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PROVISIONAL SPECIFICATION.

Improvements in Electric Clocks and like Mechanisms.

I, GEORGE BENNETT BOWELL, of 116, Northdown Road, Margate, in the County of Kent, Electrical Engineer, do hereby declare the nature of this invention to be as follows:—

This invention for improvements in electric clocks and like mechanisms has for its object a magneto electrical arrangement for giving a definite step by step motion for electrical dials and other purposes that on receipt of an electric current shall start a step that shall be positively completed by the magnetic action on the cessation of the current.

In one way of carrying out this invention an armature, approximately of double cam shaped contour, is mounted on an arbor and is surrounded by four pole pieces. Alternate pole pieces are in magnetic connection with wound cores and a yoke, said parts forming the electromagnet which is arranged to receive periodic currents timed by a master clock; and the other alternate pole pieces are in magnetic connection with a permanent magnet.

The action of the apparatus is as follows:—Upon sending current through the winding of the electric magnet the magnetic field normally due to the permanent magnet becomes distorted, neutralised, and overpowered and the cam shaped armature is therefore rotated till its new position presents its minimum air gap to the poles of the electro magnet and upon cessation of the current the armature is similarly turned forward under the influence of the permanent magnet alone. Thus it will be seen that the armature performs one half revolution for each current transmitted by the master clock, this being usually effected at each half minute. Overshooting is not possible owing to the fact that the armature is always being held in a magnetic field, *i.e.* normally that due to the permanent magnet and—whilst moving—that due to the electro-magnet. The contour of the armature is such that although neither permanent nor electro-magnet are required to rotate it through more than 90°, yet either are able to rotate it through 120°, hence a "positive" action is secured. The contour of the armature is so graded as to secure practically a uniform torque on the armature arbor throughout each quarter turn. The arbor is geared by pinions and wheels, worm and wheel and/or other convenient gearing to the minute and hour hands for use as an electric clock.

Dated this 7th day of September, 1909.

WHEATLEY & MACKENZIE,
40, Chancery Lane, London, W.C.,
Agents.

COMPLETE SPECIFICATION.

Improvements in Electric Clocks and like Mechanisms.

I, GEORGE BENNETT BOWELL, of Bank Buildings, Northdown Road, Margate, in the County of Kent, Electrical Engineer, do hereby declare the nature of

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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 for improvements in electric clocks and like mechanisms has for its object a magneto electrical arrangement for giving a definite step by step motion for electrical dials and other purposes that on receipt of an electrical current shall start a step that shall be positively completed by the magnetic action on the cessation of the current.

In a practical way of carrying out this invention, an armature, approximately of double cam shaped contour is mounted on an arbor and surrounded by four pole pieces. Alternate pole pieces are in magnetic connection with wound cores and a yoke, said parts forming the electro-magnet which is arranged to receive periodic currents timed by a master clock; and the other alternate pole pieces are in magnetic connection with a permanent magnet.

Referring to the accompanying drawings,

Figure 1 is a front view of the mechanism,

Figure 2 is a side view of the same, and

Figure 3 is a view showing only the armature and its adjacent magnetic parts.

Referring to Figures 1 and 2, the plate *a* carries a train of wheels on arbors *b*, *c*, *d* and *e*; the rear ends of these arbors are pivoted in a bridge *f*, *f* supported on pillars behind the screws *g*, *g*, the front ends of said pillars being fixed to the plate *a*; the front ends of the arbors *b* and *c* are pivoted in the plate *a*; the front end of arbor *d* rotates in a bearing fixed to the plate *a*; and this arbor *d* carries the minute hand. The front end of the arbor *e* is pivoted in a bridge *k* and a pinion *l* on this arbor gears with the wheel *m*. This wheel *m* is integral with the pipe *h* which rotates on the fixed bearing through which the spindle *d* passes. The wheel *m* is held in place by a bridge m^1.

The numbering of the wheels and pinions is such as to give the desired motion to the arbor *d*, and the wheel *m* for each operation of the armature which is fixed to arbor *b*; as for example arbor *b* may carry a pinion of 8 leaves gearing with a wheel of 60 teeth on arbor *c*, which arbor also carries a pinion of 8 leaves to gear with a wheel of 64 teeth mounted upon arbor *d*; thus half a revolution of arbor *b* would move the minute hand attached to arbor *d* a distance representing half a minute on the clock dial. The arbor *d* may also carry a pinion of 16 leaves gearing with a wheel of 48 teeth upon arbor *e*, which arbor also carries a pinion of 14 teeth to gear with wheel *m* which would have 56 teeth so that the hour hand would be driven at one twelfth the rate of the minute hand.

The magnetic parts consist of a permanent magnet *n* with an adjustable keeper *o*, *o*, whereby its effective strength may conveniently be adjusted, and this magnet *n* is fixed against two opposite pole pieces, one of which is seen at *p*. The yoke *q* and the wound cores *r*, *r*, form the electro magnet which is fixed against the other two opposite pole pieces, one of which is seen at *s*.

Referring to Figure 3, the armature *t* is pivoted within the pole pieces *s*, *p*, s^1, and p^1; the pole pieces *p* and p^1 are always magnetised and when, as normally, the electro-magnet is not energised the armature is held in the position shown in Figure 3, though when pole pieces *s* and s^1 are magnetised by the operating current being sent through the windings *r*, *r*, the magnetic field normally due to the permanent magnet *n* becomes distorted, neutralised, and then over-powered and the cam shaped armature *t* is therefore rotated till its new position presents its minimum air gap to the poles *s*, s^1, of the electro-magnet, and upon cessation of the current the armature is similarly turned forward under the influence of the permanent magnet alone.

Thus it will be seen that the armature performs one half revolution for each current transmitted by the master clock, this being usually effected at each half minute. Faulty action due to residual magnetism in the armature is avoided because the armature is alternately magnetised in the contrary senses, wear on

the pivoting of the armature is minimised because the magnetic pull is balanced, that is, the turning effort is a pure couple, silent action is obtained because there are no mechanical locking or driving parts to strike together, and over-shooting is not possible owing to the fact that the armature is always being held in a magnetic field, *i.e.* normally that due to the permanent magnet and—whilst moving—that due to the electro-magnet. The contour of the armature is such that although neither permanent nor electro-magnet are required to rotate it through more than 90°, yet either are able to rotate it through 180°, hence a "positive" action is secured, the permanent magnet acting to carry the armature past that position which would be a dead centre if the electro-magnet only were acting, when said electro-magnet ceases to act. The contour of the armature is so graded as to secure practically a uniform torque on the armature arbor throughout each quarter turn.

It will be understood that my invention is not limited in its application to electric clocks, it could be used for any other mechanisms in which a controlled step-by-step motion is required, such as revolution counters and workmen's time recorders; and it could also be used as a synchroniser for cinematograph and phonograph apparatus, each being driven by one of these appliances and both actuated from the same driver.

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. In an electro-magnetic mechanism for electric clocks or like purposes, a double cam-shaped armature operated upon in turn by an electro-magnet and a permanent magnet whereby a definite turning effect is produced throughout the whole of its cycle.

2. In an electro-magnetic mechanism for electric clocks or like purposes, a permanent magnet and intermediate pole pieces in conjunction with an electro-magnet acting upon a double cam-shaped armature whereby upon cessation of the magnetic pull exerted by the electro-magnet the permanent magnet acts to carry the armature forward past that position which would otherwise be a dead-centre.

3. In electric clock and like mechanisms the apparatus as particularly described with reference to the drawings.

Dated this 7th day of March, 1910.

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Fig. 1.

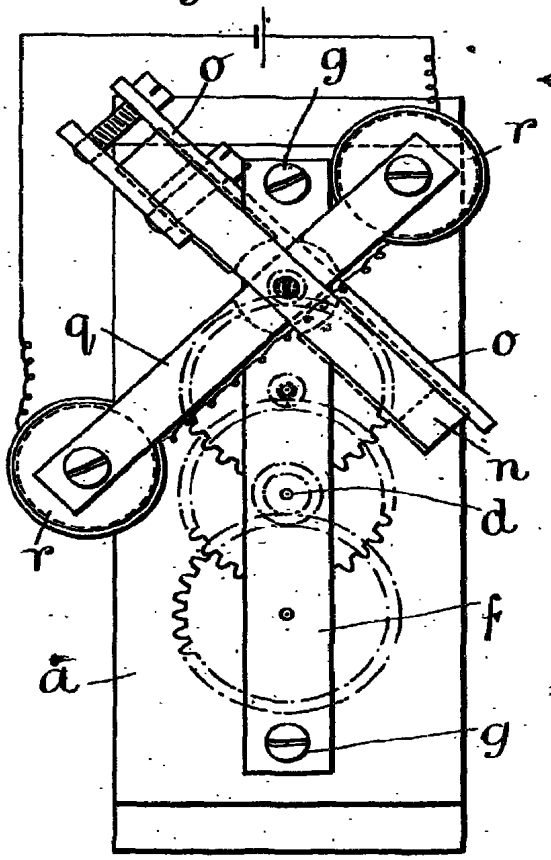


Fig. 2.

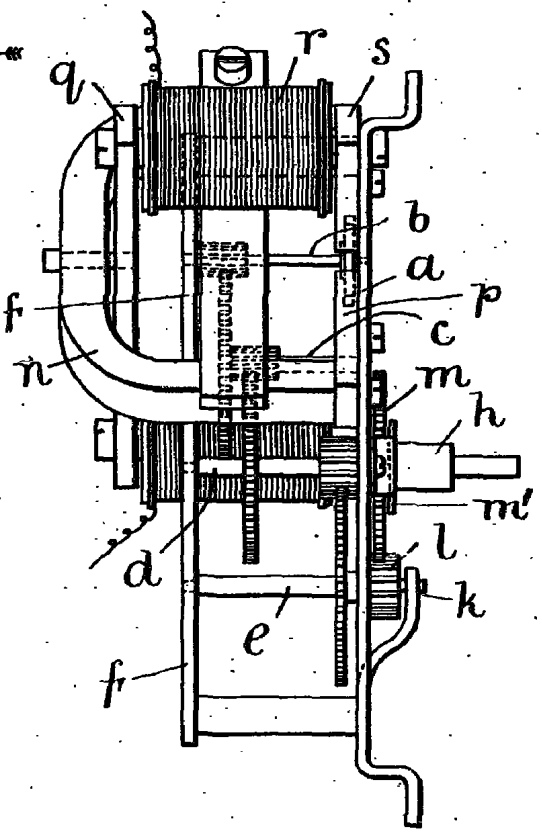
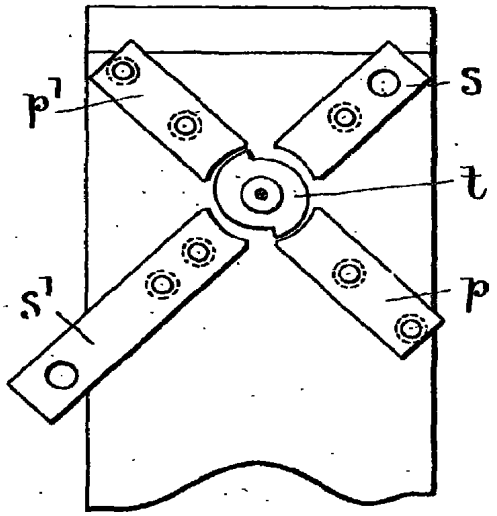


Fig. 3.



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