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TIME SWITCH

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FIG.1

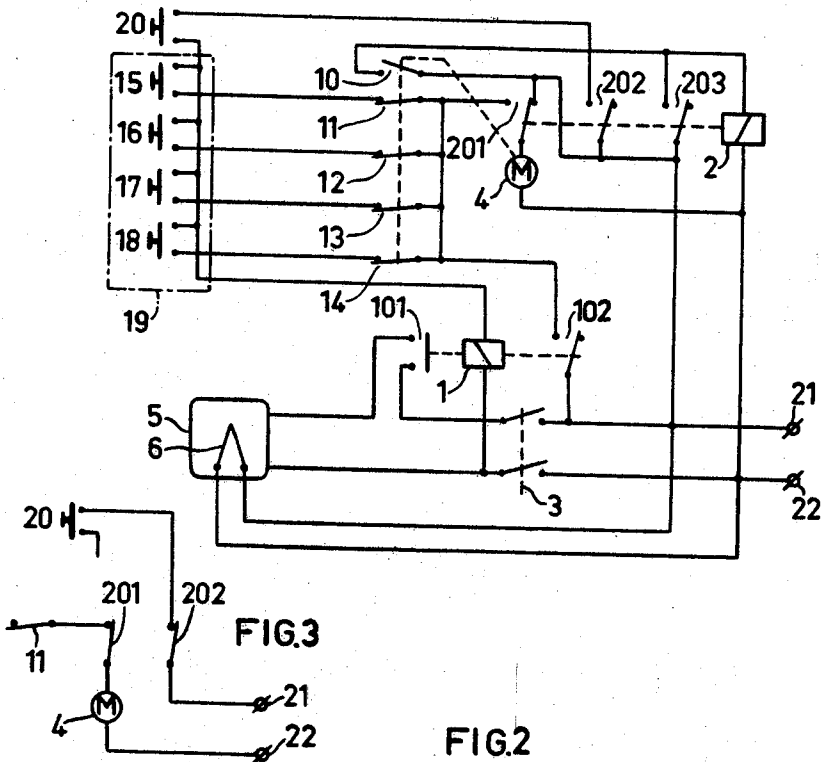
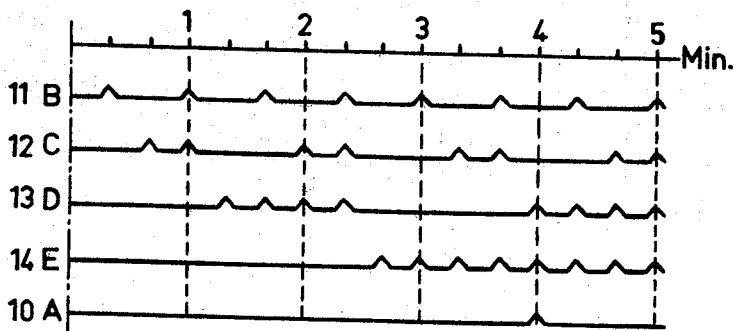


FIG.2



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1

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TIME SWITCH

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ABSTRACT OF THE DISCLOSURE

A time switch for temporarily connecting a micro-wave oven or the like to an electric current supply system for a selectable time comprising a relay governing a first contact for current supply to said oven. Said relay has a plurality of mutually parallel holding circuits each comprising the series combination of a manually actuatable switch and a mechanically operated switch. The time switch further comprises an equal plurality of mechanical, power driven means for opening said mechanically operated switches momentarily, on the one hand after a time, specific to its respective holding circuit and determined by its mechanical means, and on the other hand at moments corresponding to the sum of the specific, individual time(s) of any selected ones of the other holding circuits as determined by the respective mechanical means thereof.

This invention relates to a time switch for electric apparatus, particularly micro-wave ovens.

The principal object of the invention is to provide a time switch of the kind referred to which is particularly reliable and economical.

This and other objects of the invention is attained by the specific features set forth in the claims.

The invention will be more particularly described with reference to the accompanying drawing, in which:

FIGURE 1 is an electric circuit diagram of a preferred embodiment of the invention;

FIGURE 2 is a graph of the timing of this embodiment; and

FIGURE 3 illustrates a simplified embodiment of part of the circuitry according to FIGURE 1.

The time switch according to FIGURE 1 is particularly designated for use in micro-wave ovens comprising a transmitter tube 5 of the hot cathode type and in which the cathode 6 for the sake of convenience and with regard to the life of the tube is maintained at a certain, raised temperature when the transmitter tube is not operative. In such ovens the switching in of the transmitter tube for power output purposes has to be prevented, until the cathode has reached a proper temperature after that the oven has become connected to the electric supply system. The time switch comprises a principal relay 1, a starting relay 2, a main switch 3, a synchronous motor 4, and a pair of connection terminals 21, 22 for single phase alternating current. The motor 4 is through five cam discs A-E or the like actuatably connected to corresponding switches 10-14, four of which are connected in series electrically with individual, manually actuatable switches 15, 16, 17, and 18 respectively in a time selector 19. At this selector 19 there is also arranged a switch 20 adapted to close momentarily when manipulated. FIGURE 2 illustrates diagrammatically the profile or circumference of the cam discs E-A in relation to their time of running. Near the designations A-E there are set forth the designations of the corresponding switches 10-14 respectively.

When electric voltage is supplied to the terminals 21 and 22 current flows partly through the cathode 6 of the

2

transmitter tube 5, partly through the motor 4 via the break contact 201 of the relay 2. This occurs independently of the position of the switch 3. After an interval which is selected to correspond to a sufficient heating of the transmitter tube 5, the motor 4 by means of its cam A operates to close the switch 10. Thereby a circuit is established through the coil of the relay 2, so that its contacts 201, 202 and 203 become transferred into their operative position. This means, that motor 4 through contact 201 becomes connected to the switch 11, 12, 13, 14, that switch 20 becomes connected to the terminal 21 through the contact 202, and that the coil of the relay 2 receives holding current through the contact 203. Thereby, the current through the motor 4 is interrupted and its cam discs are returned by a return spring in a manner known per se. If the switches 3 and 20 are now closed manually, a circuit is established from terminal 22 through switch 3, the coil of the relay 1, switch 20 and the contact 202 to the terminal 21. The contact 101 of relay 1 is thereby actuated and closes the main circuit of the transmitter tube 5 which starts operating. As soon as the manipulation of the switch 20 is interrupted, these circuits are opened. A predetermined time of operation for the transmitter tube may be selected by manual closing of one or more of the switches 15, 16, 17, 18. When this has been done, the closing of the switch 20 establishes another circuit from the coil of relay 1 to the terminal 21 through the manipulated switch(es) 15-18, the corresponding ones of the switches 11-14 and the contact 102 of relay 1. Thereby also the motor 4 receives current through relay contacts 102 and 201 with the consequence that the motor initiates rotation of the cam discs A-E.

On account of the energization of relay 1, this second circuit remains established even when the contact 20 is opened and subsequently until the switches 11-14 in question is opened by its cam disc. Assuming that the switch 15 was manipulated, this means that the time interval for the operation of the transmitter tube will be 20 seconds, since switch 11 connected in series with switch 15 is opened by its cam disc B only after a running time of 20 seconds of the motor 4, according to FIGURE 2. When the switch 11 is opened, relay 1 drops and breaks the current through motor 4, so that the cam discs are returned to their initial or home position by their return spring. In this manner there is obtained for each of the manually actuatable switches 15-18 a characteristic time interval determined only by the cam first actuating its respective switches 11-14, according to FIGURE 2. In addition to these initially operative cams, cam discs B-E have a number of other cams which are mutually coincident according to an addition system. Thus, the discs B and C have mutually coincident cams in a position corresponding to 1 minute, discs C and D have coincident cams at 2 minutes, and discs B, C and D at 2 minutes 20 seconds and so on, which means that coincident cams are provided for any time intervals which may be obtained by addition of the characteristic time intervals. With four manual switches (15-18) the number of time intervals will be fifteen, according to FIGURE 2, covering the range from 20 seconds to 5 minutes in 20 seconds' increments. This is obtained thereby, that two or more simultaneously closed switches 15-18 together with their respective series connected switches 11-14 form parallel current paths or branches for the coil of the relay 1, through which a current accordingly flows until all branches are coincidentally opened by the action of the cam discs B-E.

The switches 15-18 may each be actuated by means of individual push buttons which are preferably marked with the time interval characteristic for the respective push button and may have a colour which clearly differs from that of the other push buttons. The push buttons are mechanically interconnected in a manner known per se in

such a way that the depressing of one push button resets previously pressed buttons, and several push buttons may be set by simultaneous depressing. Switch 20 may be of the same type but returning immediately when released.

Other embodiments are also possible within the scope of the invention, which may be applied to other electrical apparatuses, e.g., apparatuses for diathermic treatment or photographic purposes. In apparatus requiring no initial operation corresponding to the above cathode heating, members 2 and A may be omitted contacts 201-203 being replaced by permanent connections corresponding to the operative positions of these contacts. This modification is illustrated in FIGURE 3.

What I claim is:

1. A time switch for temporarily connecting an electric apparatus to an electric current supply for a selectable time comprising:
 - a relay having first and second pairs of normally open relay contacts, said first pair of relay contacts being connected between said electric current supply and said electrical apparatus,
 - an energizing circuit for said relay including a first manually actuable switch for momentarily energizing said relay,
 - a holding circuit for said relay including the series combination of said second pair of normally open contacts and a plurality of mutually parallel switching circuits, each of said switching circuits comprising the series combination of a second manually actuable normally open switch and a normally closed mechanically operated switch,
 - a plurality of mechanical power driven means associated with respective ones of said mechanically operated switches, each of said mechanical power driven means being effective to momentarily open its associated mechanically operated switch at a first preselected time after the energization of said relay and at a plurality of subsequent times, said plurality of subsequent times being selected such that the closure of two or more of said manually operable switches

results in an energization time of said relay equal to the sum of said first preselected opening times of the mechanically operated switches associated with the closed manually operable switches, and

driving means for driving said plurality of mechanical power driven means, said driving means being energized in response to the energization of said relay.

2. A time switch according to claim 1 further comprising a second relay having third and fourth pairs of normally open contacts, an energizing circuit for said relay including a second mechanically operable switch, a further power driven mechanical means being driven by said drive means for closing said second mechanically operable switch after a predetermined time to permit the energization of said second relay, a holding circuit for said second relay including said third pair of normally open contacts, said fourth pair of normally open contacts being connected in said energizing circuit for said first relay and in series with said first manually operable switch.

3. A time switch according to claim 1 further comprising a third manually actuable switch for connecting said electric current supply to said charging circuit for said first relay.

4. The apparatus of claim 1 wherein said driving means comprises a synchronous motor for driving said mechanically driven means.

5. The apparatus of claim 4 wherein said motor is connected in parallel with the series combination of said mutually parallel switching circuits and said first relay.

6. The apparatus of claim 5 wherein each of said plurality of mechanical power driven means comprises a rotatable cam mounted on the shaft of said synchronous motor.

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