July 15, 1952 A. H. MIDGLEY 2,603,287

TIME SWITCH

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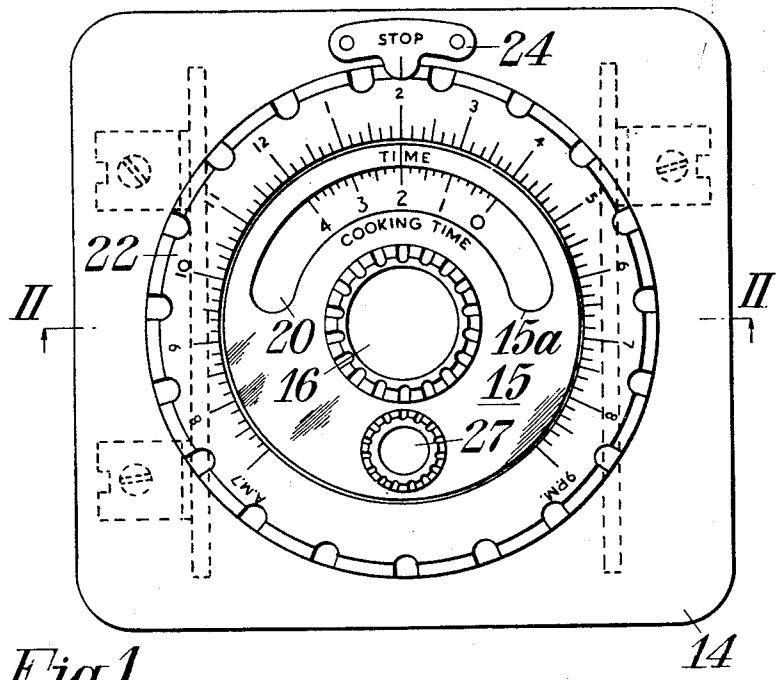


Fig. 1.

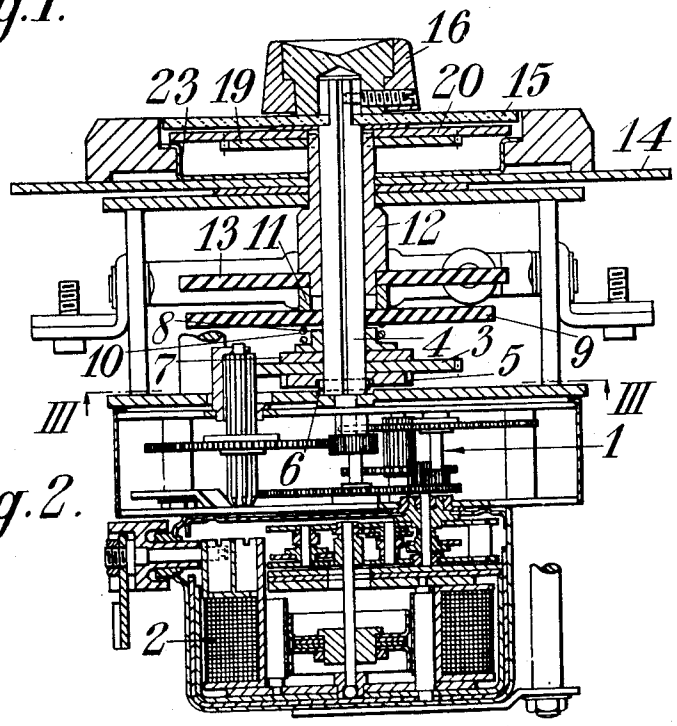


Fig. 2.

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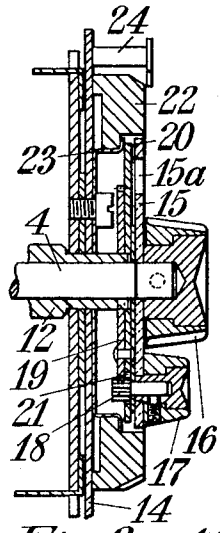


Fig. 2a

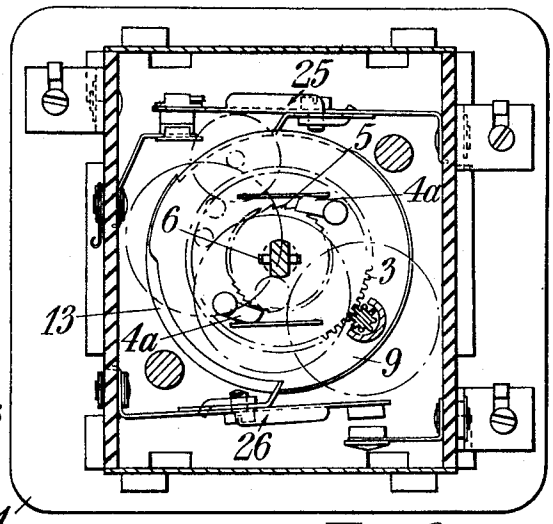


Fig. 3.



Fig. 6a.

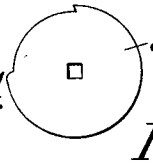


Fig. 4.

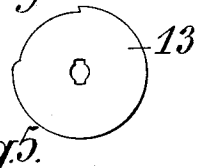


Fig. 5.



Fig. 6b.

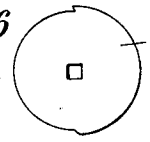


Fig. 7.

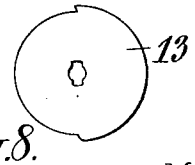


Fig. 8.

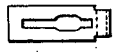


Fig. 6c.

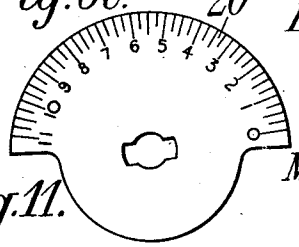


Fig. 11.

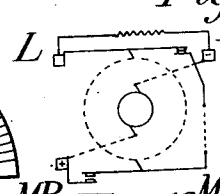


Fig. 12.

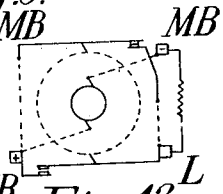


Fig. 13.

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Fig. 9.

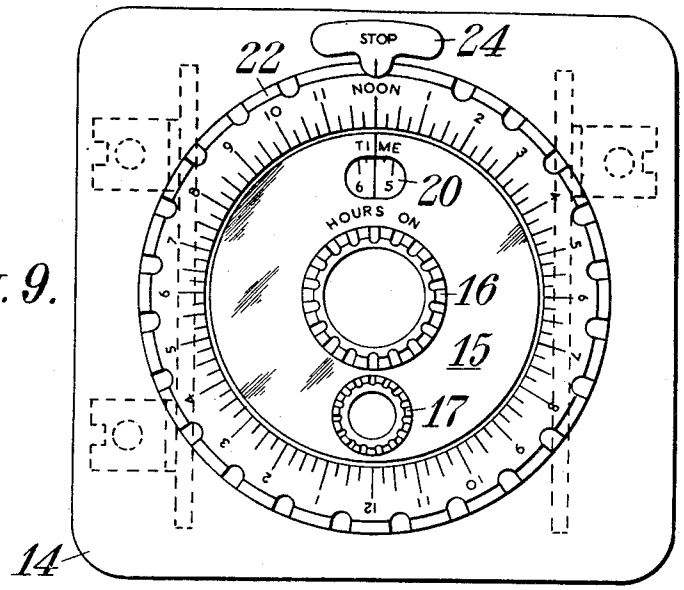
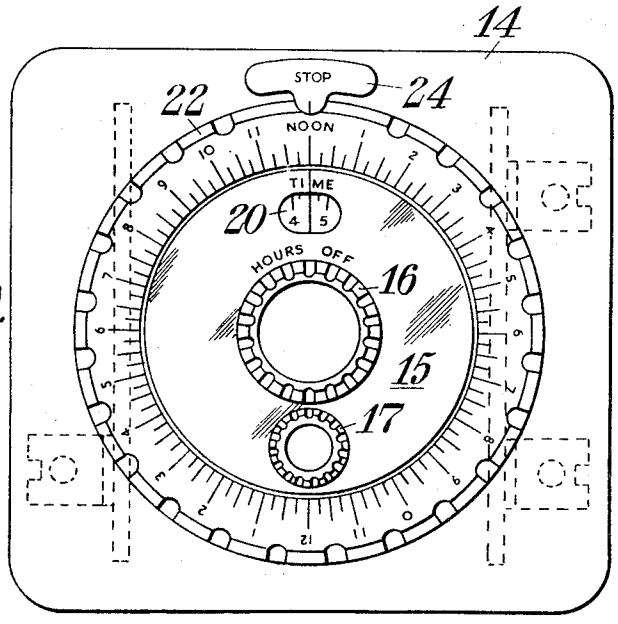


Fig. 10.



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Patented July 15, 1952 2,603,287

UNITED STATES PATENT OFFICE

2,603,287

TIME SWITCH

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Application April 7, 1950, Serial No. 154,499
In Great Britain April 8, 1949

8 Claims. (Cl. 161—1)

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This invention relates to time switches and more especially but not solely to time switches suitable for controlling the times of putting "on" and "off" an oven such as a cooking oven or the like.

The oven might be an electrically heated one in which case the time switch might have a clockwork mechanism turned by an electric motor and would operate electric switches at predetermined instants of time.

Alternatively a gas oven might be controlled by such a time switch in which case the time switch would control valve turning on and off operations. The clockwork mechanism might still be electrically driven or might be driven by a spring of the kind used in ordinary watches and clocks. The spring might be wound up by separate winding means or might be wound up automatically by the setting operations of the time switch. If necessary the clockwork mechanism might then be locked when the switching off operation occurred.

The time switch according to the invention is not limited in its application to cooking ovens but might be employed wherever any putting on and off operations are required to be performed at specified times or at specified time intervals, e. g. in street lighting systems.

The invention consists in a time switch having a clockwork mechanism adapted to drive a switch-operating member, for performing a switch operation, said switch-operating member having an associated pointer or indicator the position of which pointer will coincide with a second stationary pointer or indicator when the first pointer or indicator is in the position at which the switch operation occurs and a movable scale marked in time periods, such as hours of the day, and any appropriate subdivisions associated with the two pointers or indicators so that the time switch may be set by manually setting the scale to the position in which the stationary pointer or indicator indicates the time of the day at which the switch operation is to occur and manually setting the movable pointer or indicator to the position on the scale which indicates the time at which this manual operation is carried out.

A second switch operating member may be driven by the clockwork mechanism together with the first but is adapted to be displaced with respect to the first so that its switching operation occurs at a desired time interval in relation to the time at which the switching operation of the first switch operating member occurs, which time interval is indicated on a scale.

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The invention further consists of a time switch comprising a clockwork mechanism adapted to drive two moving switch-operating members respectively for performing "on" and "off" switch operations in which means are provided for manually rotating the two moving switch-operating members bodily together away from their operating positions in a setting operation so that the clockwork mechanism will return them to their operating positions only after the time interval required for the clockwork mechanism to rotate them back from their displaced position to their operating position, means being provided for displacing the "on" switch-operating member with respect to the "off" switch-operating member or vice versa so that in the restoring movement under the control of the clockwork mechanism the "on" switch will be operated before the "off" switch by a period determined by the amount by which the two switch-operating members have been mutually displaced.

The invention still further consists of a time switch comprising a fixed reference point, a scale, the scale graduations of which show time periods such as the hours of the day and any appropriate subdivisions thereof, the scale being rotatable so that any desired scale graduations may be set to coincide with the fixed reference point, a rotatable pointer or indicator, the movement of which is linked with the movement of a moving switch-operating member of a time switch and which may be set to any desired graduation on the scale, a second scale graduated to indicate time periods such as hours from zero to a selected value and any appropriate subdivision thereof and a pointer or indicator associated with said scale, the scale and pointer or indicator being mutually displaceable so as to indicate a time period, said second scale and pointer or indicator being carried round bodily by the rotatable pointer or indicator and being linked with a second moving switch-operating member so that relative movement of the second scale and its pointer or indicator will bring about relative movement of the second moving switch-operating member with respect to the first moving switch-operating member.

This invention yet further consists of a time switch comprising two switch-operating cams frictionally coupled so as to be mutually displaceable and adapted to be driven together by the clockwork mechanism of the time switch whereby one cam may be set or adjusted to perform a switching operation after the pre-adjusted time interval and the second cam may be adjusted in relation to the first cam to perform a second

switching operation at the pre-adjusted time interval in relation to the first switching operation.

Conveniently slipping means are provided so that the clockwork mechanism is not affected by the setting of the switch-operating member or cams.

The clockwork mechanism may be operated by an electric motor which is started by the setting operation and is stopped when the switch operations to be performed have been completed.

The invention will be further described with reference to an embodiment shown in the accompanying drawings.

Figure 1 is a front elevation of a time switch for a cooker.

Figure 2 is a section on the line II—II of Figure 1.

Figure 2*a* shows a detail of the dial in section.

Figure 3 is a section on the line III—III of Figure 2.

Figure 4 shows the cam **13** of Figure 2.

Figure 5 shows the cam **9** of Figure 2.

Figures 6*a*, 6*b* and 6*c* show a detail of the cam operated switch member.

Figures 7 and 8 respectively show modified forms of the cams **9** and **13** of Figure 2.

Figures 9 and 10 show face views of time switches suitable for street lighting systems, and

Figure 11 shows a modified form of the plate **20** of Figure 2 for use therewith.

Figures 12 and 13 show diagrammatic circuits for use with the time switches of Figures 9 and 10, respectively.

A clockwork mechanism **1** driven by an electric motor **2** drives a gear wheel **3** loosely mounted on a solid shaft **4**. On one side of the gear wheel is mounted a second smaller ratchet wheel **5** keyed to the shaft and in frictional contact with the first gear wheel, the shaft after passing through the second gear wheel having an end bearing in a supporting plate of the clockwork mechanism; the second gear wheel **5** engages with spring loaded pawls **4***a* on the first wheel **3** so as to allow of relative motion in one direction but not in the other and the second gear wheel is locked against axial movement in the direction away from the first gear wheel by means of a pin **6** through the shaft.

On the other side of the first gear wheel is a friction washer **7** keyed to the shaft, then there is a loose collar **8** around the shaft, and next a disc-shaped cam **9** of insulating material keyed to the shaft. Over the collar between the cam and friction washer is a coil spring **10**.

On the other side of the disc-shaped cam is a further collar **11** around the shaft and then a hollow shaft **12** around the first shaft.

To this hollow shaft is keyed a second disc-shaped cam **13** of insulating material.

The solid shaft and hollow shaft thereon extend further through a cover plate **14**. The solid shaft after passing through a bearing opening in a disc-shaped plate **15** terminates in a knurled knob **16**. The disc-shaped plate **15** which may be made of perspex painted at the back, carries a reference mark at one position around the circumference marked "Time" and radially inwards from this a second reference mark marked "cooking time" is formed along a transparent part-annular opening **15***a* in the disc-shaped plate.

Radially opposite to the "Time" mark a second smaller knurled knob **17** is mounted in a bearing opening in the disc-shaped plate **15** and at the other side of the plate carries a small pinion **18**.

The pinion engages with a gear wheel **19** keyed to the hollow shaft.

This gear wheel is riveted to a second disc-shaped plate **20** which lies up against the first so that the pinion engages the gear wheel through a part-annular slot **21** in the second plate **20** and in the part-annular slot in the first plate **15** there shows a circumferential scale on the plate **20** extending over about 125° and marked with four equal intervals from zero to four with each interval subdivided into six equal parts. This scale shows the cooking time.

On the cover plate concentric with the bearing aperture an annular scale **22** is rotatably mounted by means of a dished brass plate **23** screwed to the cover plate and engaging on an annular shoulder on the scale.

The scale is marked over about 270° with an hours scale reading from 7.0 a. m. to 9.0 p. m. with one sixth subdivisions.

At the top side of the cover plate is mounted a pointer **24** projecting over the annular scale and marked "stop."

At the top side of the time switch to engage with the cam **13** nearer the cover plate is mounted an "on" switch **25**. The cam is located and shaped so that when the "Time" pointer coincides with the "stop" mark and the "cooking time" is on zero the "on" switch is operated. When the cooking time is increased, then the "on" switch is operated by this period before the "time" pointer reaches the "stop" pointer.

At the bottom side of the switch to engage with the cam **9** which is further from the cover plate is mounted an "off" or "stop" switch **26**. The cam is so shaped that this switch is arranged to operate when the "Time" mark on plate **15** reaches the "stop" pointer.

In the operation of the switch the rotatable scale **22** is first set so that the "stop" pointer coincides with the time (final time) as marked on the scale at which the "off" switch **26** is to be operated. The cooking-time scale or disc-shaped plate **20** is then operated by means of the knob **17** to indicate the desired period between the "on" switch operation and the "off" switching operation. The disc-shaped plate **15** is then set by clockwise rotation of the knob **16** to the time as marked on the rotatable scale **22** at which these operations are being effected.

Mechanically during the second operation described the cam nearer the cover plate will be turned by the hollow shaft while the solid shaft will remain stationary. The turning will overcome the friction between the disc-shaped cam nearer the cover plate and the collar between it and the other disc-shaped cam.

Mechanically in the third operation described the solid shaft will be allowed to slide with respect to the first gear wheel which engages the clockwork mechanism with this shaft, due to the sliding of the second gear wheel and the friction washer as allowed by the pawl arrangement.

Both cams will be carried round in this movement.

By these setting operations the "on" switch will be moved by the cams to the "off" position and the "off" switch to the "on" position.

Once the setting operations have been made the clockwork mechanism will take up the drive over the frictional engagement between the first gear wheel and the second gear wheel and friction washer, due to the pressure of the coiled spring to the first cam, and over the pinion and gear wheel between the first and second disc-

shaped plates to the second cam. The "Time" pointer will move round and as it comes to the scale reading on the rotatable scale which corresponds to the final time less the cooking time, the "on" switch will be operated to its "on" position. When the "time" pointer comes to the scale reading corresponding to the final time, the "off" switch will be operated to its "off" position.

It will be understood that it could be arranged to make the "off" pointer an "on" pointer and set the rotatable scale to the reading at which the "on" switch is to be made. The "off" switch would then be broken at the time after this which corresponded to the "on" time plus the cooking time.

Figures 6*a*, 6*b* and 6*c* show a modified form for the switches **25** and **26** whereby a very accurate setting of the switching time may be effected.

The electrical circuit is arranged so that when the setting operations are performed the electrical motor is connected in by what has been described as the "off switch." This switch is connected in series with the cooker switch or "on" switch so that the latter may switch on the cooker at the appropriate time. Then both the cooker and electric motor are switched off when the "off" switch breaks its contact at the final time.

Thus the sequence is:

(*a*) In the setting operation effected by turning the knob **16** after setting the knob **17** the sequence is—

(1) Gradual break of cooker or load switch;
(2) Gradual make of electric motor switch;

(*b*) In the running down operation—

(3) Snap make of make cooker or load switch;
(4) Snap break of break electric motor switch.

The use of the switch according to the invention may be extended for example for use in connection with street lighting systems where lights have to be switched on for a given period.

With such systems an electric motor driving the switch will be set to run continuously so that the two switch operating members or cams may be used to extend the switched on time considerably beyond the cooking time allowed for by the domestic time switch.

It is found to be a relatively simple matter to use the same cam system to cover any period of switched on time of an electric load circuit required with two alternative sets of connections one for periods less than 12 hours and the other for periods greater than 12 hours which for convenience will be described in round figures as the "0 to 11 hours, on" and "0 to 11 hours, off" connections.

The cams corresponding to cams **9** and **13** are shown respectively in Figures 7 and 8 the mechanism being otherwise as in the preceding description of the domestic time switch.

The contacts of the switches **25** and **26** are arranged for connection in series with the load circuit and with each other for the "0 to 11 nours, on" time switch so that the switch **25** acts to close the load circuit and the switch **26** to open it. Figures 12 and 13 show diagrammatically the circuited arrangement MR and MB being the terminals to which the mains are connected and L representing the terminal to which one terminal of the load is connected, the other terminal of the load being connected to the appropriate mains terminal.

If the contacts of the switches **25** and **26** are now arranged for connection in series with the load circuit but in parallel with each other as shown in Figure 13 then the arrangement functions to provide "0 to 11 hours, off" connections since both switches must be in the "off" position to disconnect the load circuit.

Figures 9 and 10 respectively show face views of the "0 to 11 hours, on" and "0 to 11 hours, off" time switches.

A common plate is used corresponding to the plate **20** and shown in Figure 11 to convert the "0 to 11 hours, on" type of time switch to the "0 to 11 hours, off" type it is only necessary to remove this plate and re-apply it in the reverse position after turning the cam **13** through 180°.

A new marking plate corresponding to plate **15** of the domestic time switch and applied rotated through 180° with respect to the position of the old one would of course be necessary with the words "hours on" replaced by "hours off."

The reverse conversion would be performed in a corresponding manner.

Various other modifications could be made within the scope of the invention. Thus more than two cams might be used if an additional switch operation had to be performed.

Furthermore it will be understood that the arrangements described in connection with street lighting systems as suitable for controlling an electric load circuit could be modified so that instead of opening or closing electric contacts valves in a gas supply for example could be opened and closed.

I claim:

1. A time switch comprising a clockwork mechanism, two moving switch-operating members for performing switch operations, and driven by the clockwork mechanism, the two moving switch-operating members being bodily rotatable together away from their operating positions in a setting operation so that the clockwork mechanism will return them to their operating positions only after the time interval required for the clockwork mechanism to rotate them back from their displaced position to their operating position, and means for displacing one switch-operating member with respect to the other so that in the restoring movement under the control of the clockwork mechanism the one switch will carry out its switch operation before the other switch carries out its switch operation by a period determined by the amount by which the two switch-operating members have been mutually displaced.

2. A time switch comprising a fixed reference point, a scale, the scale graduations of which show time periods such as the hours of the day and any appropriate subdivisions thereof, the scale being rotatable so that any desired scale graduation may be set to coincide with the fixed reference point, a rotatable pointer or indicator which may be set to any desired graduation on the scale, a moving switch-operating member, the movement of which is linked with the movement of the rotatable pointer or indicator, a second scale graduated to indicate time periods such as hours from zero to a selected value and any appropriate subdivision thereof, a pointer or indicator associated with said second scale, the second scale and pointer or indicator

being mutually displaceable so as to indicate a time period, said second scale and pointer or indicator being carried round bodily by the rotatable pointer or indicator, and a second moving switch-operating member linked with said second scale and pointer so that relative movement of the second scale and its pointer or indicator will bring about relative movement of the second moving switch-operating member with respect to the first moving switch-operating member.

3. A time switch as claimed in claim 2, in which the switch-operating members comprise two switch-operating cams frictionally coupled so as to be mutually displaceable and adapted to be driven together by the clockwork mechanism of the time switch whereby one cam may be set or adjusted to perform a switching operation after the pre-adjusted time interval and the second cam may be adjusted in relation to the first cam to perform a second switching operation at the pre-adjusted time interval in relation to the first switching operation.

4. A time switch as claimed in claim 3, in which slipping means are provided so that the clockwork mechanism is not affected by the setting of the switch-operating members or cams.

5. A time switch as claimed in claim 4 in which the switch-operating members or cams control the opening and closing of contacts in an electric load circuit.

6. A time switch as claimed in claim 5, in

which the clockwork mechanism is operated by an electric motor which is started by the setting operation and is stopped when the switch operations to be performed have been completed.

7. A time switch as claimed in claim 5, suitable for connecting the load circuit for periods less than 12 hours in which the contacts of the respective switch-operating members are arranged for connection in series with the load and with each other.

8. A time switch as claimed in claim 5, suitable for connecting a load circuit for periods greater than 12 hours in which the contacts of the respective switch-operating members are arranged for connection in series with the load circuit but in parallel with each other.

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