May 7, 1940. H. H. ANDERSEN 2,200,110

TIME SWITCH

Filed Feb. 24, 1939

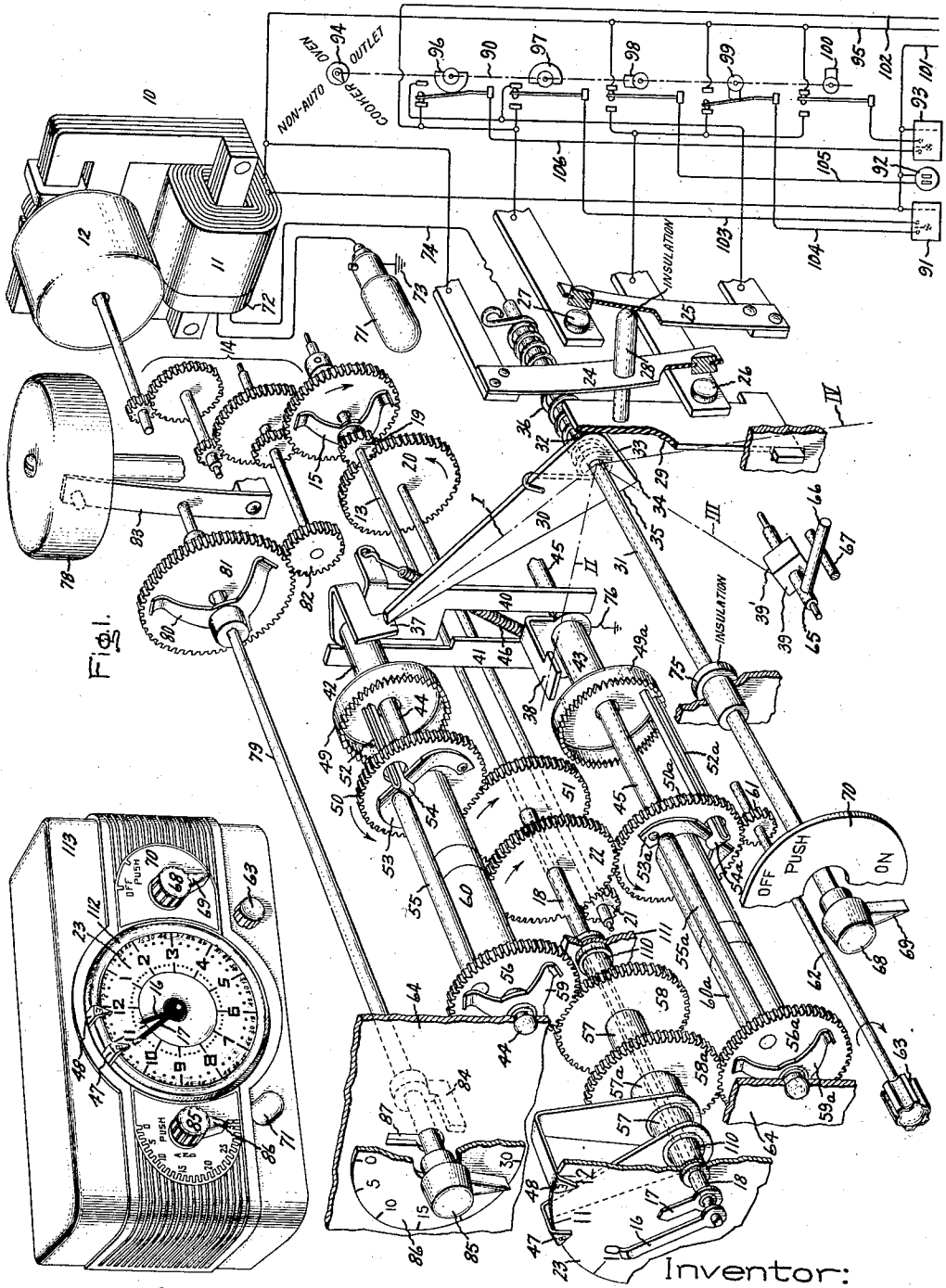


Fig. 1.

Fig. 2.

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Patented May 7, 1940 2,200,110

UNITED STATES PATENT OFFICE

2,200,110

TIME SWITCH

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Application February 24, 1939, Serial No. 258,219

9 Claims. (Cl. 200—39)

My invention relates to time switches and its primary object is to provide a time switch in which the levers used for setting the time of operation of the switching mechanism are arranged to be concentric to and indicate on a central clock dial in a practicable and simple manner. Another feature is to employ a switch controlling lever and certain stops against which it operates as a signaling switch. A switch of the general type to which my invention is applied is disclosed in United States Patent No. 2,056,400, October 6, 1936. In said patent two rotary switch setting time dials are provided separate from and in addition to an ordinary clock dial. Where the switch is used as a range timer for controlling a domestic cooking range, for example, the presence of the three dials, two of which rotate, and the necessity of adjusting switch setting levers with respect to the rotating dials becomes confusing to the ordinary user of such switches. According to my invention only one stationary normal time-telling clock dial is used for all of these time-telling and time-adjusting purposes, and the switch setting levers are adjusted concentrically about such dial in a straightforward simple manner that makes the desired adjustment a simple, readily understood procedure. The main feature of my invention is in the machinsm which makes this simplification possible without introducing other objectionable complications.

Fig. 1 of the drawing represents an exploded perspective view of the complete switch mechanism embodying my invention. At the right in Fig. 1 I have also represented a manual control switch and circuit connections often used in conjunction with the type of time switch represented for convenience in shifting the automatic time controlling function to different appliances and which is of assistance here in explaining the double contact arrangement of the time switch itself. Fig. 2 represents a front perspective view of the timer in its casing.

The time switch embodies a time-telling clock which is driven in this instance by a self-starting synchronous motor the stator of which is represented at 10, the field winding at 11 and a rotor enclosing gear casing at 12. The motor drives a minute hand shaft 13 through a gear train 14 and a slip friction clutch 15, the clutch being provided to facilitate setting of the clock hands. The minute hand 16 is secured to the forward end of shaft 13 and is driven in a clockwise direction one revolution per hour. The hour hand 17 is secured to a hollow sleeve 18 concentric with minute hand shaft 13 and is driven from shaft 13 through back gears 19, 20, 21 and 22. The minute and hour hands cooperate with a twelve hour clock dial 23. It is thus seen that I have introduced no complications in the well known simple form of clock driving mechanism.

The switch which is time controlled is represented as a double pole switch having movable spring blades 24 and 25 cooperating respectively with stationary contacts 26 and 27. The movable blades are mechanically connected by an insulating post 28 secured through switch blade 24. The left or rear end of post 28 as here shown rests against a movable strip of insulating material 29. Insulating strip 29 has its upper free end arranged to be moved to the right by the cam action of a lever 30 secured to a shaft 31. In the position shown, the high shoulder 32 of lever 30 pushes strip 29 to the right against the spring tension of contact blades 24 and 25 and holds the switch contacts open. This position of lever 30, may for convenience be referred to as position I. If, now, lever 30 and its shaft 31 be rotated counter-clockwise to a position II, the low cam surface at 33 will be opposite strip 29 and allow the strip together with post 28 and resilient contacts 24 and 25 to move to the left to close the switch. Further rotation of lever 30 and shaft 31 to a position III will cause another high shoulder 34 to move strip 29 back to the right and open the switch again while still further rotation to a position IV will bring low part 35 opposite strip 29 and allow the switch to close. The four positions of lever 30 just referred to are approximately indicated by the dash lines labelled I, II, III, and IV. Lever 30 is urged to rotate in the counter-clockwise direction from position I to position IV by a spring 36. However, lever 30 may be held in any one of the four designated positions by stops or abutments 37, 38, 39 and the lower part of strip 29 acting as an abutment.

Abutments 37 and 38 are parts of control levers 40 and 41 respectively which levers are secured on sleeves 42 and 43 respectively and pivot on shafts 44 and 45 respectively. These abutment levers 40 and 41 are normally held in the locking positions shown by a tension spring 46 which is fastened between them. The action of spring 46 is such as to tend to rotate both levers in clockwise directions about their pivot points and against each other as shown with the abutment projections in locking position with respect to the path of travel of the end of lever

30. Sleeves 42 and 43 are rotated temporarily a small distance counter-clockwise by the clock motor at times selected by the setting of time switch control-setting pointers 47 and 48 respectively. When these sleeves are so rotated counter-clockwise a short distance, the abutments 37 and 38 rotate sufficiently to release lever 30 and allow it to rotate under tension of spring 36 past the particular abutment or stop which is thus moved out of its path.

The two mechanisms for performing these automatic time selected operations on the two abutment levers are essentially alike and the parts for controlling abutment 37 will now be described.

Sleeve 42 is fastened to a clutch part 49 which has clutch teeth, finer than illustrated, cut in its near surface. A gear wheel 50 is rotated continuously in a counter-clockwise direction at one revolution in twelve hours by being geared to hollow hour hand shaft 18 through gear 51. Gear 50 is coaxial with clutch part 49 and rotates independently thereof except when these parts are clutched together. Gear 50 has an opening near its periphery through which clutch fingers 52 extend toward and in alignment with the toothed side periphery of clutch part 49 but normally out of engagement therewith. These clutch fingers are a part of a spring 53 riveted to the near side of gear 50 which spring is biased to normally hold fingers 52 away from the clutch member 49. This spring clutch finger structure also includes a cam-like projection 54 extending axially forward in line with the rearward extending clutch fingers. This cam projection cooperates with the rounded rear end of a cam finger 55 which is fastened to and extends to the rear from a gear wheel 56. Cam finger 55 is fastened near the periphery of gear 56 and gear 56 has the same axis of rotation of gear 50 so that once per revolution of gear 50 the cam projection 54 comes against cam finger 55 and the former is forced to the rear while these parts pass each other. During this cam action teeth 52 are forced into engagement with the toothed surface of clutch part 49 and cause sleeve 42 and the parts carried thereby to rotate counter-clockwise with gear 50. When cam 54 has moved past pin 55, spring 53 pulls teeth 52 from engagement with clutch part 49 and the latter is released and it then rotates clockwise under tension of spring 46 to again bring abutment 37 into position to block counter-clockwise rotation of lever 30 past this point.

The time of day when the automatic operation just described is performed depends upon the rotative position of pin 55 and this can be adjusted as desired by rotation of gear 56 which is in driving connection with setting pointer 47 through sleeve 57 and gear wheel 58. Sleeve 57 is concentric to hollow hour hand shaft 18 and to an intervening stationary sleeve 110 and is free to be rotated thereon. Pointer 47 is fastened to the forward end and gear 58 to the rear end of sleeve 57. The parts 49, 50 and 56 are all rotatively mounted about a post 44 parallel with shaft 13 independently of each other except as described above. Gear 50 rotates continuously, clutch part 42 rotates counter-clockwise a short distance when clutched to gear 50 and clockwise the same distance by spring 46 when released, and gear 56 is rotated manually in a direction and extent determined by the setting movement of setting pointer 47 with respect to the regular clock dial 23. A friction spring part 59 or its equivalent is preferably provided to hold gear 56 stationary except when set manually. Parts 60 are merely spacing collars.

The corresponding parts which are employed for setting the time of release and for releasing arm 30 at abutment 38 are substantially duplicates of those parts which have been described and are identified by similar reference characters followed by the letter *a*. Setting gear 58*a* is on a sleeve 57*a* which is slightly larger and surrounds sleeve 57. Hence sleeve 57 is longer than 57*a*. The gear 22 which drives gear 50*a* is one of the back gears between the minute and hour hand shafts. The gear shown at 61 meshing with gear 50*a* is on a shaft 62 extending forward through the face 64 of the clock casing and is provided with a suitable thumb piece 63 for setting the clock. This clock setting drive might be connected at any other convenient point in the time train. For convenience the principal gears in the central group which rotate continuously with the clock have arrows indicating their directions of rotation.

In assembling the parts, pointer 47 is so rotatively positioned with respect to parts 53 and 54, and pointer 48 is so rotatively positioned with respect to parts 55*a* and 54*a*, that the times at which abutment stops 37 and 38 are withdrawn will be indicated by the position of pointers 47 and 48 on the clock dial 23, and this will also be consistent with the time indicated by hands 16 and 17 on the clock dial. It is further seen that the direction of setting movement of pointer 47 about clock dial 23 is correct with respect to the direction of movement of cam finger 53 and the movement of continuously rotating cam part 54 past cam finger 55 to bring this about. For example, pointer 47 is shown set to cause withdrawal of stop abutment 37 at about 11 o'clock. If pointer 47 is now moved counter-clockwise for an earlier setting, cam finger 55 is moved clockwise for a correspondingly earlier cam operation on cam 54. Normal setting of the clock hands also sets cams 54 and 54*a* accordingly by the proper amount and in the proper direction so that this does not interfere with the desired correlation arrangement for subsequent correct operation. Setting pointers 47 and 48 may be set by movement in either clockwise or counter-clockwise direction. It is thus seen that the time is indicated and the time switch setting is made all with respect to a single central stationary clock dial in its normal upright time-telling position. The time switch setting is thus made direct, simple and convenient and can moreover be made with improved accuracy because the clock dial is made much larger than it is practicable to make separate switch setting dials and at the same time keep the dimensions of the device within reasonable limits. The mechanism which I have devised to accomplish this concentric time-telling and switch-setting arrangement is relatively simple, compact and inexpensive. The time switch setting and operating parts are properly correlated with the time as indicated by the clock hands on the same time-telling and switch-setting dial and the only thing necessary for correct operation is to see that the clock is correct.

It will be noted that to permit free movement of setting pointers 47 and 48 about the clock dial 23 and have these pointers extend from behind, around the outer edge and indicate on the front periphery of clock dial 23, it is impossible to support the clock dial at its outer edge as is customary. The clock dial is therefore staked and supported at its center to the forward end

of stationary sleeve 110. The rear end of this sleeve is staked to and supported by a supplementary clock plate 111. Stationary sleeve 110 surrounds the minute and hour hand shafts 13 and 18 and is inside of sleeves 57 and 57a. All of these parts 13, 18, 110, 57 and 57a are concentric, the shortest being on the outside and the longest inside in order that the parts which rotate may have the necessary driving connections without interference. In the drawing, Fig. 1, these concentric sleeve parts and shafts are shown longer, for purposes of illustration, than is actually the practice in the commercial device. In practice dial 23 is spaced from its holding plate 111 by not more than ½ inch and is thus securely held. Outer sleeve 57a will also have an outer supporting bearing where it passes through front clock plate 64. As shown in Fig. 2, the clock dial has a glass bezel covering fastened to the outer edge of the dial by a rim 112 inside of setting pointers 47 and 48, and a circular opening is provided between the clock dial structure and casing 113 in which setting pointers 47 and 48 are freely movable. The complete dial structure including the glass and rim 112 is supported from the forward end of stationary sleeve 110 staked to the dial near its center.

The shafts on which setting knobs 63, 68 and 85 are mounted extend through small holes in the front of the casing and these knobs are removable from their shafts in order that the cover casing may be removed by withdrawing it from the front. The central dial assembly which is independent of the casing is not disturbed when the casing is removed.

It has been explained how the stops 37 and 38 are automatically removed from the path of switch-operating arm 30 in accordance with time-setting of pointers 47 and 48. These stops are also arranged to be moved out of the path of arm 30 when it is rotated clockwise manually from position III to position I, for example. This manual movement of arm 30 in a clockwise direction simply rotates stop levers 40 and 41 counterclockwise against the tension of spring 46 a sufficient amount to allow the end of lever 30 to clear the stop, after which they return to stop positions. This is analogous to an ordinary ratchet retracting operation and is inherent in the arrangement. The stop 39 at the normal switch open position III is also arranged to permit of clockwise manual rotation of arm 30 past it. For this purpose the stop 39 has a shoulder 39' and is pivoted on its center to a pin 65 and is biased in the position shown by a weight 66 resting on a stop 67. When so positioned only the upper corner 39' of this stop projects into the path of the outer end of arm 30. It will thus hold the arm from rotation past this point in a counter-clockwise direction. However, if arm 30 be moved past this stop manually in a clockwise direction, it will rotate the stop counter-clockwise sufficiently to allow the arm to pass by the low or flat part of the squared stop and then the stop will rotate back to the position shown.

Arm 30 is rotated manually clockwise or "cocked" by means of the knob 68 on the forward end of shaft 31. Such rotation also winds spring 36. Shaft 31 is normally urged endwise towards the handle 68 by this same spring 36 and, if rotated while in this forward position, it will engage the various abutments in positions I, II and III past which it is rotated. However, the shaft 31 is arranged to have sufficient endwise play that inward pressure on handle 68 will move the shaft inward to a point where if the arm 30 be rotated, it will clear the inside end of the various stops at positions I, II and III and move past without touching the stops. The arm 30 may thus be pressed in and cocked in case an abutment such as 38 happens to be clutched to gear 50a at the time the arm 30 is manually rotated clockwise and is holding stop 38 against quick retracting movement. Also, the arm may be manually released from any one of the stops at positions I, II and III when resting at such positions, if that is desirable, by simply pushing in on handle 68 until the end of lever 30 clears the inner edge of the stops. The spring 36 will then rotate the lever to the next position or to the final position IV, if pressure on the handle is not immediately relieved.

If it is desired that the switch contacts 24, 26 and 25, 27 remain closed with no automatic time switch operation, lever 30 is moved to position IV. If it is desired that these switch contacts remain open with no automatic time switch operation, lever 30 is positioned at position III. If it is desired that the switch be closed and later opened automatically at a predetermined time, lever 30 is cocked to position II and hand 48 is set at the time it is desired that the switch be opened. At such time stop 38 is temporarily retracted by the automatic time switch mechanism and allows arm 30 to rotate it position III, thus opening the switch.

If it be desired that the switch be closed at a predetermined time and opened at a later predetermined time, lever 30 is cocked to position I and lever 47 set at the time for the switch closing and lever 48 set for the time of switch opening. When stop 37 is temporarily withdrawn automatically in accordance with the time setting of lever 47, arm 30 rotates from position I to position II and closes the switch. Then later stop 38 is withdrawn temporarily in accordance with the time-setting of pointer 48 and lever 30 rotates from position II to position III to open the switch.

It is immaterial whether the cocking action be made before or after the setting of levers 47 and 48 unless, of course, lever 47 be in such a position that it will release arm 30 in setting lever 47 to the new position. Levers 47 and 48 may be rotated in either direction in setting them and if desired may be positioned as to move past each other although this is unnecessary. For example, with the pointers 47 and 48 in the positions shown, if it is desired to move pointer 47 to the opposite side of pointer 48, say to the one o'clock position, it may be done by simply rotating pointer 47 counter-clockwise to such position. I prefer to mark lever 47 with a "B" and lever 48 with an "E", designating beginning and ending of time period during which the switch will be closed when set for automatic operation. Also the handle 68 may be provided with a pointer 69 cooperating with a dial 70 having the important positions of lever 30 designated in some suitable way. For example, with lever 30 cocked for automatically closing the switch at a selected time, pointer 69 may point to the inscription "On", indicating that the switch is set to go on at the time designated by beginning pointer 47. For position II when the switch is on, pointer 69 may point to the inscription "Push" indicating that the switch may be turned "off" by pushing button 69. Other appropriate markings may be used, supplemented with suitable instructions.

For further convenience in using this switch I

provide a small low-voltage signal lamp 71 which is lit when lever 30 is in either of the automatic operating positions I or II but not otherwise. Lamp 71 has an energizing circuit consisting of a low-voltage transformer coil 72 on the stator 10 of the electric motor. The motor coil 11 acts as the primary of this transformer. One side of this circuit is grounded after going through the lamp to the metal part of the switch structure as indicated at 73. The other side of coil 72 is connected to shaft 31 by wire 74. Shaft 31 and all metal parts connected thereto are insulated from the rest of the clock structure except at the outer end of metal lever 30. Thus shaft 31 has insulated bearing bushings such as shown at 75. When lever 30 rests on either metal stop 37 or 38 the circuit of lamp 71 is completed back through the metal grounded part of the switch structure as represented by the ground at 76.

At position III the lamp will not be lit since stop 39 is insulated from the general metal structure of the clock. Hence the lamp serves as a warning when lit that the switch is set for automatic operation.

As a further convenience to the housewife and cook I have provided a signal bell 78 operated by the timer mechanism by means of which the desired ending of short cooking periods or other short time reminder periods may be signaled. For this purpose a shaft 79 may be connected in driving relation with the timer motor through clutch 80, gear 81 and gear 82. Shaft 79 is movable endwise. It is biased forward by a spring 83 which is also a bell clapper member and which bears against the rear end of shaft 79. Near the front end of shaft 79 it has fastened to it an eccentric finger 84 and a pointer knob 85. Pointer knob 85 indicates on a minute dial 86 and finger 84 cooperates with the front clock plate 64 and in the zero minute indicating position of pointer 85, finger 84 registers with an opening 87 in the clock plate and in such position will enter the opening under tension of spring 83 and move shaft 79 forward, demeshing gear 81 from gear 82 and the clapper 83 will strike bell 78 and give a signal. In the position of the parts shown shaft 79 has been pushed to the rear to disengage arm 84 from slot 87. Also, knob 85 has been turned to indicate 30 on dial 86. The shaft 79 is thus held in this rearward position by reason of finger 84 bearing against the rear of plate 64. In such position gears 81 and 82 are in mesh and shaft 79 is driven clockwise, in this case, at the rate of one revolution per hour. Spring 83 is under tension. In thirty minutes finger 84 will register with opening 87, shaft 79 will quickly move forward, gear 81 will be demeshed from gear 82 and the upper end of clapper spring 83 will strike the bell, giving a signal. This mechanism then remains out of operation until reset by pushing in on knob 85 and turning it to the left to the position desired. Shaft 79 may thus be turned when pushed to the rear and gears 81 and 82 are in mesh by reason of slip friction clutch 80.

This is a convenience for timing short operations which need not necessarily have to do with cooking but which may have to do with cooking operations that are too short or too exacting to be left to automatic switch operation. For example, suppose eggs boiled exactly four minutes are desired. The time required for the water to come to a boil is indefinite since it depends, for example, on the original temperature of the water. As soon as the water starts to boil, the eggs are put in and pointer knob 85 set at four on dial 86. In exactly four minutes the bell will sound, signaling the end of the four minute period. Where desired the shaft 79 may be geared to rotate faster than one revolution per hour and the dial 86 graduated accordingly for greater accurancy in setting and timing. This signaling convenience, while operated by the same timing mechanism as the time switch and clock, does not interfere with their independent or simultaneous operation, as will be more fully explained.

A front view appearance of this timer in its casing is represented in Fig. 2 and is covered by Design Patent 110,906, August 16, 1938 to Patten.

At the right in Fig. 1 I have shown a manual switch, the rotary operating shaft of which is designated by reference character 90 by means of which the automatic time switch may be selectively connected to control a circuit through a switch 91, a convenience outlet 92 or a switch 93. Switch 91 is assumed to lead to a cooker and switch 93 to an oven to correspond to the designations opposite pointer 94 on shaft 90.

The supply circuit to the installation is a 220 volt circuit with a neutral wire 95 and it is assumed that the switches 91 and 93 are designed to connect the cooker and oven respectively for either 110 or 220 volt operation. Manual switch 90 is so connected between switches 91 or 93, depending on its position, and the double circuit time controlled switch contacts 24, 26, 25, 27 that the time switch automatically controls the circuit in which it is connected whether the switches 91 or 93 be connected for either 110 or 220 volt operation of their respective circuits. In the position of switch 90 shown it connects the cooker switch 91 to the supply circuit through the automatic time switch and switch 91 may be connected for either 110 or 220 volt operation of its circuit and have that circuit controlled by the time switch. At the same time, the circuit to the convenience outlet 92 is closed for 110 volt operation and the circuit to oven switch 93 is closed for manual operation of the oven circuit for 110 or 220 volt operation. Shaft 90 has on it five cams numbered 96 to 100 and each of these cams controls a single pole, double throw contact member cooperating with stationary contacts which for convenience may be referred to as right and left contacts according to their disposition at the right or left in the drawing.

Outside supply wire 101 does not go to any switch contact of switch 90 or to the time switch but does connect directly through switches 91 and 93 and to outlet 92. For simplification of this explanation it may be assumed that switches 91 and 93 do not open the circuit from wire 101 but that it goes directly to one side of the heater elements controlled by said switches. Timing motor coil 11 is also permanently connected across neutral wire 95 and outside wire 101 for 110 volt operation and hence runs continuously. Also the circuit of signal lamp 71 which receives its energy through the motor is independent of any of the switches mentioned.

With the switch 90 connected as shown for automatic control of the circuit through switch 91 a circuit is closed from wire 101, circuit 91, wire 103, right contact 97 of switch 90, time switch contacts 25 and 27 to outside wire 102. Hence if switch 91 is connected for 220 volt operation, it will be controlled by the time switch. Another circuit is connected from wire 101 to switch 91 back through wire 104, left contact 98 of switch 90, contacts 26 and 24 of the time

switch to neutral wire 95. Hence, if switch 91 be connected for 110 volt operation it will be controlled by the time switch. Convenience outlet 92 is connected for 110 volt non-automatic operation from wire 101, wire 105, right contact 98 to neutral wire 95. The 110 volt circuit to switch 93 is closed from wire 101, right contact 100 of switch 90 to the neutral wire 95 and the 220 volt circuit is closed to switch 93 from wire 101, wire 106, left switch contact 96 to outside supply wire 102.

If, now, switch 90 be rotated 90 degrees counter-clockwise for automatic time switch operation to outlet 92, the latter will be connected from wire 101, wire 105, left contact 98, time switch contacts 26 and 24 to neutral wire 95. At this time a 110 volt circuit is closed to switch 91 from wire 101, wire 104, right contact 99 to neutral 95 and a 220 volt circuit is connected from wire 101, wire 103, left contact 97 to wire 102. At this time also a 110 volt circuit is connected to switch 93 from wire 101, right switch contact 100 to neutral wire 95 and a 220 volt circuit is connected through wire 101, wire 106, left contact 96 to wire 102.

If, now, switch 90 be turned 90 degrees further counter-clockwise, oven switch 93 is connected for time switch control, the 220 volt circuit being from wire 101, wire 106, right contact 96, time switch contacts 25 and 27 to outside wire 102 and the 110 volt circuit being from wire 101, left contact 100, time switch contacts 26 and 24 to neutral wire 95. At this time outlet 92 is connected for 110 volt operation from wire 101, wire 105, right contact 98 to neutral wire 95. Also 110 and 220 volt circuits are connected to switch 91, the 110 volt circuit being from wire 101, wire 104, right contact 99 to neutral and the 220 volt circuit from wire 101, wire 103, left contact 97 to wire 102.

When switch 90 is turned to the designation "Non auto" none of the circuits to 91, 92 or 93 go through the time switch contacts but all are nevertheless energized, switches 91 and 93 for either 110 or 220 volt operation. The 110 volt circuit for switch 91 is from wire 101, wire 104, right contact 99 to neutral and the 220 volt circuit through wire 103, left contact 97 to wire 102. The 110 volt circuit to outlet 92 is through wire 105, right contact 98 to neutral.

The 110 volt circuit to switch 93 is through right contact 100 to neutral and the 220 volt circuit is through wire 106, left contact 96 to outside wire 102.

The need for two independent circuits through the time switch is thus explained. These circuits at the time switch contacts should be well insulated from each other, as illustrated, and so arranged that regardless of which circuit therethrough is being used, the time switch setting procedure is the same for both.

It is also seen how the signal bell timer feature may be of considerable convenience in timing a cooking operation on one circuit while the time switch is in use controlling another of the circuits described.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A timer comprising a clock dial, clock hands cooperating with said dial, minute and hour hand shafts, a motor for driving said shafts, a switch, a pair of means driven from said hour hand shaft for controlling different operations of said switch, a pair of adjustable means for determining the times of operation of said controlling means on said switch, said adjustable means including a pair of pointers independently adjustable about said clock dial and a pair of rotatable sleeves outside and concentric to said minute and hour hand shafts and to which said pointers are secured, and a stationary sleeve between said shafts and pair of sleeves and concentric thereto for supporting said clock dial from its central position, said pointers extending from the rear about the outer edge of said clock dial to indicate on the front periphery thereof.

2. A timer comprising a clock dial, minute and hour hands indicating on said dial, minute and hour hand shafts, a timer motor for driving said shafts and hands, a switch, a rotary lever for operating said switch, said lever having a rotary positon where the switch is open and a different rotary position where the switch is closed, manually wound spring means for urging said lever to rotate through said positions, stops for said lever at said positions, a pair of means driven from said hour hand shaft for temporarily removing said stops to permit rotation of said lever through said positions, a pair of independently adjustable means for determining when said stops shall be removed, including sleeves concentric to and rotatable about said shafts, pointers secured to said sleeves and independently adjustable about said clock dial to indicate thereon when said switch shall close and open by the removal of said stops, and a stationary sleeve between said pair of sleeves and said shafts for supporting said clock dial near its center, said shafts extending through the center of said clock dial and said pointers extending from the rear about the outer edge of said clock dial to indicate on the front periphery thereof.

3. In a timer, the combination of contact apparatus, a control member governing said contact apparatus, said control member being adapted to be moved from a normal position to a set position, means normally tending to cause a unidirectional return motion to said control member from said set position back to said normal position, a movable stop biased to a stopping position at a point in the path of such return movement, time responsive driving means for actuating said stop to release said control member, said driving means including a normally disengaged clutch, cam means for temporarily engaging said clutch to cause said tripping stop to release said control member, and means for adjusting said cam means to release said tripping means at a predetermined time.

4. In a timer, a switch, a lever for operating said switch adapted to be moved from a normal position to a set position, means normally tending to cause a unidirectional return of said lever from a set position back to said normal position, a pair of movable stops biased to stopping positions at different points in the path of such return movement, a timer motor, a pair of driving connections between said timer motor and movable stops, each connection including a normally disengaged clutch, a pair of cam means for temporarily engaging said clutches to cause said stops to be moved to release said lever, said pair of cam means being independently adjustable to cause release of said lever at different stopping positions at selected predetermined times.

5. In a timer, a switch, a lever for operating said switch, said lever having a normal position and cocked position, means for biasing said lever so that it will return to the normal position from

a cocked position, a movable stop normally biased into the path of the return movement of said lever to hold it in cocked position, a timer motor, a driving connection between said timer motor and stop including a normally disengaged clutch, said clutch comprising a normally stationary wheel connected to said stop and having a clutching surface on one side and a gear co-axial with said wheel continuously driven by said motor, a spring secured to said gear having a clutch finger part extending through an opening near the periphery of said gear towards the clutch surface of said wheel and a cam projection extending in the opposite direction, and means for temporarily pressing said clutch finger part against the clutch surface of said wheel to engage said clutch and move the stop to release said lever comprising a second cam extending into the path of rotation of said first mentioned cam and adjustable about the axis of rotation of said gear wheel to select the time when said lever shall be released.

6. In a timer, a clock dial, a support, a stationary sleeve fastened at its rear end to said support and secured at its front end to the central portion of said dial and comprising the sole support for said dial, minute and hour hands indicating on the front of said dial, minute and hour hand shafts extending through said stationary sleeve and supporting said hands on their forward ends, a timing motor and gear train for driving said shafts located to the rear of said stationary sleeve and its support, switching mechanism, means operated from said gear train for operating said switching mechanism, and rotary adjustable means for adjusting and indicating the time at which said switch shall be operated, said means including a hollow shaft supported on said stationary sleeve and having a pointer extending radially from the forward end of said hollow shaft back of said dial to its periphery and around the edge thereof to indicate on the front of said dial.

7. In a timer, a clock dial, a support, a fixed hollow sleeve secured at its rear end in said support and secured at its forward end to the central portion of said dial and constituting the sole support for said dial, minute and hour hands indicating on the front of said dial, minute and hour hand shafts extending through said hollow sleeve and dial, a timer motor and a gear train located to the rear of said hollow sleeve for driving said shafts, a switch, means controlled by said motor for closing said switch and means controlled by said motor for opening said switch, said control means including continuously rotary parts geared to the hour hand shaft to the rear of said stationary sleeve and normally stationary adjustable rotary parts cooperating with the continuously rotating parts for determining the time at which said switch operations shall occur, said adjustable parts being geared to and including hollow sleeves concentrically and independently rotatively mounted on said fixed hollow sleeve and pointers indicating on the front periphery of said clock dial secured to said last mentioned hollow sleeves to indicate the time of occurrence of said switching operations.

8. In a timer, a switch, a metallic rotary lever for operating said switch, said lever having different rotary switch controlling positions in which it may be set, movable metallic stops for positioning said lever in said different switch controlling positions, time controlled means for moving said stops to release said lever, adjustable means for determining the times at which said stops shall be so moved, means for rotating said lever when released, and signaling means for signaling when said lever is in one of said set switch controlling positions comprising an electric signal and an energizing circuit therefor independent of said switch and which is completed only when said lever is positioned on one of said stops.

9. In a timer for automatically controlling operations at predetermined adjustable times comprising a stationary twelve-hour clock dial, minute and hour hands indicating on the front of said dial, minute and hour hand shafts extending from the rear through said dial at its center for driving said hands, automatic operation time adjusting levers indicating on and independently adjustable about the front periphery of said dial, hollow shafts concentric with said minute and hour hand shafts and surrounding them to which said adjusting levers are secured behind said dial and a fixed hollow sleeve outside of the minute and hour hand shafts and inside of said hollow shafts comprising the sole support of said dial, said dial being secured near its center to the front end of said fixed hollow sleeve.

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