PATENT SPECIFICATION

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Complete Specification Left: Sept. 20, 1934.

Complete Specification Accepted: April 8, 1935.

PROVISIONAL SPECIFICATION

Improvements in or relating to Electric Synchronous Motors

We, THE LOWNE ELECTRIC CLOCK AND APPLIANCES COMPANY LIMITED, of Boones Street, Lee, London, S.E. 13, a Company organised under the Laws of Great Britain and Northern Ireland, and FREDERICK ROBERT MANN LOWNE, of 42, Manor Park, Lee, London, S.E. 13, a British Subject, do hereby declare the nature of this invention to be as follows:—

This invention relates to electric motors of the alternating current synchronous kind and has for its object to provide an improved small motor of this kind suitable for use with electric clocks and other electrically driven low-power apparatus for which a constant speed is required.

The improved construction of electric motors of the above indicated kind according to our invention comprises a single stator coil wound upon a core terminating at each end in an iron disc provided with a ring of peripheral polar teeth, and an armature in the form of an iron cylinder having within each end a ring of inwardly projecting polar teeth and rotatably supported so as to completely cover the stator coil and to rotate around and co-axially therewith, the upper and lower rings of inwardly projecting polar teeth of the armature rotating in proximity to the upper and lower rings, respectively, of polar teeth of the stator end discs.

In this improved motor the operative parts are so designed and assembled that the electro-magnetic forces produced in operation do not increase the pressure of the armature spindle upon its bearings, or the friction of the drive generally. Owing to the consequent relief of the armature bearings from all friction, in case the supply current should be cut off for a short period and later on be again restored, the armature will continue to run during the interval when the current is cut off, which is a very great advantage in the case of a clock or other apparatus which is required to run continuously at synchronous speed.

In one way of carrying out the invention the same number of inwardly projecting polar teeth is provided on the ring of teeth at each end of the armature cylinder and the same number of outwardly projecting polar teeth is also provided on each end disc of the stator core. But if desired one ring of armature polar teeth may be staggered relatively to the other ring of armature teeth and in this case the two rings of the stator polar teeth are similarly staggered relatively to one another, so as to correspond to the adjacent ring of the armature polar teeth.

The motors will generally be run at synchronous speed, but, if desired, they can be made to run steadily at half synchronous speed.

The invention also includes an improved form of starting device which consists of a small disc of rubber a part of phich is cut straight across to form a flat side. This disc is supported upon a small spindle or rod which projects to the outside of the case of the clock or other apparatus and terminates in a small crank enabling the rubber disc to be rotated against the action of a spring. The spring normally holds the rubber disc with the flat side adjacent, but not touching, the top end of the armature. To start the armature rotating the crank on the end of the spindle is given an impulse in the right direction and is then released, whereupon the periphery of the rubber disc engages the top plate of the armature with sufficient friction to start the motor rotating, and the spring returns the rubber disc to its normal position in which it is clear of the armature.

In one form of the construction of the motor, which has been tested with very good results, the upper end of the armature iron cylinder is closed by a plate of non-magnetic material such as brass, in which the armature spindle is fixed co-axially with the armature and with the stator core. The spindle passes both upwardly and downwardly from the said brass plate, being steadied at its upper end in any convenient form of bracket bearing consisting of non-magnetic material.

At its lower end the armature spindle is supported in a bearing consisting of a tube of brass or the like fixed co-axially with the stator core. The lower end of

[*Price* 1/-]

the spindle is of a smaller external diameter than the internal diameter of the brass tube, so that there is no friction between these two parts, and the lower extremity of the spindle is supported upon an anti-friction step bearing at the lower end of the brass tube.

In the preferred form the stator core is hollow and the entire stator structure, including the coil and end discs, is able to rotate freely on the above-mentioned tube. This construction facilitates the starting of the motor.

The brass tube can be filled with oil at the beginning of the useful life of the clock or other apparatus in which the motor is employed, and the motor will then run for an indefinite period without further lubrication or other attention.

Dated this 7th day of October, 1933.

MEWBURN, ELLIS & CO.,
Chartered Patent Agents,
70 & 72, Chancery Lane, London,
W.C. 2.

COMPLETE SPECIFICATION

Improvements in or relating to Electric Synchronous Motors

We, THE LOWNE ELECTRIC CLOCK AND APPLIANCES COMPANY LIMITED, of Boones Street, Lee, London, S.E. 13, a Company organised under the Laws of Great Britain and Northern Ireland, and FREDERICK ROBERT MANN LOWNE, of 42, Manor Park, Lee, London, S.E. 13, a British Subject, 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 electric motors of the alternating current synchronous kind and has for its object to provide an improved small motor of this kind suitable for use with electric clocks and other electrically driven low-power apparatus for which a constant speed is required.

The alternating current synchronous motor according to the invention comprises a single stator coil wound upon a core terminating at each end in an iron disc provided with a ring of peripheral polar teeth, the entire stator structure including coil and end discs being able to rotate within a limited range upon a supporting pin, and a rotor or armature in the form of an unwound iron cylinder having at each end a ring of inwardly projecting polar teeth and rotatably supported so as to completely enclose the stator coil and core and to rotate coaxially therewith the upper and lower rings of inwardly projecting polar teeth of the rotor rotating in proximity to the upper and lower rings, respectively, of the polar teeth of the stator end discs.

In this improved motor the operative parts are so designed and assembled that the electro-magnetic forces produced in operation do not impose any drag upon the rotor and do not increase the pressure of the rotor spindle upon its bearings nor the friction of the drive generally. Owing to the consequent relief of the rotor, in case the supply current should be cut off for a short period and soon after be again restored, the rotor will continue to run, during the interval when the current is cut off, without the aid of an auxiliary flywheel; which is a very great advantage in the case of a clock or other apparatus which is required to run continuously at synchronous speed.

A constructional form of the improved synchronous motor as used in connection with a mains-driven clock is illustrated as an example in the accompanying drawings, in which:

Fig. 1 is a plan of the framework of the clock lying face downwards;

Fig. 2 is a side elevation of the parts shown in Fig. 1 and illustrating a starting device;

Fig. 3 is a section on the line III—III of Fig. 1 looking in the direction of the arrows;

Fig. 4 is a central sectional view drawn to an enlarged scale of the improved synchronous motor removed from the clock framework;

Fig. 5 is an inverted view of the motor shown in Fig. 4.

Fig. 6 is a section of the rotor on the line VI—VI of Fig. 4 looking in the direction of the arrows.

Referring to the drawing, the stator coil 1, Fig. 4, is wound upon an iron core 2, which terminates at its upper end in an iron disc 3 and at its lower end in an iron disc 4, the upper disc 3 of the stator being provided with peripheral polar teeth 5 and the lower disc 4 being provided with peripheral polar teeth 6. The core 2 is hollow and is passed over and supported upon a hollow stationary pin 7 of brass which terminates at its lower end in an externally screwed portion and, in the completed clock, is secured by a nut 8 upon the brass distance piece 9 arranged between and connecting the lower parts of the clock dial plate 10 and back plate 11, the upper parts of these plates 10 and 11 being fastened together by the brass distance piece 12.

The outer ends of the electric connections 13, 14 for supplying alternating current from the mains to the stator coil 1 are secured to the insulated terminals 15, 16 on the back of the dial plate 10, while their inner ends are passed through a hole 17 formed in the lower end disc 4 of the stator core 2 to be connected to the opposite ends of the stator coil 1.

The rotor or armature consists of the iron cylinder 18, Fig. 4, which is open at the lower end, and the upper end of which is closed by a plate 19 of brass or other non-magnetic material. The plate 19 carries the spindle 20 of the rotor which is fixed therein coaxially with the rotor cylinder 18 and with the stator core 2. The lower end of the spindle 20 passes into the hollow pin 7 which supports the stator, while the upper part of the spindle 20 extends upwards and is steadied in a suitable bearing in the upper distance piece 12 of the clock framework. This upper part of the rotor spindle 20 carries a small worm 21 from which the clockwork is driven when in operation.

Within the upper end of the rotor cylinder 18 a set of inwardly projecting peripheral polar teeth 22 is formed so as to come, when placed in operative position, opposite to the upper set of peripheral polar teeth 5 on the disc 3 of the stator. Within the lower end of the rotor cylinder 18 a second set of inwardly projecting peripheral polar teeth 23 is arranged so as to rotate immediately opposite to the set of peripheral polar teeth 6 on the lower iron disc 4 of the stator.

The lower end of the armature spindle is supported in a bearing within the hollow stationary pin 7 supporting the stator. The lower end of the rotor spindle is made of a smaller external diameter than the internal diameter of the said brass tube 7, and the lower extremity of the spindle is supported upon an anti-friction step bearing at the lower end of the said brass tube.

The stator core is hollow and the entire stator structure including the coil and end discs is able to rotate upon the supporting pin 7 the rotation being restricted by friction and limited by the conducting leads. This construction relieves the moving parts of friction and facilitates the starting of the motor.

The invention also includes an improved form of starting device consisting of a lever 24 which is best seen in Fig. 3, this lever being pivoted at 25 in a brass support 26 secured at the back of the clock dial plate 10. At or near one end of the lever 24 a small disc 27 of rubber or the like is secured while the opposite end is held in the inoperative position by means of a tensile spring 28 secured to the back of the clock dial plate 10. In the middle part of the lever 24 a press-pin 29 is pivoted and projects towards the back of the clock through a hole in the back plate 11 of the framework. In order to start the motor the pin 29 is pushed inwards until the rubber disc 27 presses against the upper edge of the rotor 18 in opposition to the action of the spring 28. On releasing the pin 29 the spring 28 jerks the lever 24 towards the back of the clock and gives a rotary impulse to the rotor 18 of the motor, thus calsing the motor to start. If current is now supplied to the motor the latter will continue to rotate at synchronous speed.

As an alternative way of operating the starting device, particularly useful for a clock supported at a height at which the press-pin 29 is inaccessible, the lever 24 can be pulled inwards by means of a depending cord or wire 30, the upper end of which is passed through an eye on the free end of the lever 24 and is then fastened to any suitable fixed point 31 on the back of the clock dial plate 10, the depending end of the cord being provided with a button or the like 32 to facilitate manipulation. On the cord or wire being pulled the end of the lever 24 is pulled to the right as seen in Fig. 3 until the rubber disc 27 presses against the rotor 18 and on the button 32 being released the spring 28 acts upon the lever 24 to give a starting impulse to the rotor 18 as before.

The arrangement of two polar toothed discs at each end of the stator core facilitates the passage of the magnetic flux to the corresponding polar toothed rings at each end of the rotor cylinder, the magnetic field passing through the rotor cylinder. In this arrangement the path for the magnetic flux is through the entire circumference of both poles simultaneously and no loss arises from unutilised rotor teeth or from flux passing from the stator to the rotor otherwise than by way of the toothed stator end discs.

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 alternating current synchronous motor, comprising on a supporting pin a single stator coil wound upon a core terminating at each end in an iron disc provided with a ring of peripheral polar teeth, the entire stator structure including coil and end discs being able to rotate within a limited range upon a supporting

pin, and a rotor or armature in the form of an unwound iron cylinder having at each end a ring of inwardly projecting polar teeth and rotatably supported so as to completely enclose the stator coil and core and to rotate coaxially therewith, the upper and lower rings of inwardly projecting polar teeth of the rotor rotating in proximity to the upper and lower rings, respectively, of the polar teeth of the stator end discs.

2. Improved electric motor according to claim 1 applied to a mains-driven clock constructed substantially as described and illustrated in the accompanying drawings.

3. An electric motor as claimed in claim 1 having a starting device arranged and operated substantially as described and illustrated in the accompanying drawing.

Dated this 20th day of September, 1934.

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Chartered Patent Agents.

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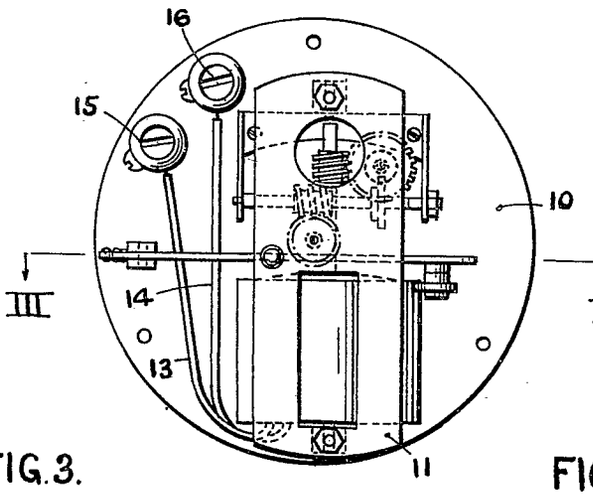


FIG. 1.

FIG. 3.

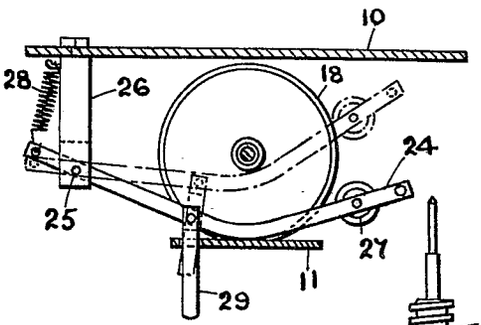


FIG. 2.

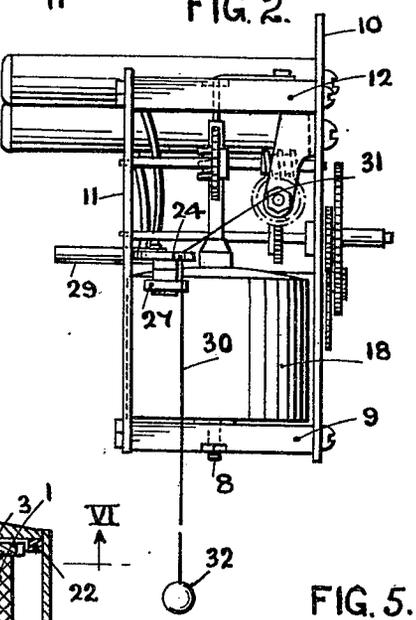


FIG. 4.

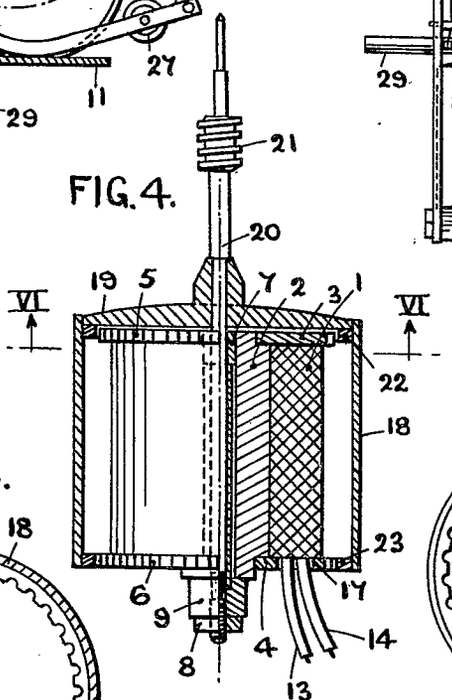


FIG. 5.

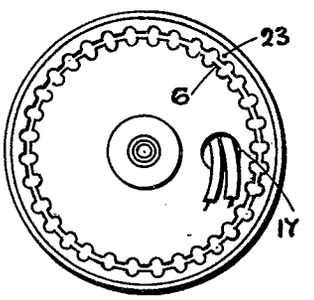
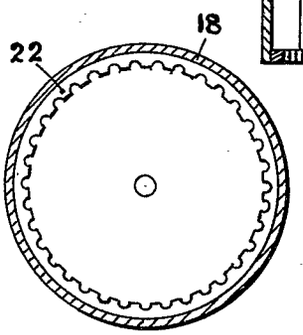


FIG. 6.



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