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H. F. ELLIOTT
TIME CONTROL DEVICE

2,440,142

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2 Sheets-Sheet 1

FIG. 1

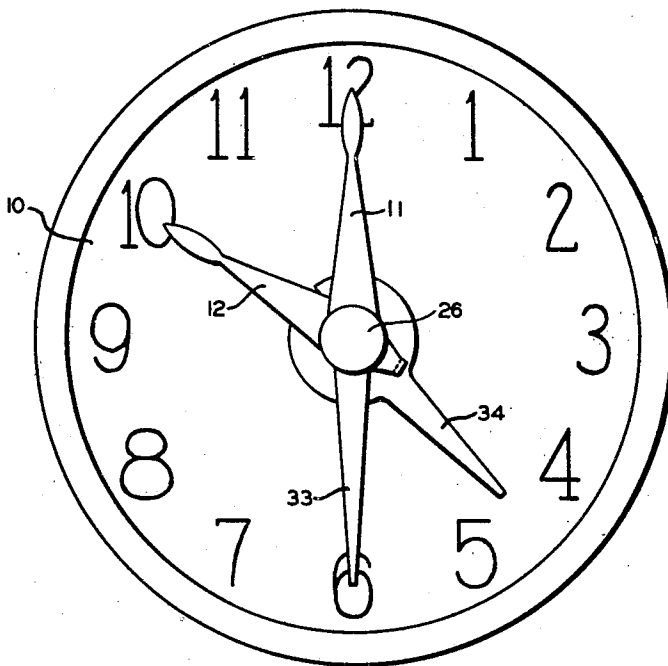
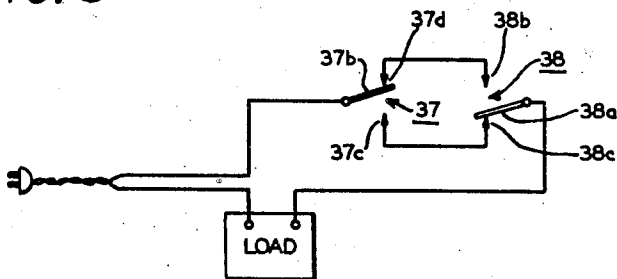


FIG. 3



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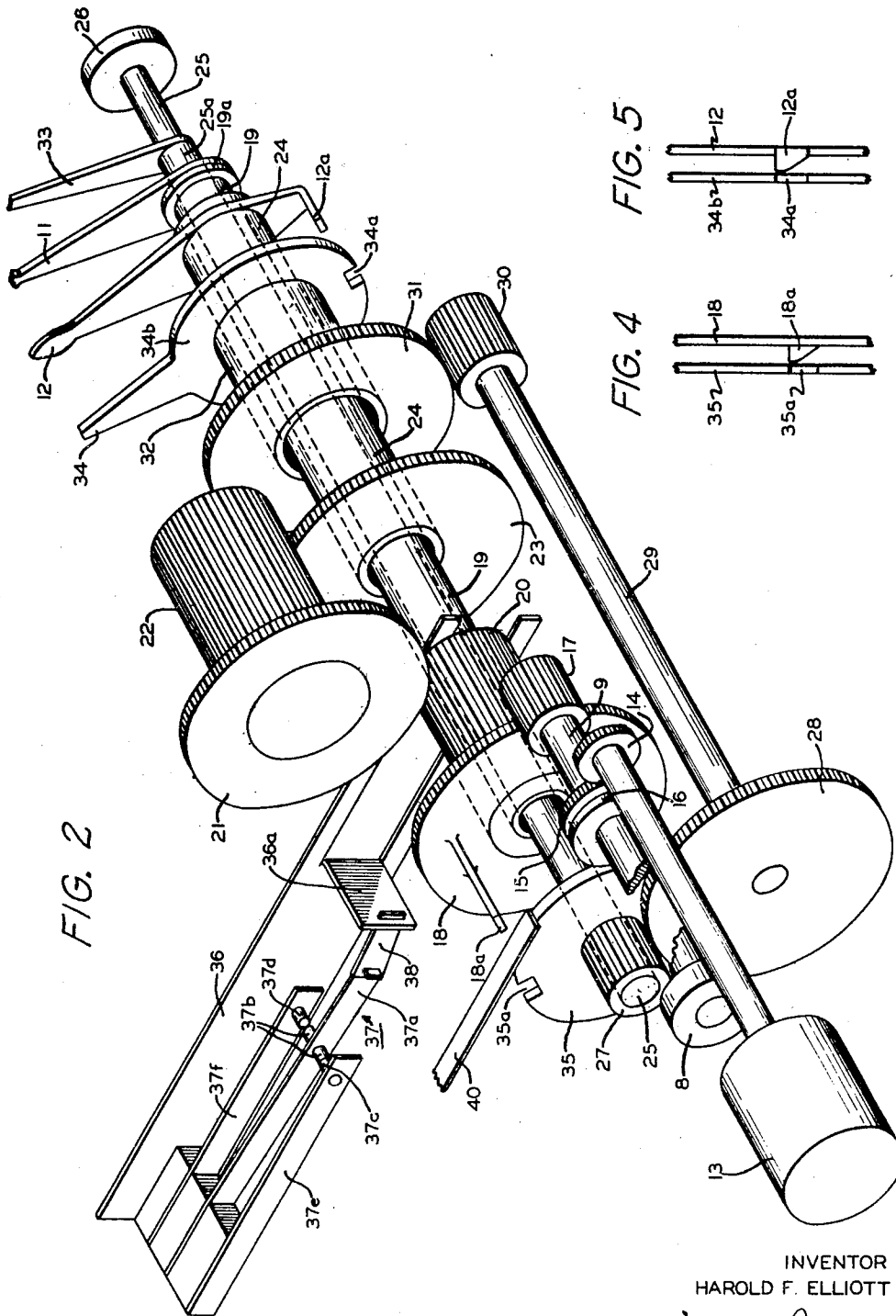


FIG. 5

FIG. 4

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TIME CONTROL DEVICE

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6 Claims. (Cl. 161-1)

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This invention relates to time-control devices and, while it is of general application, it is particularly suitable for embodiment in a precision interval timer for determining the duration of operation of an electric or electrically controlled appliance.

Heretofore there have been devised and marketed a wide variety of time-control devices or switches; however, such devices have generally been subject to one or the other of two troublesome limitations. The simplest and most common form of interval time control device has comprised a single settable hour shaft which has an element cooperating with an hour time shaft of an associated clock to effect an electrical control or switching operation when these two shafts are in angular correspondence. This simple arrangement has the disadvantage that it is not possible to provide a reasonably precise interval of time, due to the coarse nature of the setting of the settable hour shaft. On the other hand, a time-control device or switch in which it has been attempted to determine the time interval more precisely has either been limited to time intervals of less than one hour or has involved extremely complicated timing and setting mechanisms.

It is an object of the invention, therefore, to provide a new and improved time-control device which is simple and economical in construction and which at the same time is capable of determining the time of operation of the control device with a high degree of precision.

It is another object of the invention to provide a new and improved time-control device of the type described in which the control device may be operated after any desired precisely determined time interval up to 12 hours or 24 hours.

In accordance with the invention, in a timing system including a timing motor means, a time-control device comprises minute and hour time shafts adapted to be driven by the motor means, a settable minute shaft, and a settable hour shaft. The device further includes control means and means operable only upon angular correspondence of the time shafts and the respective settable shafts for actuating the control means.

Further in accordance with the invention, in a timing system including timing motor means a time-control device comprises a time shaft adapted to be driven by the motor means, a settable shaft axially movable relative to the time shaft only when such shafts are in angular correspondence, and means for biasing the shafts for such relative axial movement. The device

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further includes control means, such as a control switch, and means responsive to such relative axial movement of the shafts for actuating the control means.

For a better understanding of the invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawings while its scope will be pointed out in the appended claims.

Referring now to the drawings, Fig. 1 is a front view of a time switch embodying the invention; Fig. 2 is an exploded perspective view, partially schematic, of the timing and switching mechanism of the device of Fig. 1; Fig. 3 is a circuit diagram of an arrangement for adapting the apparatus to operate either as a circuit-opening or a circuit-closing switch; while Figs. 4 and 5 are fragmentary detailed views of elements of the apparatus for controlling relative axial movements of the several shafts.

Referring now specifically to Figs. 1 and 2 of the drawings, there is represented a timing system including a timing motor means and a time-control device embodying the invention. This system may constitute a modification of a conventional clock 10 having a 12-hour dial, a minute hand 11, and an hour hand 12. The minute hand 11 is driven by a motor 13, which may be either a spring motor or an electric motor, through gears 14 and 15, a slip clutch 16, a shaft 9, and a motor pinion 17. The pinion 17 drives a gear 18 attached to a minute time shaft 19 to which is secured the hand 11. Attached to the gear 18 is a pinion 20 which drives a gear 21 attached to a pinion 22 which, in turn, drives a gear 23 attached to an hour time shaft 24 on which is secured the hour hand 12. The shaft 9 and motor pinion 17 may also be driven through a hand reset knob 8 and slip clutch 16, which is preferably of the over-running ratchet and pawl type to permit the time shafts 19 and 24 to be over-driven by the knob 8 but prevents their being driven backward against the motor 13. So much of the timing system described comprises a conventional clock mechanism.

The time-control device of the invention includes a minute shaft 25 settable by a manual operating element or knob 26 attached thereto and protruding through the front of the clock casing for ready adjustment. To the opposite end of shaft 25 is attached a pinion 27 connected to drive a gear 28 on a shaft 29, the other end of which carries a pinion 30 driving a gear 31 secured to a settable hour shaft 32. To a shoulder 25a of the

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settable minute shaft 25 is secured a minute-indicating hand 33, while on the settable hour shaft 32 is secured an hour-indicating hand 34. It is noted that all of the several shafts are coaxial, the minute-setting shaft 25 being the innermost shaft and the other shafts being tubular shafts surrounding the shaft 25.

The minute and hour time shafts 19 and 24, respectively, are axially movable relative to their respective settable shafts 25 and 32 only when in angular correspondence therewith. To this end, the gear 18 attached to the minute time shaft 19 is provided with an axially extending arm 18a engageable with a recess 35a in a disk 35 carried by the settable minute shaft 25 only when the shafts 25 and 19 are in angular correspondence, engagement of the arm 18a and the recess 15a permitting relative axial movement of these two shafts. However, the shaft 19 has a shoulder 19a which rests against the end of the hour time shaft 24. The hour hand 12 is provided with an extension 12a which is bent over to extend axially and is engageable with a recess 34a of an enlarged hub 34b of the settable hour indicator 34 only when the shafts 24 and 32 are in angular correspondence, thereby permitting relative axial movement between these two shafts.

In the exploded view of Fig. 2, it is to be understood that the axial lengths of the several pinions and shafts, as well as of the arms 12a and 19a are exaggerated for the sake of clarity to show the elements in their engaging positions. For example, in Figs. 4 and 5 are shown detailed views of the arms 12a and 18a in their proper proportions. The ends of these arms are bevelled, as indicated, to permit the disk 35 and gear 18 and the hub 34b and hand 12 to be cammed apart by reverse relative rotation of these elements, as described hereinafter.

The control device of the invention also includes means for biasing the several shafts for the relative axial movements described above. This biasing means may be in the form of a leaf spring 36 which is bifurcated at its end to straddle the shaft 19 and to bear against the end of the pinion 20 attached thereto. The control device also includes control means, for example a single-pole double-throw snap switch 37. The switch 37 comprises a resilient blade 37a carrying a pair of contacts 37b adapted selectively to engage opposed contacts 37c, 37d carried by the resilient arms 37e and 37f, respectively. The control device also includes means operable only upon angular correspondence of the time shafts 19 and 24 and the respective settable shafts 25 and 32 and responsive to the relative axial movements of such shafts for actuating the control switch 37. This operating means may comprise the biasing spring 36 provided with an upturned arm 36a pivotally engaging a link 33 of insulation material, the other end of which pivotally engages the end of the resilient blade 37a of the switch 37. The arrangement of parts is such that, as the biasing spring 36 moves between its two limiting positions, as described hereinafter, the arm 36a moves across dead center of the leaf 37a to snap the leaf 37a from one position to the other through the pivotal actuating link 33.

It is believed that the operation of the above described timing system including the conventional clock and the control device of the invention will be apparent from the foregoing description. In brief, the shaft of the clock motor means 13, rotating at 1 R. P. M., drives the minute hand 11 through the gears 14, 15, the slip clutch 16, and

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the pinion 17 and gear 18 and simultaneously drives the hour hand 12 through the above described driving connection and the pinion 20 and gear 21 and pinion 22 and gear 23 attached to the hour time shaft 24. The time hands of the clock may be set in a conventional manner by means of the setting knob 26, projecting through the rear of the casing, the slip clutch 16, and the shaft 9 to which the motor driving pinion 17 is secured.

In considering the operation of the time-control device of the invention, it will be assumed that the arms 12a and 18a are initially in engagement with their respective recesses 34a and 35a, respectively, after a previous operation of the device. Under these conditions the settable minute and hour hands 33 and 34, respectively, are dragged around with the minute and hour time shafts 19 and 24, respectively. If now the knob 26 is actuated to advance the settable minute and hour shafts 25 and 32, respectively, forward, that is clockwise, the camming arms 12a and 18a will ride out of their respective recesses 34a and 35a and move the minute and hour time shafts 19 and 24, respectively, axially to the right, as viewed in Fig. 2. Further clockwise movement of the setting knob 26 causes the arms 12a and 18a to ride on the right-hand faces of the members 34b and 35, respectively, being biased into engagement with such faces by the spring 36. Under these conditions the shoulder 19a of the minute time shaft 19 is substantially in engagement with the right-hand end of the hour time shaft 24. The setting knob 26 is then actuated to adjust the time interval indicating hands 33 and 34 for the desired time interval after which the control switch 37 is to be actuated. This is accomplished simply by rotating knob 26 until hands 33 and 34 indicate the minute and hour at which the functions of switch 37 is desired.

Once during each hour when the minute time hand 11 and its associated shaft 19 come into angular correspondence with the settable minute hand 33 and shaft 25, the arm 18a on the gear 18 is in alignment with the recess 35a of disk 35 and tends to engage therewith under the action of the biasing spring 36. However, the shoulder 19a of the minute time shaft 19 is in engagement with the right-hand end of the hour time shaft 24 so that the shaft 19 is restrained from such axial movement until the hour time hand and its associated shaft 24 are in angular correspondence with the settable hour hand 34 and its associated shaft 32. When such angular correspondence occurs, the biasing spring 36 is effective to move the shafts 19 and 24 axially to the left and, in the course of movement, to actuate the snap control switch 37. Obviously if the desired time interval were less than an hour, the arm 12a would be in alignment with the recess 34a the first time the minute time shaft 19 came into angular correspondence with the settable minute shaft 25. Further, when the knob 26 is rotated clockwise again to set the indicator hands 33 and 34, as described above, axial movement of the pinion 20 to the right deflects the biasing spring 36 to snap the switch 37 to the position shown in the drawing.

With the described arrangement, in which both the minute shafts and the hour shafts must be in angular correspondence in order to actuate the control switch 37, there is obtained a degree of precision some twelve times that procured by conventional time-control devices utilizing only the hour shaft of the clock. In fact, it is entirely feasible to obtain a precision of considerably less

than one minute in the operation of the control switch 37 after any time interval up to twelve hours, or up to twenty-four hours in the case of a 24-hour clock. It will be apparent that the biasing spring 36 may be utilized to actuate any type of desired control device in lieu of the control switch 37.

The control switch 37 of the time-control device of Fig. 2 being of the single-pole, double-throw type will ordinarily be connected either to open a circuit or close a circuit. In case it is desired to provide a time-control switch which will selectively either open or close a circuit, the control switch 37 may be connected in the circuit represented in Fig. 3, which is a conventional three-wire, two-way connection. By connecting the switch 37 in series with an auxiliary single-pole double-throw switch 38 having a switch blade 38a movable between stationary contacts 38b and 38c, actuation of the movable blade 38a converts the switch 37 from a circuit-opening to a circuit-closing device. In the position of the movable contacts 37b and 38b illustrated, it is seen that the switch 37 is of the circuit-closing type. Actuation of the switch blade 38a to its contact 38b converts the switch 37 to a circuit-opening device. The switch 38 may be a conventional snap or toggle switch. In order to prevent the settable shaft 25 from being rotated by the frictional drag of the clock shafts, a friction brake 40 may be applied to disk 35.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit or scope of the invention.

What is claimed as new is:

1. In a timing system including a timing motor means, a time-control device comprising, minute and hour time shafts adapted to be driven by said motor means, a settable minute shaft, a settable hour shaft, control means, and means operable only upon angular correspondence of said time shafts and the respective settable shafts for actuating said control means.

2. In a timing system including a timing motor means, a time-control device comprising, coaxial minute and hour time shafts adapted to be driven by said motor means, a settable minute shaft, a settable hour shaft, said settable shafts being coaxial with said time shafts, control means, and means operable only upon angular correspondence of said time shafts and the respective settable shafts for actuating said control means.

3. In a timing system including a timing motor means, a time-control device comprising, minute

and hour time shafts adapted to be driven by said motor means, a settable minute shaft having a manual operating element, a settable hour shaft driven by said settable minute shaft, control means, and means operable only upon angular correspondence of said time shafts and the respective settable shafts for actuating said control means.

4. In a timing system including a timing motor means, a time-control device comprising, minute and hour time shafts adapted to be driven by said motor means, a settable minute shaft, a settable hour shaft, said settable shafts being provided with time-setting hands, control means, and means operable only upon angular correspondence of said time shafts and the respective settable shafts for actuating said control means.

5. In a timing system including a timing motor means, a time-control device comprising, minute and hour time shafts adapted to be driven by said motor means, a settable minute shaft axially movable relative to said minute time shaft only when in angular correspondence therewith, a settable hour shaft axially movable relative to said hour shaft only when in angular correspondence therewith, means for biasing said shafts for said relative axial movements, control means, and means responsive to said relative axial movements of said shafts for actuating said control means.

6. In a timing system including a timing motor means, a time-control device comprising, minute and hour time shafts adapted to be driven by said motor means, a settable minute shaft, a settable hour shaft, one of said minute shafts having an element provided with a recess and the other having an element engageable with such recess to permit relative axial movement of said minute shafts upon angular correspondence thereof, one of said hour shafts having an element provided with a recess and the other having an element engageable with such recess to permit relative axial movement of said hour shafts upon angular correspondence thereof, means for biasing said shafts for said relative axial movements, control means, and means responsive to said relative axial movements of said shafts for actuating said control means.

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REFERENCES CITED

The following references are of record in the file of this patent:

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