PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION.

Improvements in Electrically Driven Clocks.

I, CHARLES EDMOND PRINCE, a British subject, of Stubbings Manor, Burchetts Green, in the County of Berks, do hereby declare the nature of this invention to be as follows:—

This invention relates to the method of synchronising electrically driven clocks having a slight gaining rate by automatically stopping the clock at intervals by means controlled or actuated by a revolving arbor of the clock and re-starting it at definite periods by means of electric impulses derived from a master clock or transmitter, such as are commonly used to control the operation of repeater or subsidiary dials in electric clock installations.

According to the present invention the hands of a time recording or indicating mechanism, as for example of a large turret clock, are driven through suitable reducing gear by means of an electric motor running at a constant suitable speed, the speed and gear ratio being such as for example will drive the minute arbor of the train of wheels at a slightly greater speed than one revolution per minute.

The circuiting supplying current to the driving motor is controlled by means of a locking relay which, when energised momentarily by an electric impulse derived from the master clock or transmitter, say once a minute, establishes a locking current circuit in the relay which keeps the supply current circuit of the motor closed so long as the relay is energised by the locking current.

Assuming that the synchronisation of the driven train of wheels is effected by means of minute impulses, the minute arbor is caused by suitable means to open the locking current circuit of the relay momentarily once per revolution, so that before the receipt of each minute impulse from the master clock or transmitter the supply circuit to the motor is broken and remains broken until the next minute energising impulse again effects the closure of the motor circuit. Thus, each revolution of the minute arbor, and consequently of the train of wheels, is controlled by the receipt of the minute impulses from the master clock.

It may be arranged that the motor should not cease rotating, but should merely slow down for a given time, as for example by arranging that the relay-actuated switch controlling the circuit should not break the motor circuit entirely but cause the insertion of a resistance or produce other change in the motor circuit having the effect of reducing the speed of the motor; or, although the motor supply circuit is broken by the action of the relay consequent upon the interruption of its locking current circuit, the inertia of the rotating parts of the motor, assisted or not by a flywheel on its shaft, may cause the latter to rotate at a reduced speed until the receipt of the next energising impulse from the master clock, so that no heavy starting current will be required at each minute impulse.

Dated this 26th day of March, 1924.

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COMPLETE SPECIFICATION.

Improvements in Electrically Driven Clocks.

I, CHARLES EDMOND PRINCE, a British subject, of Stubbings Manor, Burchetts Green, in the County of Berks, do hereby declare the nature of this inven-

[*Price* 1/-]

tion and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the method of synchronising electrically driven clocks having a slight gaining rate by automatically stopping the clock at intervals by means controlled or actuated by a revolving arbor of the clock and re-starting it at definite periods by means of electric impulses derived from a master clock or transmitter, such as are commonly used to control the operation of repeater or subsidiary dials in electric clock installations.

According to the present invention the circuit supplying current to the electric motor driving the clock is controlled by means of a locking relay which, when energised momentarily by an electric impulse derived periodically from the master clock or transmitter, establishes a locking current in the relay which maintains the supply circuit of the motor normal until the locking circuit of the relay is interrupted by the movement of an element of the clock train, whereupon the motor supply circuit is modified in such manner that the speed of the motor is reduced and the clock train is driven at a reduced speed until a fresh impulse from the master clock re-establishes the relay locking circuit and restores normal conditions in the motor supply circuit.

The electric motor driving the clock and the control of the supply circuit therefor may be of such a character that the motor is stopped completely when the locking circuit of the relay is broken, and is re-started when the said circuit is re-established consequent upon the reception of an impulse from the master clock.

If it is desired to obviate the relatively heavy currents inseparable from re-starting the motor, it may be arranged that the latter should not cease rotating, when the locking circuit of the relay is mechanically interrupted, but should merely slow down for a given time, as for example by arranging that the relay-actuated switch controlling the circuit should not break the motor circuit entirely but cause the insertion of a resistance or produce other change in the motor circuit having the effect of reducing the speed of the motor; or, although the motor supply circuit is broken by the action of the relay consequent upon the interruption of its locking current circuit, the inertia of the rotating parts of the motor assisted or not by a flywheel on its shaft, may cause the latter to rotate at a reduced speed until the receipt of the next energising impulse from the master clock.

The accompanying drawing illustrates diagrammatically a suitable arrangement in accordance with the present invention for synchronising a time recording or indicating mechanism of the character of a large turret clock the hands of which are driven through suitable reducing gear by means of an electric motor running normally at a suitable constant speed, the speed and gear ratio being such as, for example, will drive the minute arbor of the train of wheels at a slightly greater speed than one revolution per minute.

In the drawing 1 represents an electrical motor driving through worm gearing 2 a wheel train indicated by 3, 4. The motor is supplied, through a resistance 8 and preferably also a steadying resistance 9, with current from a source of direct current indicated by circuit terminals 15, 16. A locking relay 10 supplied from the same source of current controls by its contact arms 11, 12 the energising circuit of the relay and a short circuit to the resistance 8. The energising circuit of the locking relay also includes a pair of contacts 6; 7 which are normally closed but are opened periodically by the operation of the wheel train, as for example by means of a cam 5 on the minute arbor of the train, which cam may be adapted, as shown in the drawing, to break the locking circuit of the relay once every half minute. An ordinary or non-locking relay 13 supplied with momentary current impulses from a circuit controlled by the master clock has an armature or contact arm 14 which is connected across the locking circuit contact arm 11 of the relay 10.

Assuming that the contact arms 11, 12 are closed and the motor to be working at its normal speed so that the minute arbor is revolving rather faster than once per minute, the wheel 3 will continue to revolve until the cam 5 opens the contacts 6, 7, thereby breaking the locking circuit of relay 10, so that the latter is de-energised and the contact arms 11, 12 immediately assume the position shown in the fig. The resistance 8 being no longer short circuited, the speed of the motor is reduced and the train will therefore revolve at a slower speed, the cam 5 passing onwards to permit contacts 6 and 7 to close. This condition will hold until the relay 13 is energised by a current impulse from the master clock system through the current terminals 17, 18. This impulse momentarily closes the contact arm 14, thus short circuiting locking contact 11 so that the relay

10 is again energised and the contact arms 11, 12 thereby again shifted to their closed position.

It will thus be seen that the motor is constantly running, but with two speeds, a high and a low. Supposing that the controlling impulses arrive every half-minute, the high speed should carry the clock hands, which are finally attached to the train 3, 4 over the half-minute division of the dial, in a less time than a true half-minute, while the slow speed should advance them over the same distance in a period exceeding a true half-minute. The clock hand will therefore traverse the dial too quickly until the cam 5 operates, when it will begin too slowly, waiting for another impulse to speed it up. Thus each indicated half-minute of the hands' advance will correspond with a true half-minute on the master clock.

One advantage of this arrangement is that a compensating action takes place. If the relative speeds of the high and low speed be adjusted, so that each half-minute's travel of the hand takes place approximately half of it on the high and half of it on the low speed, then if any action such as extra load or a falling off in supply of voltage occurs, the clock as a whole will automatically compensate itself for this by taking more of the high speed and less of the low to cover the half-minute's advance. There will be a converse compensation if anything occurs to speed up the motor.

Another advantage will be noticed, and that is that the whole clock is controlled by instantaneous impulses of exactly the same type as are supplied to an ordinary system, and that both the relays 10 and 13, together with resistances 8 and 9, need not be in or near the clock itself but can be mounted as an independent unit in some other position, such as indoors.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A device for synchronising electrically driven clocks, wherein the speed of the electric motor driving the clock is controlled by means of a locking relay the locking circuit of which is periodically interrupted by the movement of an element of the clock train and is restored by periodically received impulses from the master clock system, substantially as described.

2. A device for synchronising electrically driven clocks, wherein the supply circuit of the electric motor driving the clock is modified so as to reduce the speed of the motor each time that the energising circuit of a locking relay is periodically interrupted by the movement of an element of the clock train, and is restored to normal running conditions when the locking circuit of the relay is re-established consequent upon a current impulse derived from the master clock or transmitter, substantially as described.

3. A device for synchronising electrically driven clocks operating substantially as herein described with reference to the accompanying drawing.

Dated this 29th day of December, 1924.

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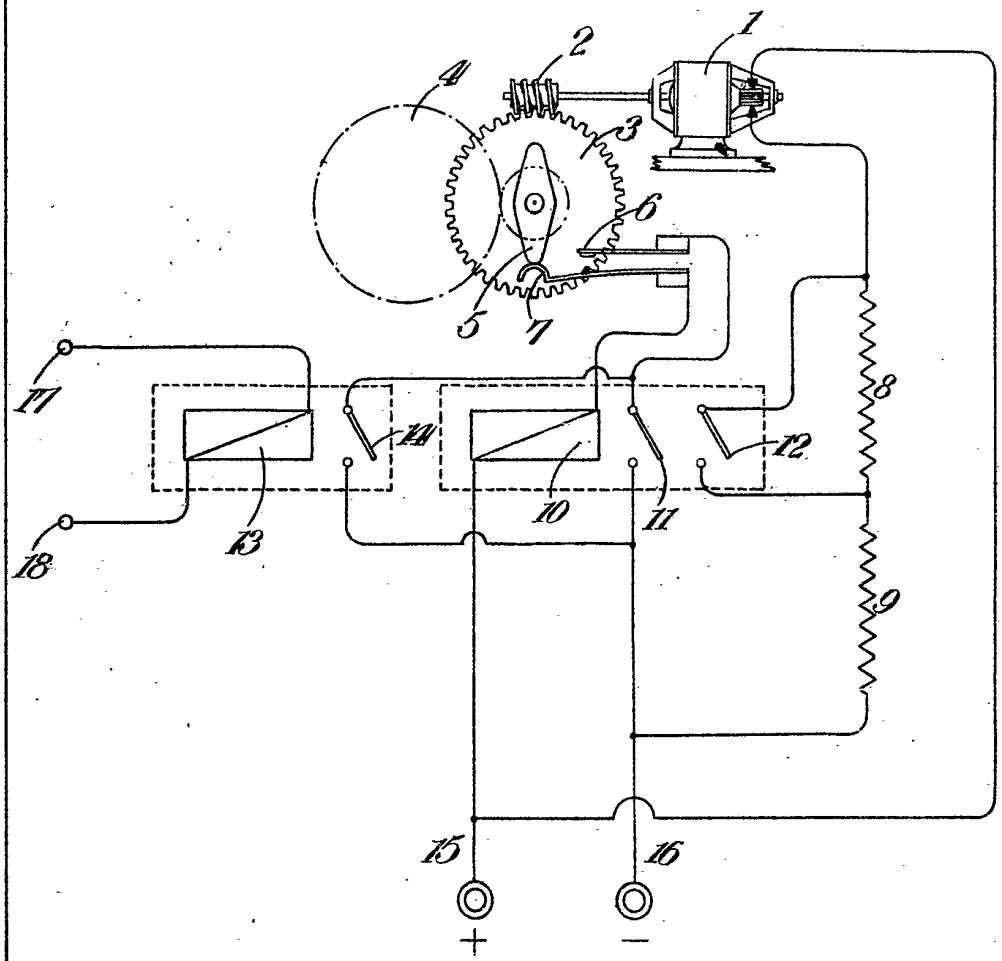
Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1925.

[This Drawing is a reproduction of the Original on a reduced scale.]



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