Aug. 11, 1959 C. G. MONTGOMERY 2,898,992

TIME CONTROL MECHANISM

Filed June 1, 1953 2 Sheets-Sheet 1

Fig. 1.

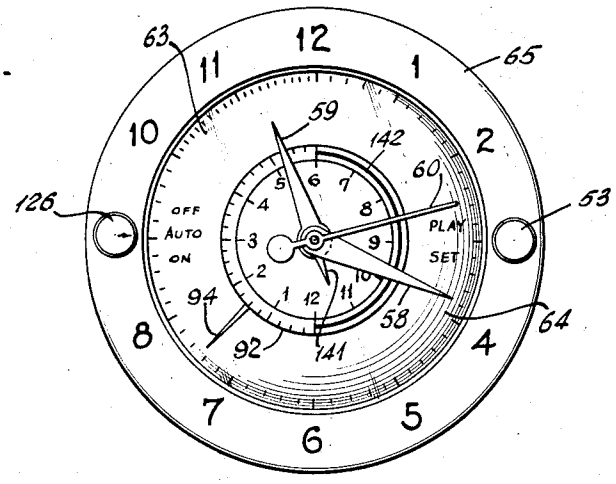


Fig. 2.

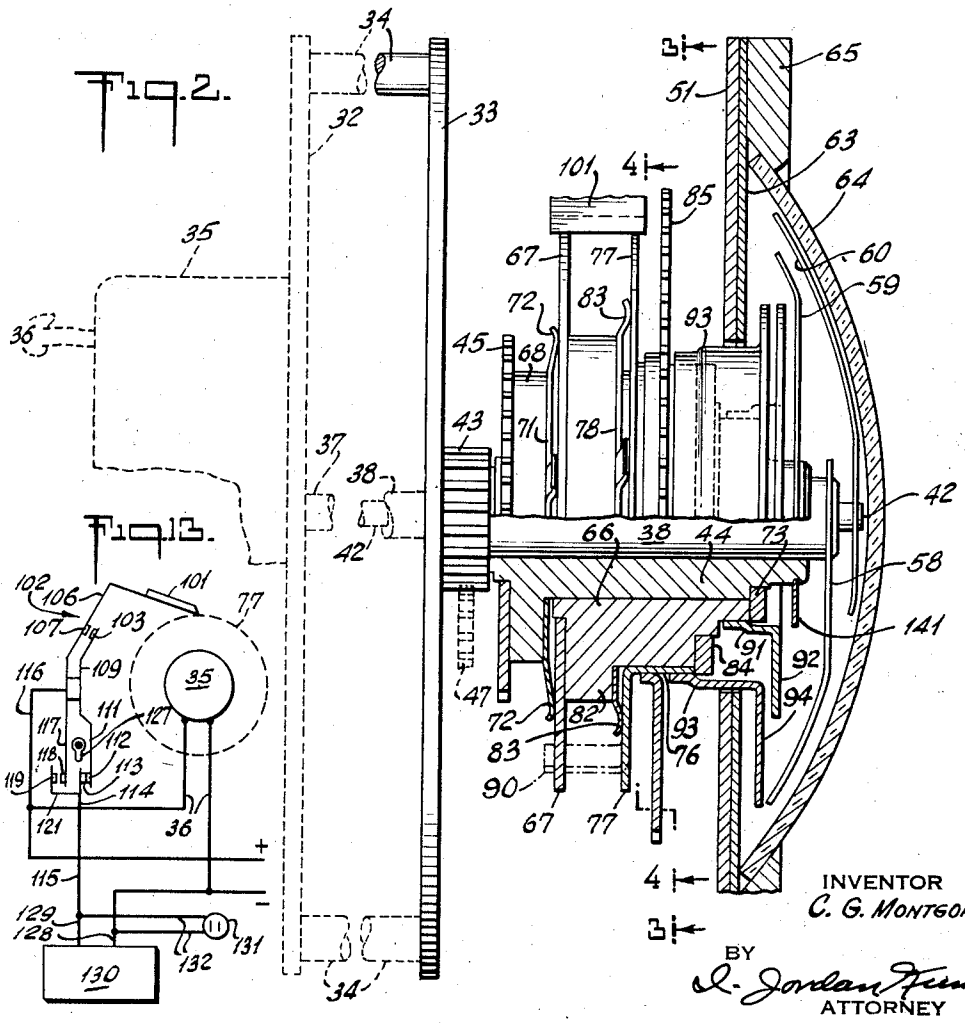


Fig. 3.

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TIME CONTROL MECHANISM

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Fig. 3.

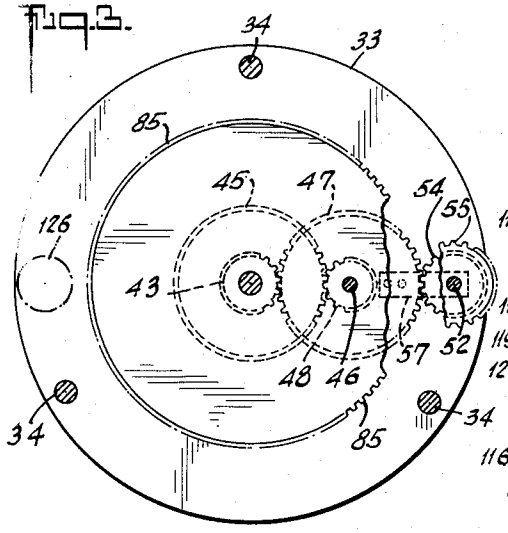


Fig. 4.

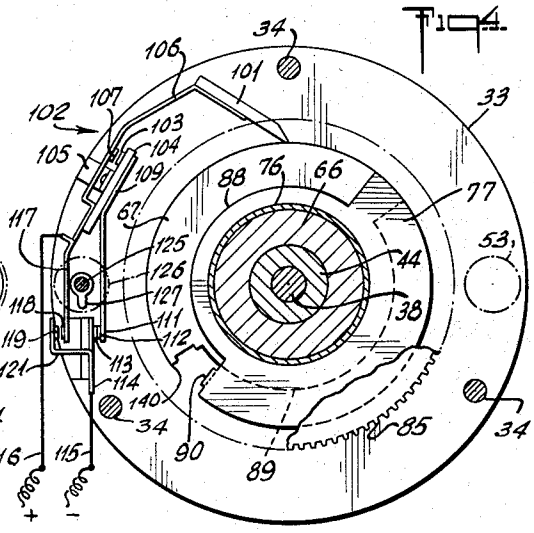


Fig. 5.

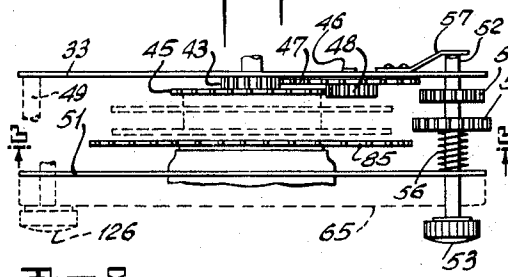


Fig. 6.

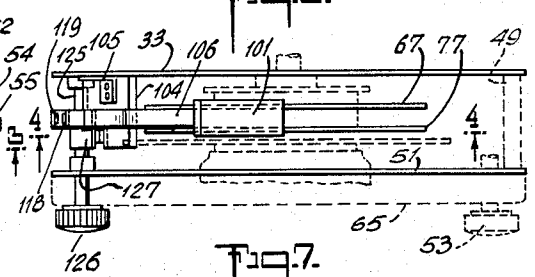


Fig. 8.

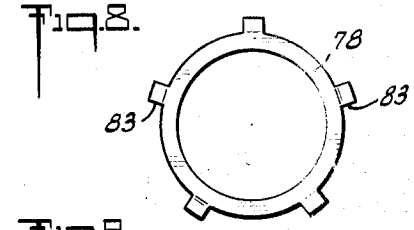


Fig. 7.

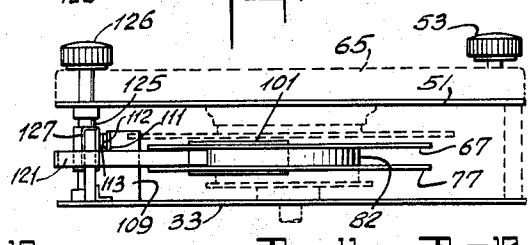


Fig. 9.

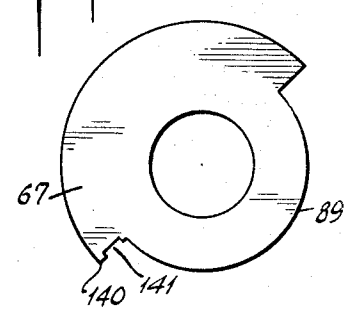


Fig. 10.

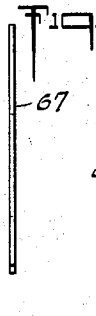


Fig. 11.

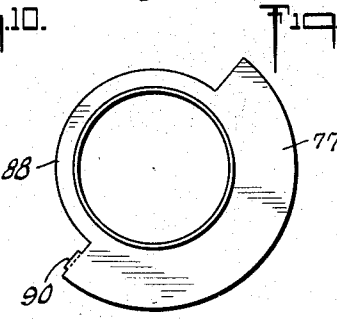
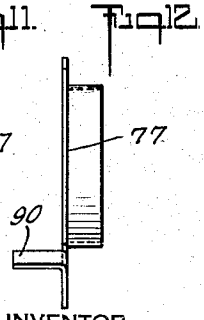


Fig. 12.



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2,898,992

TIME CONTROL MECHANISM

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Application June 1, 1953, Serial No. 358,911

8 Claims. (Cl. 161—1)

This invention relates to time control devices and more particularly to a time control mechanism for operating various electrical appliances on a time interval basis.

The present invention comprises a time control device which is adapted for mounting on synchronous motor or spring wound clock movements to operate electrical appliances on a selectable and controlled time interval basis. Where it is desired to operated a radio or television set, an electric oven, an egg boiler, and air conditioning unit, or the like, on an adjustable time interval basis, with a comparatively high degree of precision, the present invention provides such a mechanism which is economical to manufacture and assemble and which is simple to operate.

A salient feature of the present invention is the mounting of switch operating cams upon the spindle of the clock movement by means of a novel clutching arrangement which obviates the heretofore utilized gear or pawl connections between the clock and the switch operating mechanisms, thereby preventing damage to the clock works upon improper handling of the device.

The present invention also provides for a single knob control both for setting the hands of the clock proper and for setting up the time interval during which the appliance will be on or off.

Provision is also made for a single knob switching mechanism for establishing either automatic control by the device, or eliminating automatic control to permit manual control of the appliance, as well as alternatively to disconnect the appliance altogether.

The novel structural arrangement of parts herein provides an instrument having only two knob controls which in previous devices required three or four knobs for performing all the required functions.

Still other features and advantages of my invention will be apparent from the specification.

The features of novelty which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its fundamental principles and as to its particular embodiments, will best be understood by reference to the specification and the accompanying drawings, in which:

Figure 1 is a front elevation of the time control device showing the clock face and indicating elements;

Fig. 2 is a greatly enlarged central cross section of the device shown in Fig. 1, some parts being in elevation, some other parts being in phantom outline, and still other parts being omitted;

Fig. 3 is a front view, partly in phantom outline, taken on line 3—3 of Fig. 2, some parts being omitted, and other parts being broken away, but with the addition of several time and interval setting elements;

Fig. 4 is a front view taken on line 4—4 of Fig. 2, with the additional showing of the switch mechanism for selectively setting automatic, manual or off operation of the device, various parts being either in cross section, omitted, or in phantom outline;

Fig. 5 is a top view, partly in phantom outline showing the time and interval setting mechanism shown in Fig. 3, some parts being omitted;

Fig. 6 is a top view of the mechanism shown in Fig. 4, partly in phantom outline, and some parts being omitted;

Fig. 7 is a bottom view of Fig. 4, partly in phantom outline, and some parts being omitted;

Fig. 8 is a plan view of a spider spring clutch such as utilized in the mechanism shown in Fig. 2;

Fig. 9 is a plan view of one of the timing cams;

Fig. 10 is an edge view of the cam shown in Fig. 9;

Fig. 11 is a plan view of the second timing cam;

Fig. 12 is an edge view of the cam shown in Fig. 11; and

Fig. 13 is a schematic electric circuit diagram of the device described herein.

Referring now to the drawings in detail, and particularly to Fig. 2, there is shown a pair of mounting plates 32 and 33 connected and spaced apart by suitable posts 34. Mounted upon the rear of plate 32 is an electric synchronous motor 35 such as utilized for operating the conventional electric clock and having a pair of leads 36 for connecting said motor to a suitable source of power. It is understood that other types of electrical or mechanical time drive mechanisms may be subbstituted for motor 35. Rotated by motor 35 is a shaft 37 which operates through any one of a number of suitable gear trains that are well known in the art and which is omitted from the drawing, to rotate shaft of spindle 38 which constitutes the minute shaft of the clock making a 360° rotation once every hour. Spindle 38 extends forward through plate 33 in front of which its diameter is enlarged.

Operating coaxially within the hollow center of spindle 38 is a second hand shaft 42 which is suitably geared to motor 35 between plates 32 and 33, and whose rotation is properly synchronized with the rotation of spindle 38. Shaft 42 is optional, however, and is not essential in the operation of the device described herein.

Adjacent the front face of plate 33 is a gear 43 fast on spindle 38. Mounted coaxially with and rotatably around spindle 38 is shaft or spindle 44, to the rear end of which is mounted gear 45 (see also Fig. 5). Gears 43 and 45 are operatively connected to each other through a gear train comprising a shaft 46 rotatably mounted in plate 33, and bearing a pair of gears 47 and 48 which rotate together. Gear 47 meshes with gear 43 and gear 48 meshes with gear 45.

Mounted to the front side of plate 33 by means of bolts 49 is a front panel 51. (See Fig. 5.) A rotatable control shaft 52 is mounted between and extends through plate 33 and panel 51. Shaft 52 is also capable of longitudinal movement in plate 33 and panel 51. Control knob 53 is mounted on shaft 52 for manual rotation and longitudinal movement of said shaft. Mounted fast on and rotated by shaft 52 is gear 54 adapted to mesh with gear 47 upon appropriate longitudinal movement of shaft 52, thereby serving as a manual time set adjustment device whereby the rotation of said knob causes the rotation of gear 54, which in turn rotates gears 47 and 48 to set the relative positions of spindle 38 and 44 by means of gears 43 and 45.

It is understood that the rotation of spindles 38, 42 and 44 for normal clock timing purposes is derived through suitable well known gearing means, not shown, positioned between plates 32 and 33, and the relative dimensions of gears 43, 45, 47 and 48 are selected to provide a rotational ratio of 12:1 between spindles 38 and 44 for conventional time indicating purposes.

Mounted on shaft 52 intermediate plate 33 and panel 51 is a second gear 55, the function of which will be described hereinbelow. Mounted around shaft 52 is a

spring 56, one end of which abuts panel 51 and the other end of which exerts pressure against gear 55 to urge shaft 52 toward plate 33 to maintain gear 55 normally out of engagement with an interval timing gear to be described hereinbelow.

Connected to the rearward side of panel 33 is a flat metal spring 57 whose free end extends over the rear end of shaft 52 and biases said shaft against the action of spring 56 to keep gear 54 normally disengaged from gear 47. When it is desired to set the time of the clock hands the operator may press inward on knob 53 against the action of spring 57 to cause gear 54 to mesh with gear 47.

Connected to the forward end of shaft 38 and rotated thereby is a minute hand 58 while an hour hand 59 is connected to and rotated by the forward end of shaft 44. Connected to the forward end of and rotated by second shaft 42 is a second hand 60. While Fig. 1 shows said time indicating hands in different angular positions, Fig. 2 shows them in a vertical array for purposes of clarity of illustration.

Spindles 38, 42, and 44 extend through a suitable aperture in panel 51 to the front of which is attached dial plate 63 which has suitable time graduations printed thereon. A cover glass 64 enclosing the indicating hands in front of dial plate 63 is retained in position by frame 65. Suitable time markings, such as numerals or the like, may also be printed or otherwise applied on frame 65 around said cover glass as shown in Fig. 1.

Mounted coaxially around spindle 44 is a time interval sub-assembly which comprises a spindle 66 independently rotatable about spindle 44. Mounted fast on and rotatable with spindle 66 is a disc cam 67. Shaft 44 has a shoulder 68 adjacent which is mounted a friction spider clutch 71, the legs 72 of said clutch being biased against the side of cam 67. The action of clutch 71 operates to urge cam 67 and spindle 66 forward against ring 73 mounted fast on shaft 44. Spindle 66 and cam 67 normally rotate with shaft 44 by virtue of the frictional engagement between spindle 66 and ring 73. Spindle 66 and cam 67 are also rotatable independently of spindle 44 by means which will be described hereinbelow.

Mounted rotatably around spindle 66 is cylinder or spindle 76, the rear end of which has a cam flange 77 (Figs. 2 and 12). Spindle 76 is frictionally coupled to spindle 66 by means of spider clutch 78 mounted around spindle 66 and bearing against flange 82 on spindle 66. Legs 83 of clutch 78 are biased to urge cam 77 and spindle 76 forward against washer 84 mounted fast on spindle 66. Spindle 76 and cam 77 are also rotatable independently of spindle 66 by means which will be described hereinbelow. It will be noted that clutch 71 is similar in structure to clutch 78 which is illustrated in Fig. 8. Both clutches 71 and 78 may be characterized as slip friction clutches since they exert sufficient force for rotating their respective cams in fixed positions relative to the rotating spindle while at the same time their frictional force may be overcome by an externally applied force to rotate the respective cams relative to the spindle to different fixed positions.

Attached fast on spindle 76 is gear 85 which is engageable by gear 55 (Fig. 5) and is operative to rotate said spindle and cam 77 against the action of clutch 78 independently of the rotation of spindle 66.

Cam 77 has a cut away portion 88 of reduced radius extending substantially 180°, while cam 67 has a similar cut away portion 89. (See Figs. 9 and 11.) Arm 90 on cam 77 extends substantially perpendicularly to the rearward face of the cam and across the reduced radius portion 89 of cam 67 within the limits of which it moves freely. Arm 90 is adapted to engage or to be engaged by either edge of cam 67 bounding the reduced portion 89 of said cam to cause simultaneous rotation of said cams in one direction or the other, but more desirably in the clockwise direction. Although cams 67 and 77 are illustrated and described as having 180° cutout recesses, certain timing operations may require cutout portions of other arcuate sizes.

Mounted fast to the forward end of spindle 66 is a cylindrical member 91 whose forward end terminates in a radially extending flange which rotates with said spindle and serves as an alarm set dial 92. (Figs. 1 and 2.)

Attached peripherally to the forward end of spindle 76 is a cylindrical member 93 to whose forward end is attached a radially extending pointer which rotates with said spindle and serves as a time interval indicator 94.

It will be noted that while the inner diameters of cams 67 and 77 are different, the radii of their respective outermost and cut away peripheries are substantially equal. Cams 67 and 77 rotate around the same axis and are positioned in tandem sufficiently close to each other that they both operate together as a time interval setting means. See Figs. 5 and 6. This is accomplished by the mechanism for adjusting the angular positions of cams 67 and 77 relative to each other and to hour hand spindle 44, as will be explained hereinbelow.

A switch arm 101 (Figs. 2, 4, 6), which is sufficiently wide to extend over both the peripheral edges of cams 67 and 77, is adapted to ride over said peripheral edges to operate a switch, generally designated 102, said switch having a stationary contact 103 attached to mounting 104 which is connected to plate 33 by means of a suitable bracket 105. Switch arm 101 which is made of a suitable insulating material is mounted on an elbowed spring blade 106 to which is connected a contact point 107 adapted to cooperate with contact point 103. Blade 106 is attached to mounting 104 and is biased normally to urge the end of arm 101 against the peripheries of cams 67 and 77.

Contacts 107 and 103 are opened and closed by the rise and fall of arm 101 riding either over the outer peripheral edges of disc cams 67 and 77 to keep switch 101 open, or falling off said peripheral edges to the reduced peripheries when said cams are rotated to selected positions where a part or all of their respective reduced sections 88 and 89 coincide. Switch 102 thereby operates as a time interval switch to close or open a circuit of a radio, an electrical appliance, or the like, the time interval being determined by the relative positions of the cams.

Contact point 103 is connected by way of stud (not shown) through mounting 104 to conductor 109 attached to said mounting, conductor 109 extending and terminating in a spring arm 111 on the end of which is attached contact point 112.

Spring arm 111 is biased normally to urge contact point 112 against contact point 113 mounted on bracket 114 to the end of which is connected one of the leads 115 of the appliance circuit to be controlled. The other lead 116 for connection to a suitable power source is connected to the foot of elbowed spring blade 106 near the base of its connection to mounting 104. The foot of blade 106 extends in the form of a spring arm 117 at the end of which is connected contact point 118. Contact point 118 is adapted to close against contact point 119 which is connected to elbow 121 of bracket 114. Switch arm 117 is biased to maintain contact point 118 normally separated from contact point 119.

Mounted between plate 33 and panel 51 is a rotatable switch shaft 125 having on its outer end a manual operating knob 126. See Figs. 4, 6 and 7. Connected intermediate the ends of shaft 125 is a switch arm 127 which is normally positioned in a neutral position, as shown in Fig. 4. Upon rotation of shaft 125 and switch arm 127 in one direction, arm 111 is moved to separate contact points 112 and 113, thereby cutting out the action of switch 102 and thereby turning off the radio or appliance.

If, on the other hand, it is desired to keep the appliance to be controlled in operation, or to operate it under manual control without time interval control, switch arm

127 may be rotated to urge arm 117 to close contact points 118 and 119 against each other, thereby effectively shorting out switch 102 and closing the radio or appliance circuit between leads 115 and 116 through bracket arm 121 and switch arm 117. It is understood that elements 109, 111, 114, 117 and 121 are electrical conductors.

Indexing means (not shown) may be provided for shaft 125 to bring said shaft into any one of the three positions described and to maintain the switch arm 127 in the desired position until shaft 125 is again rotated to another position.

The operative electrical control system is shown schematically in Fig. 13 wherein like reference numerals designate similar structural parts shown in the other figures of the drawing. One lead 36 from motor 35 is connected to a suitable source of power, such as for example, a 110 volt household power supply or the like. The other lead 36 is connected to lead 116 which is electrically connected to contact 118. Connected to the electrical system by way of leads 128 and 129 is an appliance 130 to be controlled, lead 128 being connected to the power source and lead 129 being connected to bracket 114 which provides alternate connection to either switch arm 111 or 117. The other side of the power source is connected to lead line 116.

If desired, a female plug or electrical connector 131 may be connected across leads 128 and 129 by means of a pair of leads 132, so that a second appliance may be connected to the control circuit to be operated in conjunction with the first appliance 130. This second appliance may, according to the user's choice, be an electric coffee percolator, an electric oven, or an air conditioner, or the like.

In operation, the closing of switch 102 causes the turning on of the radio or appliance, as the case may be, provided switch arm 127 is in the neutral or "automatic" position shown in Fig. 4, and this action will be referred to herein as either the "switch on" time or the "alarm" time. It will be noted that switch 102 is open while switch arm 101 rides on the outermost periphery of either cam 67 or 77 or on both peripheries simultaneously (see Fig. 4). It is only when arm 90 is separated angularly from the rearward drop off point 140 of cam 67 that arm 101 is able under the biasing action of blade 106 to pivot and bring contact points 103 and 107 together thereby closing switch 102. Although switch arm 101 may be positioned at other places, as a matter of choice or structural convenience, the invention will most conveniently be described with switch arm 101 at a drop off position at the 12 o'clock point of the clock, as it is illustrated herein.

The "switch on" or "alarm" time is determined by the position of cam 67 relative to spindle 44 and consequently by the position of drop off point 140 from which arm 101 falls to close switch 102.

In order to bring drop off point 140 into the proper relationship with the clock hour hand spindle 44, knob 53 is manually pulled out against the action of spring 56 to cause gear 55 to mesh with gear 85. A suitable shoulder or collar (not shown) may be provided on shaft 52 to assist in the alignment of gears 55 and 85. Knob 53 is then turned counterclockwise to cause cam 77 to rotate clockwise around spindle 66 until arm 90 engages the radial edge of cam 67 at drop off point 140. Thereafter, the continued rotation of cam 77 causes cam 67 also to rotate with spindle 66 around spindle 44 in a clockwise direction. This action also causes time dial 92 to rotate clockwise with cam 67 on spindle 66. This clockwise rotation is continued until the desired "alarm" time or "on" time, as represented by the clock time numerals on dial 92, is brought to a position opposite pointer 141, which is a part of hour hand 59 but which points in a 180° opposite direction.

It will be noted that clutches 71 and 78 provide for the independent rotation of spindles 66 and 76 respectively, without affecting the rotational position of spindles 38 and 42 or their movement by motor 35 through conventional clock gearing between plates 32 and 33. It is also understood that the manual time setting described hereinabove in respect of gears 54, 43, 45, 47 and 48 is rendered possible by means of clutch means well known in the art of synchronous motor electric clocks. Such clutch means (not shown) would usually be positioned between plates 32 and 33.

In order for switch 102 to operate, however, it is necessary, after the alarm set position has been determined on dial 92 to rotate knob 53 in a clockwise direction thereby causing cam 77 to rotate in a counterclockwise direction whereby arm 90 backs away from the drop off point 140 on cam 67 to leave room for the dropping of switch arm 101 to close switch 102. This is done very quickly and easily, after the alarm set time has been determined, by a simple reverse turn of knob 53.

After the "alarm" setting has been made, the hour hand spindle 44 will rotate cam 67 to a point where drop off point 140 will reach the 12 o'clock position of the clock, at which time switch 102 will be actuated. In order for this to be accomplished, drop off point 140 of cam 67 should be radially aligned with the numeral 6 on dial 92. The solid line 142 on dial 92 coincides substantially with the outermost peripheral edge of cam 67 and indicates the silent time of the clock switch mechanism since said outer periphery will always maintain switch arm 101 in a position where contacts 103 and 107 are kept separated.

Pointer 94 rotates with cam 77 and is substantially aligned with arm 90. When arm 90 has engaged the drop off edge 140 of cam 67, pointer 94 and the 6 o'clock point on small dial 94 will be substantially aligned with each other and will continue to rotate as knob 53 is rotated counterclockwise. Therefore, a time of play interval may be accurately set by rotating knob 53 clockwise, and it will be observed that pointer 94 moves counter clockwise away from number 6 on the small dial 92 which, with cam 67, remains stationary. This indicates that cam 77 also moves counterclockwise to provide a gap between the outermost peripheries of cams 67 and 77 respectively wherein switch arm 101 may drop to close switch 102.

Thus, the interval of play will be measured off by the amount of the radial clock spacing by which pointer 94 moves backward counterclockwise from the 6 o'clock point on small dial 92, and that differential in time will determine the length of time the appliance will remain in operation after it is turned on.

Clutch 71 is arranged to exert a greater force against cam 67 than clutch 78 does against cam 77 in order that spindle 66 may not turn counterclockwise when cam 77 is turned counterclockwise to set up the time of play interval. Once cam 67 is set for alarm time, it maintains its position relative to hour hand spindle 44 under the action of clutch 71, and after cam 77 is set for the timing interval, it will be maintained in its position relative to cam 67 under the action of clutch 78. Thereafter, both clutches will be operative to maintain said cams in their relative positions while they are both being rotated by spindle 44 on the timing basis established by motor 35 and the interconnecting gear train between plates 32 and 33.

It will be apparent then that the time interval on the white side of the small dial from pointer 94 to the 6 mark on the small dial is the time of play or "on" time of the appliance. In order for the appliance to go on for any period of desired time, the pointer 94 can be turned counterclockwise from the numeral 6 point on dial 92 backwards for a space of up to six hours so that the appliance can go on at the desired "alarm" time and play for a maximum of six hours, said six hours being divisible to any desired period of time.

The alignments of these operative parts are not coordinated throughout the various figures of the drawings in order to permit clarity of illustration of the parts from different views. The positions of such elements as 90, 92, 94, 101, 140 and 142 and the numerals on dial 92 are arbitrary and it will be understood that said elements are easily coordinated in assembly to perform the functions described herein.

The timing device herein is also capable of performing an intermediate timing operation independent of the alarm set mechanism described hereinabove.

This function is useful for performing specific timing operations that are measurable to a fairly fine degree of precision measured by the time divisions on the dial face 63 of the clock. The outer edge of dial face 63 may be marked off in fine time graduations from 12 o'clock back to 10 o'clock, as shown, or further if desired. Each of these hour intervals is marked off into suitable fractions of an hour, depending upon the precision of calibration desired. In some cases the calibrations may be as fine as one minute, two and a half minutes, or the like, which may further be subdivided by visual means when the operator moves pointer 94 by turning knob 53.

If it is desired, for example, to have a radio play for a certain length of time before it is turned off automatically for the night, knob 53 is turned counterclockwise until point 140 on cam 67, and accordingly, numeral 6 on dial 92, are at or past the 12 o'clock point on clock face 63, this being the operative point of switch arm 101. Thereafter, knob 53 is turned clockwise to rotate cam 77 counterclockwise, thereby opening a gap between arm 90 on cam 77 and point 140 on cam 67. Hence arm 101 will be biased downward into said gap, maintaining switch 102 closed for operation of the radio.

The interval of time during which switch 102 will remain closed will depend upon how far counterclockwise cam 77 has been rotated at the time of making what is variously known as "lullaby tuning." This interval may be established visually by the operator turning knob 53 clockwise until pointer 94, which is aligned substantially with arm 90 on cam 77, stops on the particular graduation counterclockwise of 12 o'clock on face 63 that indicates how long the operator desires the radio to play before turning off automatically. Clock spindle 44 rotates cam 77 clockwise and when the periphery of the cam at the substantial location of arm 90 reaches the 12 o'clock position, arm 101 will be lifted to open switch 102 to shut off the radio.

It will be understood that the alignment of pointer 94 with cam 77 will be such that precision of timed operation of switch arm 101 will be established. Also, if desired, clock face 63 may be marked with appropriate numerals inside the fine graduations in order to assist in setting precise tuning periods. If, for example, pointer 94 has been turned back to the 11 o'clock numeral on frame 65, the appliance will be turned off automatically in one hour from the time of making the setting. The finer graduations may be employed to establish in fractions of an hour up to substantially six hours, provided, however, that for the upper limit, numeral 6 on dial 92 is aligned with numeral 12 on frame 65. After the appliance has been turned off automatically, it will remain off until switch 102 is closed again at the "alarm" time as indicated by pointer 141 on dial 92.

When it is desired to control the timed operation of appliances, such as electric ovens, broilers, sun lamps, and the like, the device can be set accurately on this intermediate timing basis with intervals selectible from a maximum of six hours down to a minimum of one or two minutes, depending upon the ability of the operator to move pointer 94 precisely between the graduations on dial 63.

In some embodiments, arm 90 on cam 77 may be dispensed with and cam 67 may be rotated by independent means. In such case a gear similar to gear 85 would be mounted on spindle 66 between cam 67 and clutch 71, said added gear being engaged by an additional gear on shaft 52 similar to gear 55 which is adapted to engage gear 85. Such an additional gear on shaft 52 would engage the gear added to spindle 66 in such a manner as not to cause gears 55 and 54 to mesh with gears 85 and 47, respectively, upon the movement of shaft 52 inward or outward, as the case may be. Suitable indexing or indicating means may be established for shaft 52 to provide the proper engagement of the desired pairs of gears. In some cases the additional gear could be operated by an additional shaft and gear similar to shaft 52 and gear 55.

It may also be desired to dispense with the adjustable time interval setting means, in which case a single cam 77, similar to cam 67, may be utilized. Instead of being mounted around spindle 66, cam 77 would be mounted around spindle 44 and would be rotated by spindle 44 by clutch means as described hereinabove.

Switch arm 101 would ride on the peripheral edge of cam 77 and would fall off cam edge 140 to close switch 102. Of course pointer 94 would be omitted while dial 92 would be mounted on spindle 44 and its clock numbers aligned in such a manner that they would indicate the proper alarm time setting relative to the drop off point 140 on cam 77. Although cam 77 in this instance may be shaped in the form shown in Fig. 11, in which case the alarm time would have to take place within six hours of the time of being set, it may be preferable to reduce the segment of the recessed portion 88 to a smaller angular segment so that the alarm time may be set for more than six hours in advance. Since it is only important to utilize this embodiment as an alarm only, the recessed portion 88 may be reduced to a smaller segment for a time of play of substantially a half hour to an hour, and during that time of play the operator of the appliance may operate knob 126 to short out the automatic switch 102 and place the appliance under manual operation.

In order to ensure the proper cooperation of cam 77 with cam 67, the latter has a recessed notch 141 which accommodates arm 90 of cam 77 whereby accurate switch setting and time interval setting may be accomplished.

In the specification, I have explained the principles of my invention, and the best mode in which I have contemplated applying those principles, so as to distinguish my invention from other inventions; and I have particularly pointed out and distinctly claimed the part, mode or combination which I claim as my invention or discovery.

While I have shown and described certain preferred embodiment of my invention, it will be understood that modifications and changes may be made without departing from the spirit and scope thereof, as will be clear to those skilled in the art.

I claim:

1. A time control device comprising a switch a rotatable spindle, a first cam mounted rotatably around said spindle, a first clutch for causing said first cam to rotate with said spindle, a second cam spaced apart from said first cam and mounted rotatably around said spindle, a second clutch for causing said second cam to rotate with said spindle, means for rotating said second cam relative to said spindle and to said first cam against the action of said second clutch, a cutout portion on said first cam of predetermined length, means on said second cam movable within said cutout portion of said first cam without moving the latter, said second cam when rotated beyond predetermined points in either direction causing the means thereon to engage a respective edge of the cutout portion of said first cam to rotate the latter relative to said spindle against the action of said first clutch, a cutout portion on said second cam, an arm on said switch operable by both of said cams simultaneously, the opening and closing of said switch being determined by the respective positions of the combined cutout portions of both of said cams relative to each other and to said arm.

2. A device according to claim 1, and further comprising an indicator connected to said spindle, an indicator connected to said first cam and an indicator connected to said second cam, said indicators showing visually the respective angular positions of said cams and spindle relative to each other.

3. A time control device comprising a first rotatable spindle, a second spindle mounted coaxially and rotatably around said first spindle, a first cam mounted on and rotated by said second spindle, a first clutch for causing said second spindle to rotate with said first spindle, a third spindle mounted coaxially and rotatably around said second spindle, a second cam mounted on and rotated by said third spindle, a second clutch for causing said third spindle to rotate with said second spindle, means mounted on said third spindle for rotating said third spindle and said second cam relative to said second spindle against the action of said second clutch, a cutout portion on said first cam, a cutout portion on said second cam, means on said second cam adjacent an end of its respective cutout portion movable within the cutout portion of said first cam to a position to engage either edge of said first cutout portion to rotate said first cam and said second spindle relative to said first spindle against the action of said first clutch, said first clutch being formed so as to exert a greater gripping force than said second clutch whereby said second cam is capable of rotating within the distance permitted by the extent of the cutout portion of said first cam without rotating the latter, a swich, and a follower on said switch operable by the combined cutout portions of both of said cams as they rotate to cause the opening and closing of said switch.

4. A device according to claim 3, and further comprising indicating means on each of said spindles, said indicating means showing visually the respective angular positions of said three spindles relative to each other.

5. A time control device comprising a frame, a first spindle mounted in said frame and adapted to be rotated by a synchronous motor or the like, a second spindle mounted coaxially around said first spindle and rotated thereby, a first disc cam mounted on and rotated by said second spindle, a third spindle mounted coaxially around said second spindle and rotated thereby, a second disc cam spaced apart from said first cam and mounted on and rotated by said third spindle, said three spindles normally rotating together upon the rotation of said first spindle, a first clutch between said first and second spindles, a second clutch between said second and third spindles, both of said cams having peripheral portions of reduced radius, said respective portions being movable relative to each other to provide a gap of a selected and variable length, an arm on said second cam movable within the reduced radius portion of said first cam to engage either edge thereof to rotate said first cam to selected positions relative to said first spindle against the action of said first clutch, a gear on said third spindle, said gear being rotatable to rotate said third spindle and said second cam to selected positions relative to said second spindle against the action of said second clutch and to cause the rotation of said first cam when the latter is engaged by said arm against the action of said first clutch to rotatably adjust each of said cams to separate selected fixed radial positions relative to each other to establish the length of said gaps, and a switch on said frame, said switch being operated by the combination of both cams, the length of said gap determining the time during which said switch is closed.

6. A device according to claim 5, and further comprising an actuating arm on said switch, an indicator connected to and rotating with said first spindle, an indicator dial connected to and rotating with said second spindle, said indicator and indicator dial showing visually the relationship of said first cam to said first spindle, said indicator dial being graduated in suitable time intervals and mounted in relation to said first cam whereby said arm will be actuated to close said switch by falling into the reduced radius portion of said first cam at the time indicated on said dial by said indicator.

7. A device according to claim 6, and further comprising a second indicator connected to and rotating with said second cam, the reversing of said second cam relative to said first cam causing a gap formed by the combined reduced portions of both of said cams within which said switch arm remains to maintain said switch closed, said second indicator marking off from a suitable reference point in said dial the interval during which said switch will remain closed.

8. A device according to claim 7, and further comprising a clock face mounted on said frame, a series of graduations on said clock face with a reference point at the location where said switch arm falls and rises to close and open said switch, said second indicator being movable in the counterclockwise direction together with said second cam to indicate the interval during which said switch will remain closed.

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