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C. I. HALL

1,495,020

TIME SWITCH

Filed July 16, 1920

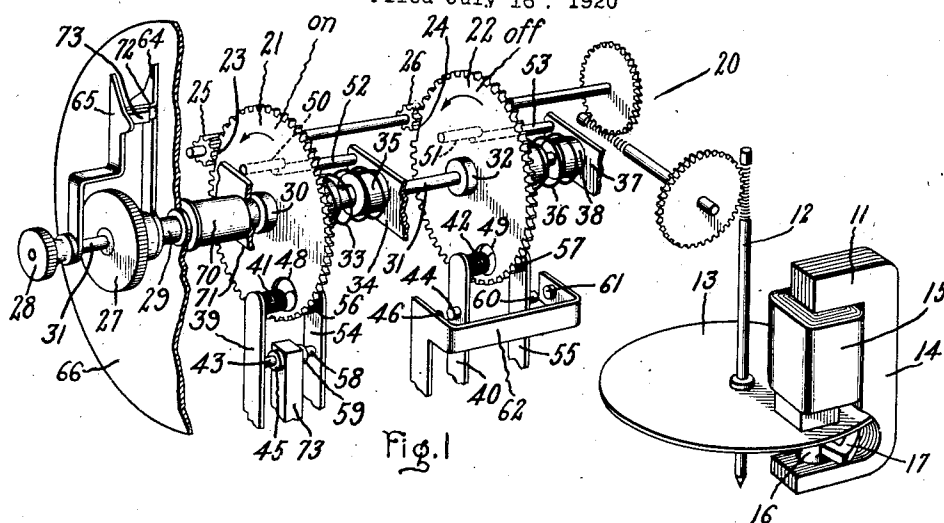


Fig. 1

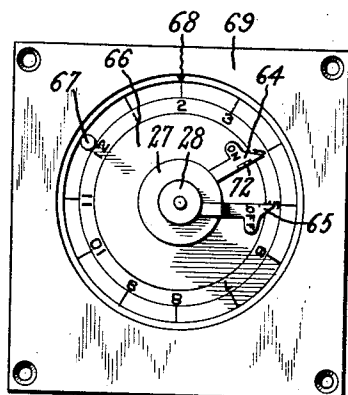


Fig. 2

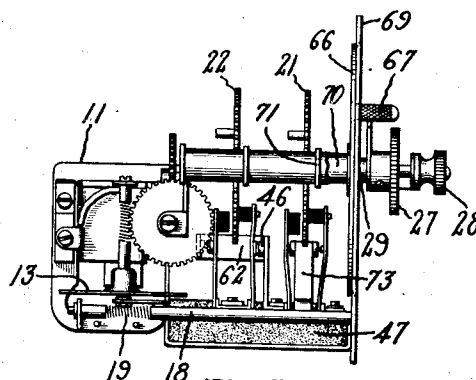


Fig. 3

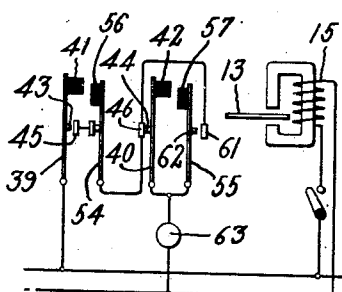


Fig. 4

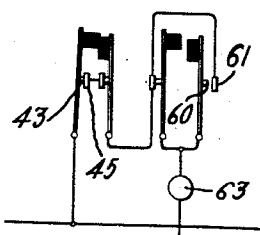


Fig. 5

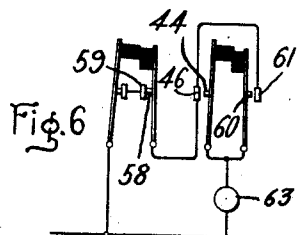


Fig. 6

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UNITED STATES PATENT OFFICE.

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TIME SWITCH.

Application filed July 16, 1920. Serial No. 396,749.

To all whom it may concern:

Be it known that I, CHESTER I. HALL, a citizen of the United States, residing at Fort Wayne, in the county of Allen, State of Indiana, have invented certain new and useful Improvements in Time Switches, of which the following is a specification.

This invention relates to time switches, and more particularly to time switches used in connection with electric ranges.

With the development of electrical household cooking devices, it becomes possible to take full advantage of using electricity for their operation. Thus, there may be provided devices for automatically turning on the current and turning it off again at certain predetermined times. In this way the person who operates these devices may set the switch so that it will properly perform the above stated function and no further attention need be paid to its operation; and in fact it is possible to leave the house with the assurance that the cooking devices will be supplied with the proper amount of electrical energy. It is essential in order that such time switches be practicable, to make their construction as simple as possible, so that the housewife may readily operate them.

Thus, the main object of my invention is to provide a device fulfilling these requirements. One complication in the construction of these switches is due to the setting function, for determining the time of operation of the contacts. This is usually due to the fact that it is hard to compensate for the time when the setting is made, unless the constant speed device or electric motor is operated continuously. Such operation would cause an unnecessary waste of current. By the aid of my invention it is not necessary to operate the constant speed device continuously; it is merely necessary to turn the switch on for operating the motor at the time the setting is made, and by a proper manipulation it is possible to compensate for the time when this is done. Another object of my invention is to provide an extremely compact device that may be readily incorporated in an electric cooking range. Another object of my invention is the provision of improved means for operating the contacts at the predetermined

time. Other objects and advantages of my invention will become apparent as the description proceeds.

The construction and mode of operation of my invention may be understood from the following description taken in connection with the accompanying drawing, in which Fig. 1 is a distorted perspective view of the time switch showing how the contacts are operated; Fig. 2 is a front view of the dial, showing the manner in which the switch is set; Fig. 3 is a side view of the device, showing generally the actual relation of the parts in a physical embodiment, and Figs. 4, 5 and 6 are wiring diagrams showing the relation of the contacts at various steps of the operation of the time switch.

Referring now more in detail to the drawings in which like reference characters refer to like parts throughout, I provide means for rotating a shaft at constant speed, such as the small electric motor 11. This motor is of the Arago disc type and arranged so that the spindle 12 upon which is mounted the rotating metal disc 13, is rotated at constant speed. This disc 13 is rotated due to the influence of the field of an alternating current magnet 14 which is excited by coil 15 connected to any appropriate source. The motor that I have illustrated is simply one convenient means for obtaining a constant speed of rotation and does not in itself form the subject matter of my present invention. It is merely necessary to add that it is possible to regulate the speed of rotation by revolving the pole piece 16 carrying the shading coil 17 by means of a shaft 18 having a worm 19 cut therein, engaging a worm gear segment not shown on the drawing, and secured to the pole piece 16. By appropriate reduction gearing designated in general by the numeral 20, a constant relatively low speed of rotation is imparted to a pair of gear wheels 21 and 22.

These gear wheels are so arranged that they may be independently set for determining the duration of their rotation. At the instant that these gear wheels stop they are so arranged that certain contacts are made or broken. Gear 21 may be designated the "on" gear, while gear 22 may be designated the "off" gear. To bring these gears to a stop they are provided

with a small mutilated portion as shown at 23 and 24. Thus, when they are rotated sufficiently these mutilated portions come opposite the driving pinions 25 and 26 and the gear wheels being out of engagement with these pinions can no longer be rotated. The direction of rotation of the gear wheels 21 and 22 is counterclockwise as indicated by the arrows thereon. The gear reduction is such that it would take exactly twelve hours for gears 21 and 22 to make one complete revolution. For what portion of the twelve hours these gear wheels rotate is determined by their initial setting. For setting these gear wheels I provide means for moving them independently of each other in an axial direction so as to be entirely free from the driving pinions 25 and 26. After they are moved into this position they may be rotated manually by the proper amount and then allowed to come back axially in the reverse direction to mesh with the driving pinions. For performing these functions I provide a knurled button 27 for the "on" gear 21 and a relatively smaller concentrically arranged button 28 for the "off" gear 22. The knurled button 27 is carried on a sleeve 29 to which is also rigidly attached the hub 30 of the "on" gear 21. The sleeve 29 is adapted to slide on the shaft 31 to which is rigidly attached the hub 32 of the "off" gear 22. This shaft 31 carries the knurled button 28 referred to, which is made use of for performing the setting operation of the "off" gear 22. It is evident that upon a rearward axial movement of the knurled button 27 the gear 21 may be disengaged from its driving pinion 25 and then manually rotated independently of said pinion or of the "off" gear 22. For facilitating the reverse axial movement I provide a helical compression spring 33, seated on a stationary strap 34 and guided over a bushing 35 rigidly attached to said strap 34. The "off" gear is set in a similar fashion by manipulation of the knurled button 28. The compression spring 36, stationary strap 37 and bushing 38 are provided for urging the "off" gear 22 back to its original position after it has been rotated the proper amount by means of the knurled button 28. Now if, the gear wheel 21 be turned in a clockwise direction manually while disengaged from its pinion to such an extent that the mutilated portion 23 is say $\frac{1}{2}$ th of a revolution away from the driving pinion 25, said gear wheel will rotate for one hour before coming to rest. In the same way the gear wheel 21 may be set to rotate for longer periods up to twelve hours. Exactly the same remarks apply to the mechanism of the "off" gear 22.

I provide appropriate means for performing switching operations when the gear

wheels 21 and 22 stop. For this purpose I arrange flexible members or flat springs 39 and 40 carrying projections 41 and 42 made of insulating material which engage the faces of the gear wheels 21 and 22. The faces of the gear wheels flex these members 39 and 40 from their free positions. These flexible members 39 and 40 carry contacts 43 and 44 respectively. If these flexible members be allowed to return to their free or unflexed positions contacts 43 and 44 are moved according to the movements of these members. Cooperating with these movable contacts 43 and 44 are stationary contacts 45 and 46 respectively. The contact 45 is appropriately mounted on a post 73 made of conducting material. This post is appropriately held on an insulation support 47. The contact 46 is similarly mounted on a stationary member 62 also held on said insulation support. The gear wheels 21 and 22 are so formed that they allow the flexible members 39 and 40 to return to their free positions when these gear wheels stop. For performing this function, I show, for example, apertures 48 and 49 located in the gear wheels 21 and 22 respectively. The insulation projections 41 and 42 are placed in the path of movement of said apertures 48 and 49. The location of these apertures 48 and 49 is such that when the mutilated portions 23 and 24 are opposite the driving pinions 25 and 26, these apertures are in just the right position to admit the entrance of the projections 41 and 42 and thereby to permit the return of the flexible members 39 and 40 to their unflexed or free positions. In the case of the "on" gear 21 the movement of the flexible member 39 carries the movable contact 43 toward the stationary contact 45 and the circuit is thus made. In the case of the "off" gear 22 the movement of the flexible member 40 serves to carry the movable contact 44 away from the stationary contact 46 and the circuit is broken. These contacts may directly control the load circuit or they may be appropriately used to relay the closure of the main circuit in case their current carrying capacity is not sufficient to take care of the load. The projections 41 and 42 when they enter the apertures 48 and 49 respectively, stop the rotation of the gears 21 and 22. There may also be provided, however, stop pieces 50 and 51 on gear wheels 21 and 22 respectively cooperating with the stationary stops 52 and 53.

When the knurled buttons 27 and 28 are pushed back to disengage the gear wheels 21 and 22 from the driving pinions 25 and 26, the resulting axial movement of the gears 21 and 22 result in the unflexing of the flexible members 39 and 40. This would ordinarily result in altering momentarily the operating conditions of the controlled circuit. Thus,

when the gear wheel 21 is pushed rearward by means of the knurled button 27, the flexible member 39 carrying the contact 43 moves towards the stationary contact 45 and circuit is made therebetween while the setting operation is performed. In many cases this feature would be objectionable, and to correct this effect I provide auxiliary contacts arranged similarly to the main contacts but so located that they perform a reverse function upon the rearward axial movement of the gear wheels 21 and 22. While these gear wheels rotate, the auxiliary flexible members 54 and 55 remain in their free position. At the upper end of these flexible members or springs there are carried projections 56 and 57 of insulating material but located out of the path of movement of the apertures 48 and 49 so that these projections can never enter the apertures and prevent the setting of the gear wheels 21 and 22. The flexible member 54 carries the movable contact 58 cooperating with the stationary contact 59, located on the post of contacting material 73. In the same way the flexible member 55 carries the relatively movable contact 60, adapted to cooperate with the stationary contact 61, carried by the U-shaped stationary member 62. The contacts 58 and 59 are so arranged that they open the circuit when the gear wheel 21 is pushed axially rearward, while contacts 60 and 61 are arranged to make contact upon the rearward movement of the gear wheel 22. Thus at the setting of the "on" gear 21 the circuit cannot be closed even momentarily, due to the movement together of the contacts 43 and 45, since the circuit is opened at contacts 58 and 59. Similarly, while the "off" gear 22 is being set there is no interruption in the circuit due to the axial movement since as the contacts 44 and 46 separate, the contacts 60 and 61 come together and keep the circuit closed until the gear wheel 22 returns to its original position.

The operation of the device may be made clearer from the wiring diagrams shown in Figs. 4, 5 and 6. In Fig. 4 the diagrammatic representation of the contacts show the relative positions after the switches are set and the gears 21 and 22 are in motion. Fig. 5 shows the state of affairs when the "on" gear wheel 21 has stopped rotating and contacts 43 and 45 moved together. Fig. 6 shows the circuit conditions after the "off" gear has also been brought to rest and shows the contacts 44 and 46 separated so as to open the circuit. The load is diagrammatically illustrated at 63. This load may comprise a relay as stated, or the useful load on the system. It is also evident that both the "on" and the "off" switches need not be used but that by appropriate variation in the wiring it is possible to set the time when the circuit will be closed and remain closed

indefinitely or to set the time when the circuit will be open and will remain open indefinitely.

To indicate to the operator just how much to rotate the gears 21 and 22 to perform their functions at the predetermined times, I provide pointer 64 rigidly fastened to the sleeve 29 and pointer 65 rigidly fastened to the shaft 31. The pointer 64 is marked with the word "on" while the pointer 65 is marked with the word "off," as clearly shown in Fig. 2. These pointers cooperate with a clock dial 66. The pointers and the clock dial are all concentric as in an ordinary time piece. It is evident, however, that if the dial 66 be stationary, the indications made by the pointers 64 and 65 would merely show how long a time it will take for the mutilated portions 23 and 24 to come opposite the driving pinions 25 and 26. In order that these pointers may be made to cooperate properly with the clock dial 66 so that they may be placed at the hour at which these switching operations are to be performed, some means must be provided for compensating for the time at which the setting is made. I do this by making the clock dial 66 rotatable with respect to a stationary pointer 68 marked on the front support 69. The clock dial 66 may be made to engage frictionally a stationary portion of the mechanism. In this case I have shown bushing 70 supported from the stationary spacer 71 for serving as a frictional engagement for the dial plate 66, and also as a bearing support for sleeve 29. To understand how the indicators work, assume that the time the setting is made is 2 o'clock and "on" switch is to operate at 4 and the "off" switch at 5, the setting would be as indicated in Fig. 2, that is, the dial 66 would be rotated until the numeral 2 representing the time of the setting comes opposite the stationary pointer 68. Then both the "off" gear and the "on" gear are set as explained heretofore, so that the "off" and the "on" pointers point respectively to numeral 5, numeral 4. It is evident that what is really done is to set the clock dial so that the time is actually read rather than the period it would take to cause the gears 21 and 22 to be stopped. The distance away that the "off" pointer is from the stationary pointer 68 shows how long it must rotate before it comes to rest, in this case three hours or $\frac{3}{4}$ th of a revolution of the "off" gear while the distance that the "on" pointer is from the stationary pointer 68 shows how long it will take before the "on" gear will stop rotating in this case two hours or $\frac{2}{3}$ th of a revolution. For moving the clock dial plate 66 I provide a small handle 67 rigidly attached to the dial plate 66, as shown in Figs. 2 and 3. The pointers 64 and 65 furthermore carry small projections 72 and 73

adapted to coact with each other. These stops make it necessary that the "off" gear 22 will rotate for at least as long a period as the "on" gear 21. In other words, it is impossible to carry the "off" pointer to the other side of the "on" pointer except by rotation in a clockwise direction. Thus the mixing up of the sequence of operations is prevented.

While I have shown in the accompanying drawings the preferred embodiment of my invention, I do not wish to be limited thereto, but I aim in the appended claims to embrace all modifications falling fairly within the scope of my invention.

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

1. In a time switch, in combination, a pinion driven at constant speed, a gear wheel driven by said pinion and having a mutilated portion whereby rotation of said gear wheel is stopped when it is rotated sufficiently to bring the mutilated portion opposite said pinion, a stationary contact, a flexible member and a cooperating contact carried thereby, said flexible member being so arranged that it is flexed from its free position only while the gear is rotated, whereby a switching function may be performed when the gear wheel is stopped.

2. In a time switch, in combination, a member rotated at constant speed, a stop therefor, means for determining the amount of rotation of said member prior to the operation of said stop, a stationary contact, a flexible member having flexed and free positions and a contact carried by said flexible member contacting with said stationary contact in one of said positions only, said flexible member being so arranged that it is flexed only when the rotatable member is in motion.

3. In a time switch, in combination, a pinion, a constant speed motor driving said pinion, a gear wheel driven by said pinion and having a mutilated portion whereby rotation of said gear is stopped when the mutilated portion comes opposite said pinion, a stationary contact, a flexible member having a projection, and a contact adapted to cooperate with the stationary contact carried by the flexible member, said flexible member being so arranged that it is flexed by the gear wheel while said gear wheel is rotated, and allowed to assume its free position when the gear wheel has stopped, due to the entrance of the projection carried by the flexible member into an aperture appropriately located in said gear wheel.

4. In a time switch, in combination, a pair of mutilated gear wheels, pinions rotated at a constant uniform speed adapted to mesh with said wheels, means for independently setting said gears for determining the amount of their rotation before the mutilat-

ed portions come opposite the pinions, and contacts operated by said mutilated gear wheels.

5. In a time switch, in combination, a pair of mutilated gear wheels, pinions rotated at a constant uniform speed adapted to mesh with said wheels, contacts operated by said gear wheels, and means for independently setting said gears comprising means for disengaging each gear wheel from its cooperating pinion, and for revolving it, and means for causing the reengagement of the wheel and pinion.

6. In a time switch, in combination, a pair of stationary contacts, a pair of movable contacts adapted to cooperate with said stationary contacts, a gear wheel rotated at a uniform rate, means for disengaging and reengaging said gear wheel from its drive by backward and forward movements parallel to its axis of rotation for determining the duration of its rotation, the backward movement causing the opening of one pair of contacts and the closing of the other pair, and the forward movement causing the reverse operation, whereby the conditions of the controlled circuit are undisturbed during the setting operation, and means whereby the gear wheel operates one of said movable contacts at the termination of its movement.

7. In a time switch, in combination, a wheel, means for rotating said wheel at constant speed, a pair of flexible members, a contact supported on each of said members, a pair of stationary contacts cooperating with the flexibly supported contacts, and means for determining the duration of the wheel's rotation comprising means for sliding said wheel along its axis, thus disengaging it from the rotating means, and means for returning it to its original position, and for manually rotating it while it is disengaged, the pair of flexible members being arranged one on each side of said wheel so that upon the first axial movement thereof, one of said flexible members is permitted to assume its free position while the other is biased therefrom, and upon the return axial movement the original positions of said members are resumed, whereby during the setting operation the controlled circuit conditions are unaltered, said wheel being so constructed that at the end of its movement the flexed flexible member is allowed to assume its free position and thus to perform a switching function.

8. In a time switch, in combination, a wheel, means for rotating said wheel at constant speed, a flexible member urged from its free position while said wheel is rotating, a contact supported by said flexible member, a stationary contact adapted to cooperate therewith, means for determining the duration of rotation of the wheel, said means upon its operation causing said mem-

ber to assume first its free position and then its flexed position, and means for causing the conditions of the controlled circuit to remain unaltered while the setting operation is performed.

9. In a time switch, in combination, means for setting said time switch to determine the time when said switch shall perform one operation, means for setting said time switch to determine the time when said switch shall perform the reverse operation, an indicator carried by each of said means and operated

thereby, the two indicators being pivoted about the same center, means for preventing the rotation of said indicators past each other, a clock dial plate also concentric with said center, said dial plate being adjustably movable about its center, and a stationary pointer cooperating with said dial plate, whereby the time when the setting is made may be compensated for.

In witness whereof, I have hereunto set my hand this 12 day of July, 1920.

CHESTER I. HALL.