PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION

Improvements relating to Electrically Driven Clocks

We, GENT & COMPANY LIMITED, a British Company, of Faraday Works, St. Saviour's Road (East), Leicester, and REGINALD SWIFT, a British Subject of 17, The Circle, Crown Hills, Leicester, do hereby declare the nature of this invention to be as follows:—

This invention relates to electrically driven clocks and has particular reference to synchronous motor clocks which are designed to be driven from the domestic supply mains. Unless some special provision is made such clocks depend entirely upon the continuance of the mains supply and if this fails the clocks must inevitably stop. Even if the interruption in the supply is only momentary the rotor of such a clock will fall below the synchronous speed and will not be brought up to the synchronous speed when the supply is continued. Again, the small synchronous motor of the type employed for these clocks is usually not self-starting and an initial starting impulse has to be applied to the rotor in order to restart the motor.

The object of the present invention is to provide a motor clock which will continue to work after interruption of the alternating current supply.

According to the present invention, an electric clock driven normally by an alternating current motor is provided with an additional driving or motor element operated by direct current and which can take up the operation if the alternating current motor temporarily fails. The two motor elements may consist of two rotors mounted on a common spindle, each rotor having a separate field system associated with it. Provision may be made to ensure that on cessation of the alternating current a source of direct current is immediately connected to the field system of the direct current element and also to ensure disconnection of the direct current element, on the alternating current motor resuming its normal activity.

In order that the nature of the invention may be more clearly understood, an electric clock motor constructed in accordance with the invention will now be described by way of example.

[*Price* 1/-]

A supporting framework has mounted upon it two separate and independent laminated field systems, of which the alternating current field is provided with a pair of serrated pole pieces, the serrations forming polar faces which co-operate with similar polar faces at the periphery of a laminated rotor which runs in synchronism with the frequency of the alternating current supply. The field system associated with this rotor is energised by a coil wound upon the laminations and supply leads connected with the coil are provided with a plug to facilitate connection with an alternating current supply socket.

The second laminated field system is also provided with an energising coil which is supplied from a primary battery placed conveniently near or within the casing which houses the clock movement. Polar faces stamped out of the laminations co-operate with polar faces of a second rotor which will be referred to as the direct current rotor or armature, mounted upon the same spindle as the first mentioned rotor but having a lost-motion driving connection with that rotor.

Between the two rotors a toothed contact wheel is mounted to rotate with the direct current rotor and a spring contact finger in circuit with the direct current field bears lightly upon the teeth of this wheel. The spring contact finger is supported from a piece of ebonite attached to the laminated direct current field system and the pressure of the spring finger upon the toothed wheel is adjusted by means of a screw which passes through a brass bracket screw to the piece of ebonite.

The circuit from the primary battery which supplys the energising coil for the direct current field system is as follows:— One pole of the battery is connected to a terminal mounted on the piece of ebonite which carries the spring contact finger and the terminal shank serves to conduct the current to the spring contact finger. The circuit is continued from this finger through the toothed wheel to the spindle and frame-work to which one end of the

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energising coil is also connected. The opposite end of the energising coil is connected to the other pole of the energising battery.

A lever mounted to pivot about a pin projecting from the alternating current field system carries at one end a small electro-magnet armature which is held in contact with the alternating current field system during energisation of the field coil by the alternating current supply. The other end of the pivoted lever carries a small insulating piece which bears against the spring contact finger and forces it out of contact with the toothed wheel. If no alternating current flows in the energising coil the armature of the pivoted lever is forced away from the alternating current field system by the pressure of the spring contact finger which then rests on the toothed wheel and completes the circuit for the direct current field.

The operation of the movement is as follows:—When the coil energising the alternating current field system is connected with the supply mains, the motor will run as an ordinary synchronous clock motor and the pivoted lever will maintain open the circuit of the battery supplying the coil which energises the direct current field system. In the event of failure of the alternating current supply, the circuit of the battery will be completed as described above and the direct current rotor will receive impulses from the direct current field system as the rotor, and with it the toothed wheel, rotates breaking the circuit of the primary battery as the tips of the teeth of the toothed wheel pass the spring contact finger. The polar faces of the direct current field system and the direct current rotor are so desired and spaced relatively to each other that the current impulses caused by the spring contact finger engaging the teeth of the toothed wheel occur as the polar faces approach each other. The direct current motor is designed so that the speed of its rotor is a little higher than the synchronous speed of the alternating current rotor. This ensures that on resumption of the alternating current supply the rotor will step into synchronism as its speed falls.

It will be understood that with the resumption of the alternating current supply, the armature of the pivoted lever will again be attracted to the alternating current field system and the spring contact finger will be raised out of engagement with the toothed wheel, thus breaking the circuit of the primary battery.

Dated this 14th day of July, 1933.
For the Applicants:
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COMPLETE SPECIFICATION

Improvements relating to Electrically Driven Clocks

We, GENT & COMPANY LIMITED, a British Company, of Faraday Works, St. Saviour's Road (East), Leicester, and REGINALD SWIFT, a British Subject of 17, The Circle, Crown Hills, Leicester, do hereby declare the nature of this invention 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 electrically driven clocks and has particular reference to synchronous motor clocks which are designed to be driven from the domestic supply mains. Unless some special provision is made such clocks depend entirely upon the continuance of the mains supply and if this fails the clocks must inevitably stop. Even if the interruption in the supply is only momentary the rotor of such a clock will fall below the synchronous speed and will not be brought up to the synchronous speed when the supply is continued. Again, the small synchronous motor of the type employed for these clocks is usually not self-starting and an initial starting impulse has to be applied to the rotor in order to restart the motor.

The object of the present invention is to provide a motor clock which will continue to work after interruption of the alternating current supply.

According to the present invention, an electric clock driven normally by a synchronous alternating current motor is provided with an additional driving or motor element operated by direct current and having the speed/torque characteristic of a direct current series motor, the additional motor being designed and connected so as to take up the operation of the clock if the alternating current motor temporarily fails. The two motor elements may consist of two rotors mounted on a common spindle, each rotor having a separate field system associated with it. Provision may be made to ensure that on cessation of the alternating current a source of direct current is immediately connected to the

field system of the direct current element and also to ensure disconnection of the direct current element, on the alternating current motor resuming its normal activity.

In a particular form of motor constructed in accordance with the invention, an automatic device is provided for completing the circuit of the field winding of the direct current motor element and includes a pivoted lever carrying an armature controlled by the field magnet of the alternating current motor element; it is designed to actuate directly a contact in the circuit of the field winding of the direct current motor. In this particular form of construction, a contact wheel driven directly by the alternating current or direct current motor element co-operates with a contact brush to control the circuit of the direct current field magnet.

In order that the invention may be more clearly understood and readily carried into effect, an electric motor clock constructed in accordance therewith will now be described in greater detail, by way of example, in connection with the accompanying drawings, in which:—

Figure 1 is a front elevation of a complete clock driving movement,

Figure 2 is an edge view taken from the left of Figure 1 but with certain elements omitted, and

Figure 3 shows diagrammatically the circuit arrangements of the two motors.

Referring to the drawings, the mechanism is provided with a supporting framework 1 which has mounted upon it, by means of spacing posts 2, two separate and independent laminated field systems 3 and 4. The field system 3 provides the alternating current field and is energised by a field coil 55 provided with conducting leads 6 and 7 for connecting by means of a plug, not shown in the drawings, to an alternating current source of supply. The coil 5 is supported on bar-shaped laminations 8 which together form a connecting bridge for the limbs 9 and 10 of the field system 3. The pole pieces 11 and 12 of the field system 3 are formed with serrations 13 forming polar faces which co-operate with similar polar faces 14 at the periphery of a laminated rotor 15 designed to run in synchronism with the frequency of the alternating current supply.

The field system 4 provides the direct current field and is energised by a coil 16 supported by bar-shaped laminations similar to the laminations 8, and is provided with conducting leads 17, 18 connected through a variable resistance 19 shown diagrammatically in Figure 3, to terminals 20. A direct current source, for example, a dry battery or an accumulator contained in the clock casing is connected to the terminals 20, and the variable resistance 19 is also mounted in a convenient position in the casing. The pole pieces 21 and 22 of the field system 4 are also formed with serrations forming polar faces 23 which co-operate with polar faces 24 of a second rotor 25 which acts as the rotor of the direct current motor. The rotor 25 is mounted on a spindle 26, which also carries the rotor 15. There is in fact a lost motion driving connection between the spindle 26 and the rotor 25. The actual form of driving connection is not shown in the drawings but it may take the form of a pin and slot connection, a pin on the spindle 26 having a limited range of movement in a slot formed in the rotor 25 which is otherwise freely mounted on the spindle 26.

Between the rotors 15 and 25, a toothed wheel 27 serving as a contact maker is mounted rigidly on the spindle 26 and a contact brush 28 in the form of a strip spring connected in the circuit of the field coil 16 is mounted so as either to bear lightly on the surface of the wheel 27 or to be held away from that surface, depending upon which of the rotors 25 or 15 is effecting the drive of the clock. The contact brush 28 is clamped between two brass strips 29 and 30, mounted on a block 31 of insulating material, and the pressure due to the strip 30 is controlled by a helical spring 32 and adjustable nut 33 which screws on to a post 34. Further control of the tension of the contact brush 28 is effected by adjustment of the sleeve nut 35, which serves to connect the brass strip 30 with another brass strip 36 secured to the opposite side of the insulating block 31. The sleeve nut 35 screws on to a post 37 secured to the strip 36.

The circuit from the dry battery connected to the terminals 20 of energising coil 16 includes the lead 18, the coil 16, the structure of the laminated field system 4, the bearings in this structure for the spindle 26, the contact wheel 27, the contact brush 28, the brass strips 30 and 36, the lead 17 and the variable resistance 19. The direct current motor provides a type of drive different from that of the alternating current motor in that it has not the characteristic of a synchronous motor that its speed depends only on frequency but the characteristic of a direct current series motor that its speed decreases with increase of load because the contact wheel 27 being on the motor shaft has a similar action to the commutator of an ordinary direct current motor and the speed of the motor depends upon the applied voltage

which can be controlled by adjustment of the resistance 19.

A lever 38 mounted to pivot about a pin 39 projecting from the alternating current field system is provided at its upper end with an armature 40 which, during operation of the mechanism by the alternating current motor, is held in contact with the field magnet of the alternating current field system 3. The lower end of the lever 38 carries a piece of ebonite 41 which bears against the contact brush 28 and forces it away from the contact wheel 27 when the armature 40 is being held against the field system 3. If no alternating current flows in the coil 5, the armature 40 falls away from the alternating current field system 3, the lever 38 pivoting about the pin 39. The contact brush 28 then comes into contact with the contact wheel 27 and completes the circuit of the direct current field energising coil 16.

The operation of the movement is as follows:—

When the coil 55 energising the alternating current field system 3 is connected with the supply mains, the alternating current motor will run as an ordinary synchronous clock motor driving the hands through reduction gearing and the pivoted lever 38 will maintain open the circuit of the battery supplying the coil 16 which energises the direct current field system 4. In the event of failure of the alternating current supply, the circuit of the battery will be completed as described above and the direct current rotor 25 will receive impulses from the direct current field system as the rotor 25, and with it the contact wheel 27, rotates, breaking the circuit of the battery as the contact brush 28 engages the edge of the contact wheel 27. The polar faces of the direct current field system and the direct current rotors are so designed and spaced relatively to each other that the current impulses caused by the contact brush 28 engaging the toothed edge of the contact wheel 27 occur as the polar faces approach each other. It will be understood that with the resumption of the alternating current supply, the armature 40 of the pivoted lever 38 will again be attracted to the alternating current field system 3, and the contact brush 28 will be forced out of engagement with the contact wheel 27, thus breaking the circuit of the battery connected to the terminals 20.

It will be understood that the speed of the direct current motor must be as nearly as possible the same as the speed of the alternating current motor, because otherwise, after a period of operation by the direct current motor, the clock will be slow or fast, depending upon whether the speed of the direct current motor has been less or greater than the synchronous speed of the alternating current motor. On the other hand, it is essential that the alternating current motor should be enabled readily to fall into step with the supply current when taking over the drive from the direct current motor and for this reason it is desirable that the direct current motor should run slightly above the synchronous speed of the alternating current motor. The speed of the direct current motor is therefore carefully set by adjustment of the tension of the contact brush 28, this being effected as previously described and also by adjustment of the variable resistance 19.

Motors of the kind described in this specification are usually not self-starting, and an initial impulse has to be imparted to the driving element. In Figure 2 of the drawings a knob 41 which may be twisted between the thumb and finger, serves to rotate a toothed wheel 42 which meshes with a spur wheel 43 on the rotor spindle 26.

In order to suppress any tendency to sparking between the contact wheel 27 and the contact finger 28, a condenser 43^1 is held between the brass strip 36 and a bracket 44 secured to the framework. The condenser 43^1 is thus connected across the point of contact between the contact wheel 27 and the contact brush 28.

It will be understood that the invention is not limited to the precise form of construction shown in the drawings, and modifications may be made within the scope of the invention as defined by the following claims. Thus it is possible to employ a single field system energised either by the coils 5 or 16, and pole pieces connected in parallel may co-operate with the rotors 15 and 25.

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

1. An electric clock provided with a synchronous alternating current driving motor and in addition, a direct current driving motor or motor element having the speed/torque characteristic of a direct current series motor and being designed and connected so as to take up the operation of the clock on cessation of the alternating current supply to the synchronous motor.

2. An electric clock according to claim 1, in which the rotor of the alternating current motor is mounted on the same spindle as the rotor of the direct current motor.

3. An electric clock according to claim 1 or claim 2, in which the rotors of the alternating and direct current motors have separate field systems associated with them.

4. An electric clock according to any one of the preceding claims, in which an automatic device is provided for completing the circuit of the field winding of the direct current motor on cessation of the alternating current supply, and includes a pivoted lever carrying an armature controlled by the field magnet of the alternating current motor and designed to actuate directly a contact in the circuit of the field winding of the direct current motor.

5. An electric clock according to any one of the preceding claims, in which a contact wheel driven directly by the alternating current or direct current motor co-operates with a contact brush to control the circuit of the direct current field magnet.

6. An electric clock, constructed and designed to operate, substantially as described with reference to the accompanying drawings.

Dated this 5th day of July, 1934.

For the Applicants:
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Fig. 1.

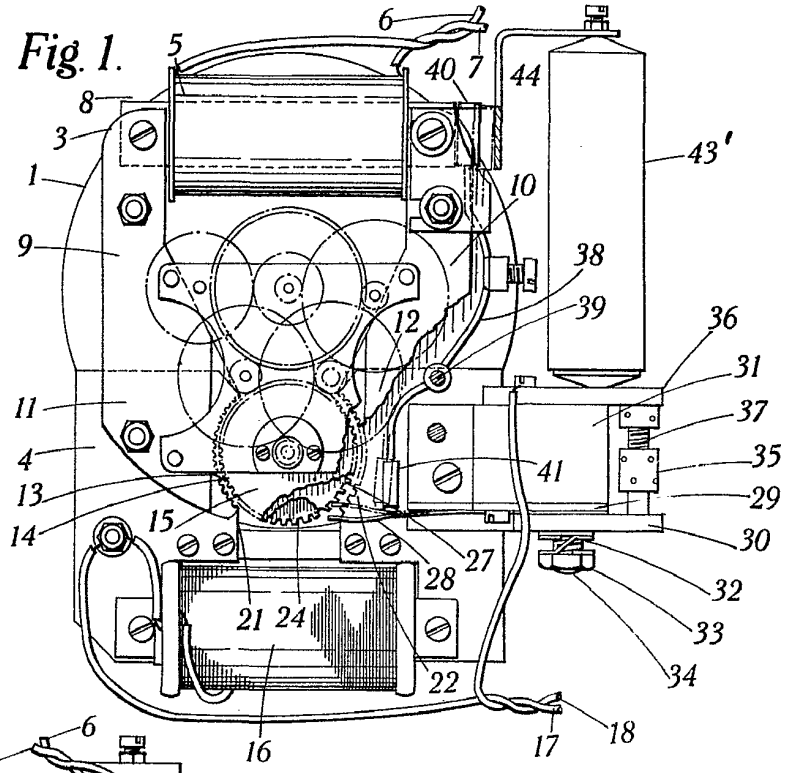


Fig. 2.

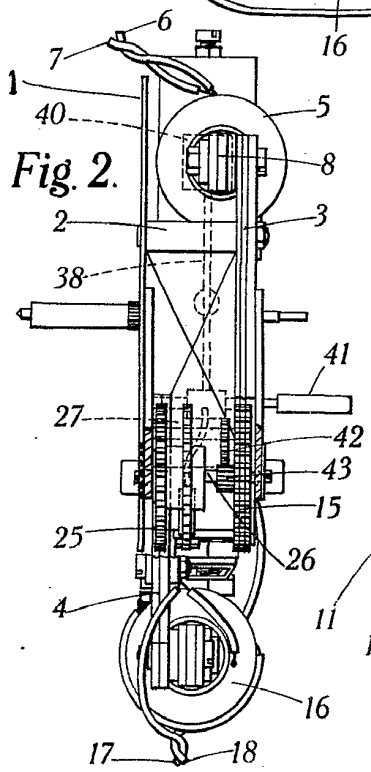
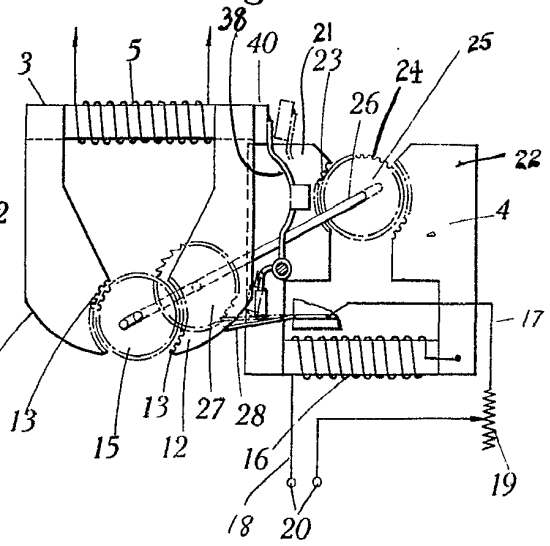


Fig. 3.



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