. As shown by the position of indicating pointer 41 on scale 43, Fig. 2, this adjusted the thermostat to approximately 50° F. As shown by the position of pointer 45, Fig. 1, at approximately 6:15 cam section 25 will come into contact with roller 32 and cause shifter arm 33—37 to rotate counter-clockwise. This will cause adjustable switch member 17 to rotate clockwise until finger 18 comes into contact with stopping arm 40. As shown by the position of pointer 42 on scale 43, this will adjust the thermostat to approximately 85° F.

As shown in Figs. 1 and 2, the proportion of the mechanism is such that with stopping arm 39 set at minimum temperature cam roller-shifter arm 33—37 has not yet reached the limit of its clockwise movement. Thus, indicating pointer 41 may be placed at any point on scale 43 and spring 34 will hold finger 18 in contact with stopping arm 39 in all positions. The proportions are also such that with roller 32 riding on cam 25—26 the counter-clockwise movement of shifter arm 33—37 will be such that spring 37 will leave the end of arm 36 even with stopping arm 40 set at maximum temperature. Thus, with roller 32 riding on cam 25—26 indicating pointer 42 may be placed anywhere on scale 43 and spring 37 will serve (as a spring) to hold finger 18 in contact with stopping arm 40 in all positions. The shape of the cams shown produce a relatively rapid shifting of the adjustable member 17 between stops 39 and 40. For some applications, it may be desired to shape the cams so that it would take several hours to make this shift or the cams may be so shaped as to produce any desired change in the position of adjustable member 17.

Referring to Fig. 2, it will be seen that the switch housing has ventilating openings only at its top and bottom. Figs. 1 and 3 show that the clock motor is located in the upper half of the housing so that the heat from coil 49 will produce an induced draft of air upward through the housing. As the clock motor operates continuously, this flow of air will be substantially constant. The bimetallic coil 12 of the thermostatic switch is located near the lower ventilating opening and will be in a substantially constant draft of air at room temperature. This makes this clock thermostat more responsive to changes in room temperature and materially reduces the effect of the heat from the clock motor on the operation and calibration of the thermostat.

It will be seen that a clock-controlled condition responsive switch has been provided in which a single dial clearly indicates the settings of the cam sections that change the adjustable member of the condition responsive switch from one setting to the other and at the same time serves as the dial of an easily-read clock, thus providing a simple mechanism that is easily set and adjusted by a person unfamiliar with mechanical and electrical devices. The invention furtherf provides means whereby the cams may quickly and positively move the adjustable member of the condition responsive switch from one setting to another in a positive manner and at the same time allow for a wide range in the upper and lower settings of the condition responsive means. The invention further provides a clock-controlled condition responsive switch in which the higher and lower settings are easily and simply adjusted by moving adjusting pointers over a single scale on the face of the instrument. The invention further provides a clock-controlled condition responsive switch with the condition responsive means and the clock motor so placed in a housing having ventilating openings only in its top and bottom so that the heat from the clock motor serves to produce a constant flow of air at room temperature upward over the condition responsive element of the switch making it more responsive to changes in the condition of the air in the room and largely eliminating the effect of the heat from the clock motor on the calibration of the instrument.

This application is filed in substitution for my prior abandoned application, Serial No. 396,600 filed June 4, 1941.

While a preferred embodiment of this invention has been described, it will be understood that this is for illustration only, and that the invention is to be limited only by the scope of the appended claims.

I claim:

1. Condition controlling apparatus comprising a base, a switch having an adjustable member

mounted on said base, a condition responsive element adapted to operate said switch, said element having two operating ranges, manually actuated means for adjusting the operating point of said element in each range, a cam comprising at least two sections rotatable with respect to each other to form a composite cam having an adjustable operating arc, clock mechanism for rotating said cam, whereby to shift automatically the adjustable member of said switch from one operating range to the other, and an arm projecting from at least one cam section passing through a slot in another cam section to limit relative rotation between said sections.

2. Condition controlling apparatus comprising a switch having an adjustable member, a condition responsive element having two operating ranges adapted to operate said switch, manual means for adjusting the operating point of said element in each range, a clock mechanism, a rotatable cam operated by said clock mechanism adapted to shift the adjustable member of the switch from one operating range to the other, said cam embodying a pair of relatively adjustable sections, a dial rotating with said cam, and projections formed on said cam sections, the projection of one of said cam sections passing through an arcuate slot in the other cam section, and the projections of both cam sections passing through arcuate slots in said dial, whereby to indicate the relative positions of said cam sections and limit their movement with respect to each other and with respect to said dial.

3. Condition controlling apparatus comprising a base, a switch mounted on said base, a thermostat having two operating ranges adapted to operate said switch, an adjustable member on said thermostat, manually actuated adjusting means for adjusting the operating temperatures of said thermostat in each of its ranges, a clock mechanism, a rotatable cam operated by said clock mechanism adapted to shift the adjustable member of the thermostat from one operating range to the other, said cam including a pair of relatively adjustable sections, a dial rotating with said cam, and projections provided on said cam sections, a projection of one cam section passing through an arcuate slot in the other cam section, and the projections of both cam sections passing through arcuate slots in said dial, whereby to indicate the relative positions of said cam sections and limit their movement with respect to each other and with respect to the dial.

4. In apparatus of the character described, a base, a thermostatic switch mounted on said base, said switch being provided with an adjustable member, a clock mechanism on said base, a rotatable cam operated by said clock mechanism, said cam having a dwell region, manually adjustable and variably spaced stop devices carried by said base, a shifter arm adapted to shift the adjustable member of the thermostatic switch between said stops, a spring pressed follower carried by said shifter arm disposed for contact with said cam, and a resilient element cooperative with said shifter arm and serving to maintain the adjustable member of said switch in engagement with one of said stops when the follower of the shifter arm is removed from engagement with said cam by registration with the dwell region therein.

5. In apparatus of the character described, in combination, a condition responsive element adapted to vary the position of a contact point, a second contact point in adjustable relation to said first contact point, primary means for varying the position of said second contact point to vary the value of the condition at which said contact points engage or disengage, secondary means for varying the position of said second contact point to vary the values of the condition at which said contact points engage or disengage, a spring operated shifter arm having a flexible part, clock-operated means alternately causing the shifter arm to hold the position of said second contact point under the control of the aforesaid primary means and placing it under the control of said secondary means by moving said shifter arm against the bias of its operating spring to a position that the flexible part of said shifter arm holds the position of said second contact point under the control of said secondary means.

6. A condition responsive switch comprising an adjustable member, primary means for varying the position of the adjustable member, secondary means for varying the position of the adjustable member, a spring operated shifter arm having a flexible part, timed means alternately causing said shifter arm to hold the adjustable member of said switch under the control of the aforesaid primary means and placing it under the control of the aforesaid secondary means by moving said shifter arm against the bias of its operating spring to a position enabling the flexible part of said shifter arm to hold said adjustable member under the control of said secondary means.

GEORGE W. CRISE.