Feb. 25, 1941. P. J. McCULLOUGH 2,233,139

SWITCH CONTROL DEVICE

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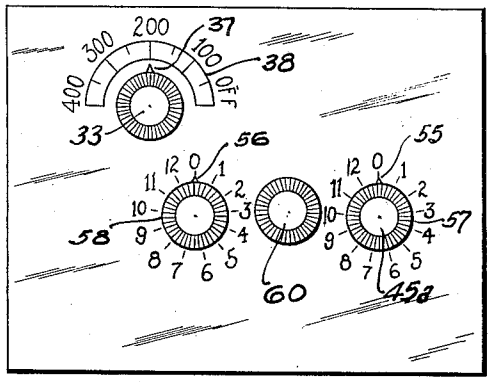


FIG.1

FIG.2

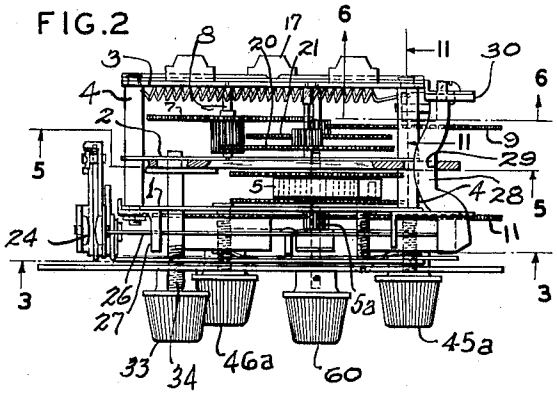


FIG.4

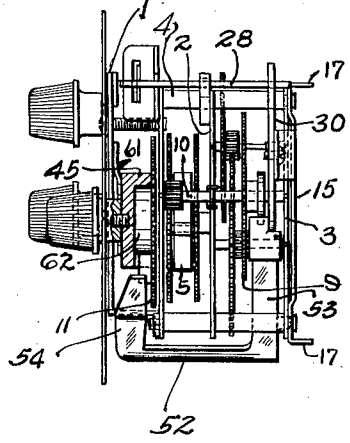


FIG.3

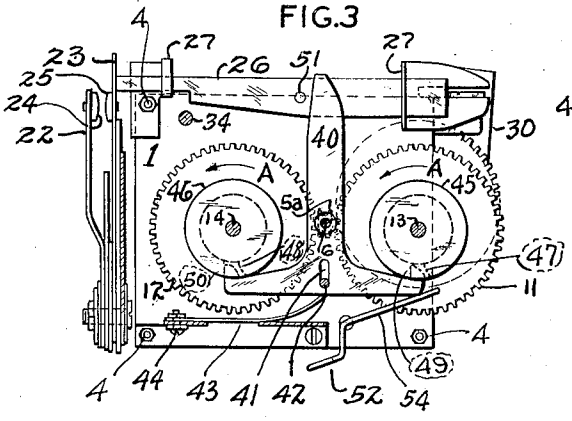
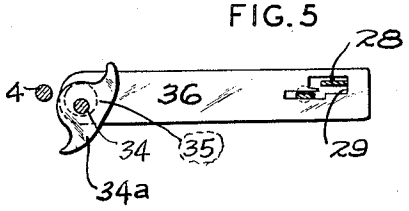


FIG.5



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FIG. 8.

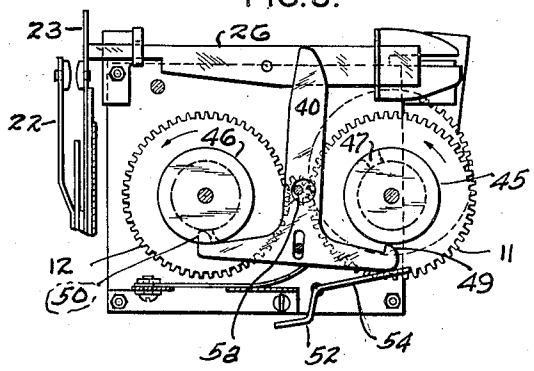


FIG. 6

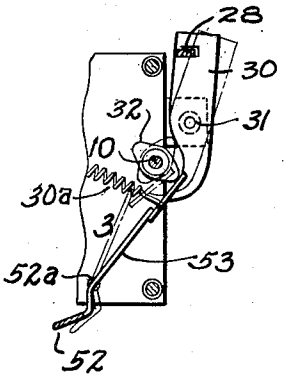
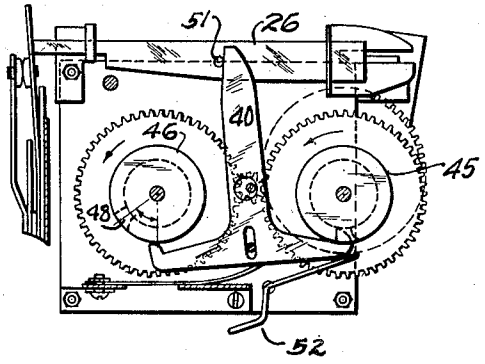


FIG. 9



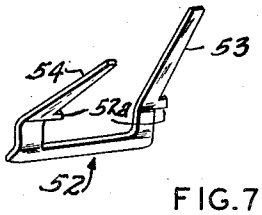
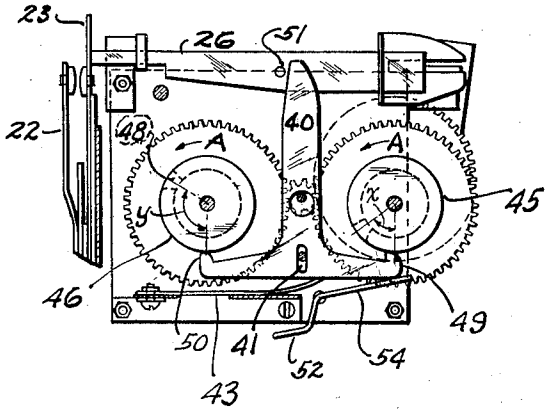


FIG. 7

FIG. 10



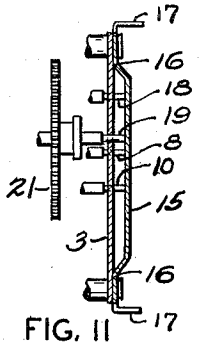


FIG. 11

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SWITCH CONTROL DEVICE

Paul J. McCullough, St. Louis, Mo., assignor to Joseph Pavelka, St. Louis, Mo.

Application January 12, 1938, Serial No. 184,544

12 Claims. (Cl. 200—38)

The invention relates to devices for controlling temperatures in ovens or like installations and consists in a clock-like mechanism and associated structure for intermittently opening and closing an electric heater circuit.

One of the objects of the invention is to enable the user to set the device to initiate automatically a heating operation after a given lapse of time.

Another object of the invention is to provide for the termination of the heating operation after it has continued for a predetermined period.

Another object of the invention is to enable the user to maintain a fairly constant temperature in the heater device throughout a functioning period which may or may not be initiated and terminated as indicated above.

Another object of the invention is to provide such a temperature control by mechanical means independently of thermostatic elements.

Another object of the invention is to make a clock control mechanism, of the type referred to, simple, effective, durable and economical.

In the accompanying drawings illustrating a selective embodiment of my invention—

Figure 1 diagrammatically illustrates the exterior of the mechanism casing and the winding and setting knobs and scales thereon.

Figure 2 is a top view of the mechanism with casing removed.

Figure 3 is a front view of the mechanism, the cover plate being removed to more clearly illustrate the structure, and is taken on the line 3—3 of Figure 2.

Figure 4 is a view of the right hand end of the structure as shown in Figure 3.

Figure 5 is a detail view taken approximately on the line 5—5 of Figure 2.

Figure 6 is a detail view taken approximately on the line 6—6 of Figure 2.

Figure 7 is a perspective of a yoke-like element utilized.

Figures 8, 9 and 10 show some of the parts illustrated in Figure 3 but in different positions assumed at various times during the operation of the device.

Figure 11 is a detail of the shaft mounting arrangement, and is taken approximately on the line 11—11 of Figure 2.

The clock mechanism may be of the usual construction comprising front, intermediate and back plates 1, 2 and 3, respectively, spaced apart by posts 4 and journaling the various shafts for the clock gearing. The main spring 5 is mounted upon shaft 6. The balance and escapement wheel 7 is mounted on shaft 8. A comparatively rapidly moving gear 9 is mounted upon shaft 10 and two relatively slow moving gears 11 and 12 are journaled on shafts 13 and 14, respectively, and enmesh with a pinion 5a on shaft 6.

Behind back plate 3 is a thrust bearing plate 15 having offset portions 16 which space the body of plate 15 slightly from back plate 3, and ears 17 on plate offsets 16 provide means for positioning and securing the unit to the frame of the stove or other structure (not shown) to which the device is applied. The ends of shafts 8 and 10 and shafts 18 and 19 for intermediate gears 20 and 21, respectively, are shouldered near their ends and journaled in back plate 3, but the diminished portions are of sufficient length to rest upon bearing plate 15 (Figure 11) with the shoulders spaced slightly from back plate 3 whereby contact between the back plate and the shouldered portions of the shafts is eliminated, reducing friction to a minimum.

It is customary to provide a separate bearing for the end of each shaft of a clock mechanism, which bearing may be of hardened steel or other construction corresponding to a jewel element, and each of these bearings must be positioned accurately with respect to the plate which journals the bearing and accurately with respect to the other shafts. With the thrust bearing plate 15 as described, the positioning of individual bearings for the shafts is avoided and the shaft ends will be provided with a thrust bearing wherever they may project through the journaling plate 3. Hence the arrangement of plates 3 and 15 not only increases the efficiency of the mechanism as by eliminating friction, but also facilitates the assembly of the mechanism. This feature is illustrated and described in the application filed by the present inventor and Joseph Pavelka, Jr., Serial No. 33,548, filed July 27, 1935, and as to this feature the present application constitutes a continuation in part of the earlier filed application.

At the left hand end of the mechanism (Figure 3) are two blades 22 and 23 of an electric circuit switch, these blades being provided with contact buttons 24 and 25, respectively. Blade 22 is substantially rigid while blade 23 is of spring material tending normally to assume a position with contact 25 spaced from contact 24 but blade 23 is adapted to be moved to the left under thrust from a reciprocating plunger 26 slidably mounted in guides 27 and actuated by control lever 28 (Figure 2) having a shiftable fulcrum 29 (Figure 5) and moved by an operating lever 30 (Figures 4 and 6) pivoted on the frame at 31. A spring

30a tends to move lever 30 to the dotted line position shown in Figure 6 but a cam 32 on shaft 9 moves lever 30 to the full line position at frequent intervals.

With the parts in the positions indicated in Figures 2, 3 and 4, each complete rotation of shaft 9 and cam 32 will cause the points of the latter and spring 30a to twice oscillate lever 30. Lever 28 will similarly oscillate, and plunger 26 will reciprocate, the movement in one direction being due to the thrust of lever 30, the return movement in the opposite direction being induced by spring switch blade 23.

The length of time buttons 24 and 25 may remain in contact with each other during each reciprocation of plunger 26 may be varied by shifting fulcrum 29 to the left and to the right. For this purpose, a temperature control knob 33 is mounted on a shaft 34 journaled in plates 1 and 2 and carrying an eccentric 35 on its inner end (Figures 2 and 5), the same being received in an opening provided therefor in bar 36, the right hand end of which forms the fulcrum 29 for lever 28. By turning knob 33 in a clockwise direction and moving bar 36 and fulcrum 29 to the extreme righthand position, fulcrum 29 causes the forward end of lever 28 to be located so far to the right at all times that the switch cannot close. As knob 33 is turned in an anti-clockwise direction and as bar 36 and fulcrum 29 are shifted to the left, the switch remains closed for increasingly longer periods. A stop lug 34a is secured to shaft 34 and has ends disposed to engage adjacent post 4 to limit the rotation of shaft 34.

Eccentric 35 and fulcrum 29 are so related that buttons 24 and 25 may have relatively long periods of contact and relatively short periods of separation or, upon suitable adjustment of the bar and fulcrum, the buttons may have relatively short periods of contact and relatively long periods of separation. Hence the parts thus far described may serve as a mechanical thermostat, as distinguished from a bi-metal or similar thermal thermostat, to maintain a desired temperature in the apparatus which the device controls. A pointer 37 and scale 38 constitute a possible degree indicating structure for manually setting the thermostatic feature.

The following description relates more particularly to mechanism whereby the above described parts may start to function only after a predetermined period of time has elapsed and will cease to function at the expiration of a further predetermined time period. A control arm 40 has a slot 41 slidably receiving a pin 42 mounted on front plate 1. A spring 43 secured to the frame at 44 yieldingly supports arm 40 in the position shown. Drums 45 and 46 are mounted upon clock gear shafts 13 and 14, respectively, and frictionally engage these shafts, or the gears 11 and 12 fixed thereon, and each drum has a corresponding knob 45a and 46a whereby the drum may be rotated manually without rotating the corresponding shaft or gear carried by the shaft. The periphery of drum 45 is notched at 47, and the periphery of drum 46 is notched at 48, and arm 40 has fingers 49 and 50 disposed to be received in notches 47 and 48, respectively, when the drums are turned to the position shown in Figure 2. When the drums and arm are in this position, there is substantial clearance between the upper end of arm 40 and a pin 51 projecting laterally from plunger 26, and arm 40 does not affect the operation of the switch closing plunger as described above.

The friction between drums 45 and 46 and their respective gears or shafts is sufficient for the clock work to rotate the drums normally but does not interfere with the manual rotation of the drums independently of the clock work when the drums are to be set as hereafter described, nor is the friction sufficient for the clock work drive of the drums to overcome the holding of the latter in stationary position by fingers 49 and 50 when the latter are seated in notches 47 and 48.

A yoke-like member 52 (Figures 3, 6 and 7) is pivoted by lugs 52a to front and back plates 1 and 3 and has a rear leg 53 engaging the lower end of lever 30. The forward leg 54 of member 52 engages the lower right hand portion of control arm 40. When drum 45 is moved from the position shown in Figure 2, control finger 49 is cammed out of notch 47 to the position indicated in Figure 8 and this depresses yoke leg 54, which in turn moves yoke leg 53 so that it holds lever 30 in the full line position shown in Figure 6 with its upper end moved to the left. Consequently, the forward end of lever 28 is moved to the right, in which position it cannot move plunger 26, blade 23 and button 25 into functioning position. As drum 45 rotates with its gear 11, notch 47 is brought into alignment with finger 49, permitting the latter and yoke 52 to return to the position shown in Figure 2 and thereby permitting cam 32, levers 30 and 28, and plunger 26 to function as previously described.

When drum 46 is moved to any position other than that indicated in Figure 2, control arm finger 50 is cammed out of notch 46 indicated in Figure 9, which rotates the upright portion of control arm 40 to the left to engage pin 51 and positively hold the same and plunger 26 in the extreme lefthand position. This will maintain contact between buttons 24 and 25 until gear 12 has rotated drum 46 to a position in which its notch 48 opposes finger 50, whereupon spring 43 will return control arm 40 to its original position (Figure 2) thereby permitting the switch spring blade 23 to open the circuit except during those intervals when it is moved to the left by lever 28.

Preferably the shafts and knobs of drums 45 and 46 have associated therewith pointers 55 and 56, respectively, and scales 57 and 58, respectively, the scales being marked to indicate time units such as hours, half hours, etc.

Operation

Assume that the device is applied to an electrically heated oven and the user places a roast within the oven and desires that cooking of the same commence two hours later and continue for two hours, and thereafter that the oven temperature be maintained at 200 degrees; the clock mechanism is wound with knob 60; knob 45a and the associated drum 45 should be turned until pointer 55 is moved to the "2" mark; knob 46a and the associated drum 46 should be turned until the pointer 56 indicates the "4" mark; knob 33 and its pointer 37 should be turned to the 200 degree mark.

The drums and control arm 40 would then be in the position indicated in Figure 10 and switch buttons could not move into contacting position for two hours, or until after drum 45 has traveled through the arc x, bringing notch 47 above finger 49. Whereupon spring 43 will thrust arm 40 to the position shown in Figure 9, engaging pin 51 to hold the switch closed. This

departure from the position shown in Figure 3 is caused by the depression of finger **50** due to the setting of drum **46**. Incidentally, when finger **49** enters notch **47**, yoke legs **54** and **53** may rise, permitting the lower end of lever **30** to swing to the left under the pull of spring **30***a* although lever **30** and the parts actuated thereby have no function so long as arm **40** is in the switch closing position shown in Figure 9.

The parts remain in the Figure 9 position for another two hours, or until drum **46** has traveled through the arc Y—Y, bringing notch **48** above finger **50**, whereupon the parts will assume the position indicated in Figure 2 and spring **30***a* and cam **32** will provide intermittent contact of abutments **24** and **25** to the extent determined by the setting of bar **36** and fulcrum **29** as effected by knob **33**.

As previously indicated, when finger **49** has once entered notch **47**, or finger **50** has once entered notch **48**, they remain in the notches until they are again cammed out of them by manual rotation of knobs **45***a* and **46***a*. The shapes of the opposing elements of the fingers and the notches are such that the rotation of the drums by the clockwork in the direction of arrows A results in direct abutment. The rotation of the drums manually in the opposite direction brings the inclined opposing faces of the fingers and notches into contact with each other and permits the camming of the fingers and notches without undue resistance.

The frictional engagement of the drums and gears is obtained by the springs **61** (Fig. 4) secured to the front plate **1** and thrusting the drums rearwardly. There is some additional friction resulting from the contact between the inner periphery of the drum and the hub **62** on the gear by the upward thrust of yoke leg **54** against finger **47**.

Figure 8 represents a position to which the parts may be set manually when it is desired to leave the circuit open for a definite period and thereafter to have the circuit open and close intermittently by the clockwork as first described herein. With finger **49** in contact with the periphery of drum **45**, yoke leg **54** is depressed and levers **30** and **28** can not be oscillated or plunger **26** reciprocated. But upon the expiration of the period required for notch **47** to reach a position opposite finger **49**, yoke leg **54** may rise, leaving the contact reciprocating mechanism free to function.

The principles of the invention and an operative embodiment of the same will be apparent from the above description and the accompanying drawings, but it will be understood that the details may be substantially modified and that some of the features of the invention may be used without being associated with the other features. For example, a device may include the intermittent contact mechanism without retaining the postponed timing mechanism. An electric drive may be substituted for the spring motor mechanism and other variations in the details of the parts and their relation to each other may be made without departing from the spirit of the invention and the exclusive use of such variations and modifications as come within the scope of the claims is contemplated.

What is claimed is:

1. In combination, a pair of switch blades one of which is relatively fixed and the other of which is of spring material normally tending to separate the switch contact points, a lever connected to said spring blade to move the same in one direction, mechanism automatically reciprocating a portion of said lever spaced from its connection to said spring blade, a fulcrum for said lever, and a manually controlled device for shifting said fulcrum, said lever being continuously in contact with said fulcrum in one position of the latter and there being lost motion between said lever and said fulcrum when the latter is in another position whereby the extent of movement of said lever and the period of closure of said switch thereby may be varied.

2. In combination, a fixed switch member, a movable switch member, opposing contacts on said members, a motor driven device providing intermittent engagement of said contacts, and clock mechanism for holding said contacts in engagement with each other for a predetermined period and then releasing the same for intermittent engagement by said device.

3. In combination, a switch having separable contact elements, a motor driven device connected to said switch to provide intermittent engagement of said elements, and clock mechanism for holding said elements spaced from each other for a predetermined period and then releasing the same for intermittent engagement by said device.

4. In combination, a switch having separable contact elements, a motor driven device connected to said switch to provide intermittent engagement of said elements, and clock mechanism for holding said elements spaced from each other for a predetermined period and then holding said contacts in engagement with each other for a predetermined period and then releasing the same for intermittent engagement by said device.

5. In a device of the class described, a switch, mechanism including an element moving to alternately open and close said switch, a member movable to a position in which it engages said element to hold the same in one switch position, yielding means for so moving said member, and a rotatable drum for engaging a part of said member to hold it from said position, said drum having a recess which when presented to said part as the drum is rotated permits said means to thrust said member into said position.

6. In a device of the class described, a switch, mechanism including an element moving to alternately open and close said switch, a member movable to a position in which it engages said element to hold the same in one switch position, yielding means for so moving said member, and a drum yieldingly rotatable by said mechanism and movable manually independently of said mechanism to engage a part of said member to hold it from said position, said drum having a recess which may be presented to said part upon rotation of the drum by said mechanism to permit said means to thrust said member into said position.

7. In a device of the class described, clock mechanism, spaced drums rotatable thereby, each drum having a recess in its periphery, an inverted T-shaped lever fulcrumed intermediate said drums with the opposite ends of its cross bar respectively opposing the peripheries of said drums and adapted to enter said recesses during the rotation of said drums to shift said lever about its fulcrum, the leg of said lever extending between said drums, a switch for opening and closing an electric circuit, a reciprocable member for controlling said switch, said member and leg having opposing elements whereby the reciprocation of

said member may be checked by the rotation of said drums.

8. A structure as described in claim 7 in which the drums are frictionally rotated by the clock mechanism and are provided with knob-like elements whereby they may be manually rotated independently of said mechanism.

9. A structure as described in claim 7 which includes a spring induced part for moving the reciprocable member in one direction and a device engaged by one end of the lever cross arm when out of the drum recess for holding said part against the thrust of its spring.

10. In a device of the class described, clockwork including parallel shafts, a pair of spaced drums mounted on said shafts, a T-shaped control arm with its leg intermediate said drums and its cross bar extending over the peripheries of said drums, there being coacting recesses and fingers on said drums and bar, an element providing a slidable and pivotal mounting for said arm, a spring for thrusting said arm on its mounting with said cross bar in contact with said drums and for rotating said arm about its mounting when said fingers oppose said recesses, an electric circuit switch, and parts for opening and closing said switch controlled by the position of said arm.

11. In a device of the class described, a switch for controlling an electric circuit, a mechanism for opening and closing said switch and including a cam and a lever actuated thereby, a clock mechanism for rotating said cam, a drum rotated by said clock mechanism and having a recess in its periphery, a pivoted element having a toe opposing the periphery of said drum and movable into said recess, a U-shaped member pivoted adjacent its cross bar and having one leg opposing said element and the other leg engaging said lever to hold the latter out of contact with said cam except when said toe has entered said recess.

12. A device as described in claim 11 in which the drum is frictionally rotatable by the clock mechanism and is provided with a knob-like element for manual rotation independently of said mechanism.

PAUL J. McCULLOUGH.