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ELECTRIC CONTROL SYSTEM FOR CLOCKS

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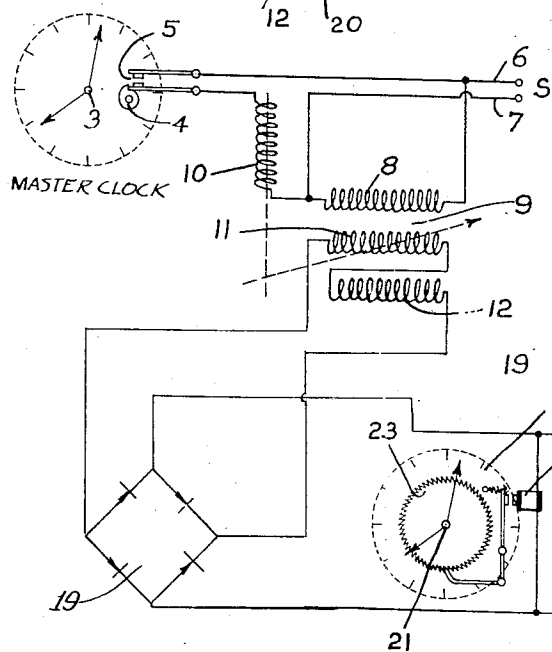
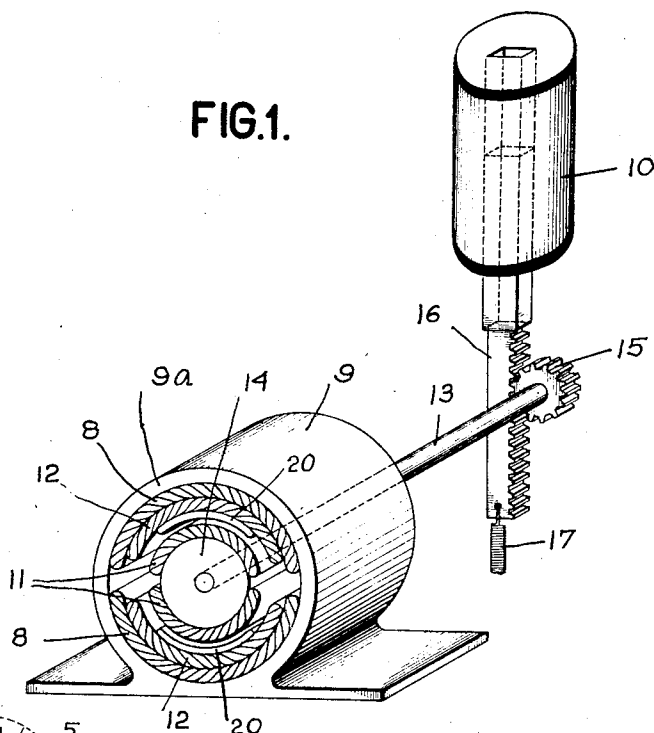


FIG. 2.

INVENTOR.

SECONDARY CLOCK:
BY

21
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UNITED STATES PATENT OFFICE

2,053,077

ELECTRIC CONTROL SYSTEM FOR CLOCKS

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4 Claims. (Cl. 58—24)

This invention relates to electric control systems and more particularly to controlling electric impulse driven clock systems.

The present invention is directed to actuation of secondary clocks under the control of a master clock by the agency of electrical energy, and has for its object to utilize for these purposes electrical energy derived from an alternating current source.

Another object resides in producing an electrically operated clock system without involving the use of magnetic switches or relays.

Another object resides in the provision of a novel impulse regulator employing the transformer regulation principle.

Various other objects and advantages of my invention will be obvious from the following particular description of one form of mechanism embodying the invention or from an inspection of the accompanying drawing, and the invention also constitutes certain new and novel features of the construction and combination of parts hereinafter set forth and claimed.

In the drawing:

Fig. 1 is a view showing the pertinent parts of the impulse regulator.

Fig. 2 is a wiring diagram of a clock system including the master clock minute contacts.

Referring to Fig. 2; connected to a suitable source of alternating current indicated at 8 are contacts 5, the usual minute impulse contacts of a master clock. The master clock in its general details may be of any desired form. For example, it may be that shown in U. S. Patent No. 1,390,018. The master clock includes the usual train adapted to drive the minute arbor 3 which makes one revolution per hour, and is provided with the usual minute impulse contacts 5 which are controlled in the usual way from a minute cam 4 or otherwise as is the custom in clocks of this sort.

Connected to the alternating current lines 6 and 7 are suitable coils 8, 8 serving as primary coils of the impulse regulator 9 (Fig. 1). A suitable solenoid coil 10 is included in the current supply circuit and has one terminal connected to the contacts 5 and the other terminal connected to line 7. Suitable separate coils 11, 11 and 12, 12 connected in series serve as the secondary of the impulse regulator 9 and are so arranged that the number of turns in the coils 11, 11 is equal to the number of turns in coils 12, 12 and that the coils as designated 12, 12 are in a fixed position while coils 11, 11 are adapted to be rotated about an axis common to both the primary and sec-

ondary coils. Referring to Fig. 1, a tubular frame 9a is provided having cores 20, 20 fixed to the inner walls thereof and concentric thereto, said cores being positioned diametrically opposite each other. Insulated primary inducing coil windings 8, 8 are wound around and supported by these cores, said coils being concentric with the tubular walls of the frame 9a and adjacent thereto. This mounting of the said coils is similar to the manner of mounting motor and generator coils which is well known in the art. In addition to the aforementioned primary coils, fixed insulated secondary induced coils 12, 12 are mounted on the cores 20, 20 adjacent to the primary coils 8, 8 and concentric thereto. Additional induced secondary coils 11, 11 are fixedly mounted on the core 18. The core 14 is fixed to a shaft 13 the axis of which coincides with the axis of the tubular member 9a. This shaft 13 is suitably journaled in end frame members (not shown) so that the core 14 and the coils 11, 11 fixed thereto may be rotated within the tubular frame 9a. At one end of the shaft 13 is fastened a pinion 15 adapted to engage a rack 16 suitably attached to the plunger of solenoid 10, so that upon energization of the coil of solenoid 10 the plunger is attracted by the exertion of the magnetic force of the solenoid coil and the attached rack is urged upwardly as viewed in Figure 1 to rotate shaft 13 through the pinion 15 fastened thereto. It is obvious that other forms of rotating shaft 13 are suggested, such as a motor energized in a manner similar to the solenoid, and are intended to be included in the scope of this invention.

Suitably attached to the lower end of rack 16 is a spring 17 adapted to bias the rack downwardly. Upon energization of the solenoid 10 the rack 16 is lifted against the action of said spring 17 and upon deenergization of the solenoid 10, the power stored in the spring 17 draws the rack 16 downwardly to its normal and original position.

As mentioned previously the primary coils 8, 8 and coils 12, 12 of the secondary are in a fixed position so that the electrical characteristics of the said coils are those of a standard transformer, in which, both the value and the direction of the voltage induced in the secondary windings are definite and fixed with respect to the value and direction of the voltage applied to the primary winding. The movable coils 11, 11 of the secondary are rotated by shaft 13 and adapted so that coils 11, 11 may be rotated through 180 degrees. With this type of construc-

tion and considering only the relationship of the characteristics of the movable half of the secondary, namely coils 11, 11 and the fixed primary coils 8, 8 it is seen that in a position as indicated in Figure 1, all the magnetic flux produced by the primary coils 8, 8 passes through the secondary coils 11, 11 and the voltage induced in the secondary winding is equal to the primary coil voltage divided by the ratio of the primary coil turns to the secondary coil turns. As the secondary core 14 and attached coils 11, 11 are rotated the amount of primary flux passing through the secondary winding is decreased until the core reaches beyond the position where the said coils are at right angles, and upon continued rotation of the core 14 in the same direction increases the amount of the primary flux threading through the secondary coils 11, 11 but it is now in the opposite direction and so reverses the direction of the voltage induced in the secondary coils 11, 11.

It has been disclosed hereinbefore that the secondary coils 12, 12 are fixedly mounted with respect to the secondary coils 11, 11 and connected in series therewith and has an equal number of turns as the turns in coils 11, 11 furthermore, assume that the ratio of the primary coils 8, 8 and the two secondary coils 11, 11 and 12, 12 have a ratio of 1:1, it is then seen that when the coils are in position as shown in Figure 1 so that the induced voltages in the secondary coils are in the same direction and having the said coil ratio the voltage induced in the secondary is equal approximately to the primary voltage. The voltages induced in the secondary coils are equal, that is the voltage induced in coils 11, 11 is equal to the voltage induced in coils 12, 12. When the secondary coils 11, 11 are rotated through 180 degrees, it was explained how the same voltage value is induced in the secondary coils 11, 11 but in the opposite direction, and with the secondary coils 11, 11 and 12, 12 connected in series, it is seen that the net voltage induced in the secondary coils is approximately zero, since half of the voltage value induced in coils 11, 11 is in one direction and opposite to the direction of the same voltage value induced in coils 12, 12. It is possible with the coil arrangement disclosed to have a maximum voltage value induced in the secondary when the rotor core is in one position and practically a zero voltage induced when the rotor is rotated through 180° from its former said position. Any amount of voltage variation is possible depending on the primary and secondary coil ratios and depending on the amount of rotation of the secondary coils 11, 11. In the preferred embodiment disclosed the secondary winding is shown to be movable, but it is obvious the same voltage relationship may be obtained by rotating the primary coils and is therefore within the scope of the present invention.

Referring to Fig. 2 the secondary clocks 18 are of conventional form and each includes a minute arbor shaft 21 which makes one revolution per hour. This shaft is preferably advanced by means of an impulse magnet 22 which acts through the usual ratchet wheel 23 to advance the minute arbor 21 step by step each time the magnet 22 receives an impulse from the master clock. The impulse magnet 22 is shown connected to the lines connected to a rectifier 19 in the secondary circuit of the impulse regulator 9.

The clocks may however be of the alternating current type and therefore connected directly

to the secondary circuit of the said regulator. The master clock contacts 5 are adapted to be closed periodically, usually once each minute, to advance the secondary clocks accordingly in the following manner: Closing of contacts 5 closes the circuit to solenoid 10 which upon energization attracts its plunger and attached rack 16 (Fig. 1) to rotate shaft 13 and attached secondary coils 11, 11 180 degrees from their normal position. While contacts 5 are open coils 11, 11 are in their normal position whereby the secondary coils 11, 11 and 12, 12 are positioned so that the direction of the induced voltage in coils 11, 11 is opposite to the direction of the induced voltage in coils 12, 12 resulting in a zero induced voltage and thus preventing the lines to the secondary clocks to be energized so as not to advance the secondary clocks.

Rotating coils 11, 11 180 degrees about their axes, caused by closing of master contacts 5, as disclosed hereinbefore causes a change of direction in their induced voltages, and since the induced voltages in the secondary coils are always in phase they are added directly to each other, so that a maximum voltage is induced in the secondary coils 11, 11 and 12, 12 when contacts 5 are closed. When the maximum voltage is induced in the secondary circuit described the lines to the secondary clocks are adapted to be energized to cause the magnets 22 to advance the said clocks accordingly, and in this manner maintain the secondary clocks in step with the master clock.

Opening of contacts 5 cause deenergization of solenoid 10 permitting return of rack 16 and secondary coils 11, 11 to their normal positions by action of the spring 17, and in so doing cause the net voltage induced in the secondary circuit to be zero thus maintaining the lines to the secondary clocks deenergized until the master clock contacts 5 are again closed to advance the secondary clocks.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is as follows:

1. In an electrical control system for clocks, the combination of a master clock, a primary inducing member, a plurality of induced members, a source of alternating current supply for energizing said members, means adapted to position one of the induced members differentially with respect to another induced member so that the induced electro-motive forces therein are induced either in the same direction or opposite directions, a secondary clock, means controlled by the master clock to cause said positioning means to select a position at a predetermined time so that the induced electro-motive forces in the said induced members are induced in the same direction, and means controlled by the said induced electro-motive forces to advance the secondary clock in accordance with the operation of the master clock.

2. In an electrical control system for clocks, the combination of a master clock, a plurality of secondary clocks adapted to be advanced under control of said master clock, a source of alter-

5 nating current power supply for operating said
secondary clocks, and means operated by said
master clock for controlling the flow of current
to said secondary clocks including a cylindrical
10 tubular frame having fixed primary inducing
members fixed within said frame and concentric
with the walls thereof, fixed secondary induced
members adjacent said primary members and
concentric therewith, and additional rotatable
15 secondary induced members adapted to be rotated
concentrically within said fixed secondary induced
members.

3. In an electrically operated clock system including a source of alternating current supply, a
15 fixed primary inducing member permanently connected to said alternating current supply, fixed and movable secondary induced members inductively related to said primary member, electromagnetic means for periodically moving said
20 movable secondary member relative to said fixed primary and secondary members, time controlled means for periodically energizing said electromagnetic means, a circuit connecting said time controlled means and electro-magnetic means with the alternating current supply, and a plurality of secondary clocks connected to a circuit
25 extending and connected to said secondary members,

comprising advancing means in each secondary controlled by the operation of said movable secondary member to advance said secondary clocks periodically in synchronism with said time controlled means.

4. An electrically operated clock system, including a master clock and one or more secondary clocks, said secondary clocks including advancing means in each clock for advancing the same, means controlled by the master clock for operating said advancing means and a circuit connecting said advancing means and master clock controlled means, said last named means including secondary induced coils mounted on a rotatable shaft for rotation therewith, fixed primary inducing and secondary induced coils inductively coupled and concentrically mounted with respect to each other and to said movable coils, a pinion gear fixed to said shaft and a rack cooperating therewith, an electromagnet for periodically reciprocating said rack to rotate the movable secondary coil relative to said fixed coil whereby an induced current impulse may be transmitted to the advancing means upon each rotation of said secondary coil to effect advance of said secondary clocks.

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