N° 5758 A.D. 1905

Date of Application, 18th Mar., 1905

Complete Specification Left, 18th Oct., 1905—Accepted, 15th Feb., 1906

PROVISIONAL SPECIFICATION.

Improvements in Secondary Electric Clocks and the like.

I, GEORGE BENNETT BOWELL, of 5 Palmer Street, in the City of Westminster, Electrical Engineer, do hereby declare the nature of this invention to be as follows:—

Whereas considerable difficulty has hitherto been met with in the matter of electro-magnetically operated secondary electric clocks or such like step-by-step movements owing to the jerky action of the electro-magnets and/or of the faulty performance of pawls and ratchet-work acting upon ratchet-wheels. Also such contrivances even when constructed to work with comparative success have at best been subject to an objectionable degree of noisiness. This, my invention, relates to a new and improved electro-magnetic step-by-step action especially suited for use as an indicator dial movement in an electric clock system; its action is rendered silent owing to the total absence of pawls or click-work and owing to the comparative slow action of the electro-magnet—this slowness also being advantageous in that it results in greater efficiency of the system by increasing the time and diminishing the rate of performing the work: Moreover in my new and improved action it is possible to provide an ample margin of power to turn the hands without resulting in undue wear of the parts or of the objectionable noise of operation.

For the sake of clearness but without wishing to bind myself to detail to the exclusion of modifications which would result in substantially the same arrangement I will describe my present invention in one form: I provide an armature which is of a double cam shape formed approximately by two symmetrical eccentric portions of circumference and having two smaller parts of the circumference cut away, this armature is pivotally mounted in the field of an electro-magnet in such a manner that upon excitation of the magnet the armature is turned through about three-eighths of a revolution. The armature arbor is provided with two pins parallel to the axis and symmetrically disposed therefrom, and the arbor itself is cut away adjacent to these pins. A wheel connected in the usual manner to the minute hand and having sixty or other suitable number of teeth is so placed as to allow these pins in turn to drive the wheel, the "depth" of this combination being such that the wheel is always engaged by one if not both of the pins, and the armature is secured to its arbor in such a phase as to leave the two pins engaging the wheel in the normal condition. In this way the wheel is locked so that no tendency of the wheel to rotate can then be transmitted to turn the armature. Another electro-magnet is also provided for the purpose of raising a spring or lever or equivalent device away from the two pins so as to leave the armature perfectly free to be rotated by its field magnet, this spring or lever, upon its controlling magnet (which I will call for the purpose of distinction the "locking magnet") ceasing to be magnetised, is adapted to carry forward the armature arbor about one-eighth of a turn and there hold it in readiness for the next periodic operating signal. In a modified form I may omit the "locking magnet" and provide that the spring or lever above described may be operated by some part of the field magnet being made movable in such manner that upon excitation both functions are effected by the

[*Price* 8*d*.]

one so modified magnet, or the same magnet may have an extra armature across its pole pieces duly proportioned so as not to unduly handicap the magnetisation and attraction of the driving armature, or I may merely employ a spring acting upon a suitably shaped cam on the armature arbor so that during the three-eighth forward movement of the armature the spring is raised and can thus upon cessation of the signal drive the armature forward; also I may employ gear wheels, or a worm gear in place of the two pins above described.

Dated this 18th day of March, 1905.

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

COMPLETE SPECIFICATION.

Improvements in Secondary Electric Clocks and the like.

I, GEORGE BENNETT BOWELL, of 5 Palmer Street, in the City of Westminster, Electrical Engineer, 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:—

Whereas considerable difficulty has hitherto been met with in the matter of electro-magnetically operated secondary electric clocks or such like step-by-step movements owing to the jerky action of the electro-magnets $\frac{\text{and}}{\text{or}}$ of the faulty performance of pawls and ratchet-work acting upon ratchet-wheels. Also such contrivances even when constructed to work with comparative success have at best been subject to an objectionable degree of noisiness. This, my invention, relates to a new and improved electro-magnetic step-by-step action especially suited for use as an indicator dial movement in an electric clock system; its action is rendered silent owing to the total absence of pawls or click-work and owing to the comparatively slow action of the electro-magnet—this slowness also being advantageous in that it results in greater efficiency of the system by increasing the time and diminishing the rate of performing the work. Moreover in my new and improved action it is possible to provide an ample margin of power to turn the hands without resulting in undue wear of the parts or of the objectionable noise of operation.

For the sake of clearness but without wishing to bind myself to detail to the exclusion of modifications which would result in substantially the same arrangement I will describe my present invention in one form: I provide an armature which is of a double cam shape formed approximately by two symmetrical eccentric portions of circumference and having two smaller parts of the circumference cut away. This armature is pivotally mounted in the field of an electro-magnet in such a manner that upon excitation of the magnet the armature is turned through about three-eights of a revolution. The armature arbor is provided with two pins parallel to the axis and symmetrically disposed therefrom; and the arbor itself is cut away adjacent to these pins. A wheel connected in the usual manner to the minute hand and having sixty or other suitable number of teeth is so placed as to allow these pins in turn to drive the wheel; the "depth" of this combination being such that the wheel is always engaged by one if not both of the pins, and the armature is secured to its arbor in such a phase as to leave the two pins engaging the wheel in the normal condition. In this way the wheel is locked so that no tendency of the wheel to rotate can then be transmitted to turn the armature. Another electro-magnet is also provided

for the purpose of raising a spring or lever or equivalent device away from the two pins so as to leave the armature perfectly free to be rotated by its field magnet. This spring or lever, upon its controlling magnet (which I will call for the purpose of distinction the "locking magnet") ceasing to be magnetised, is adapted to carry forward the armature arbor about one-eighth of a turn and there hold it in readiness for the next periodic operating signal. In a modified form I may omit the "locking magnet" and provide that the spring or lever above described may be operated by some part of the field magnet being made movable in such manner that upon excitation both functions are effected by the one so modified magnet, or the same magnet may have an extra armature across its pole pieces duly proportioned so as not to unduly handicap the magnetisation and attraction of the driving armature, or I may merely employ a spring acting upon a suitably shaped cam on the armature arbor so that during the three-eighth forward movement of the armature the spring is raised and can thus upon cessation of the signal drive the armature forward. Also I may employ gear wheels, or a worm gear in place of the two pins above described.

In the accompanying illustrations, Fig. 1 shows the complete mechanism, and Figs. 2 shows an alternative method of constructing a part.

In Fig. 1 the electro-magnet comprises a pair of bobbins *a a* whose interior iron cores are continued in the pole pieces *b b b b* which embrace the armature *c*, also the armature *d*. The armature *c* is mounted upon an arbor with pinion *e*, meshing with wheel *f* which in turn also gears with the centre wheel *g*. These parts are pivoted between the plate *j j* and the plate *k* (shown dotted), pillars *l l l* being provided to support the plate *k*. The armature *d*, which is pivoted at *h*, has attached to it the lever *m*, whose upper end is shaped as shown to engage with the two pins *n n*; *p* is a "banking" spring, which is fixed on the lever *m*.

The action of the apparatus is as follows:—Upon the electro-magnet being excited the armature *d* is drawn up, and the lever *m* consequently moves to the left away from the pins *n n* on armature *c*. Armature *c*, as soon as it is thus unlocked, rotates (counter-clockwise in Fig. 1) on account of its shape until it has moved through nearly half a revolution and presents its maximum diameter to the magnetic circuit. Upon cessation of the magnetising current the armature *d* falls by its own weight and lever *m* in returning to its normal position completes the exact half revolution of armature *c*, and prevents further movement in either direction.

Referring to Fig. 2, which shows another alternative method of carrying out my invention. The electro-magnet comprises a pair of bobbins *a a*, whose interior iron cores are continued in the pole pieces *b b* at their top ends and are connected by the iron yoke b^1 at their lower ends. The pole pieces *b b* embrace the armature *c* which is mounted upon an arbor with pinion *e* meshing with wheel *f* which in turn also gears with the centre-wheel *g*. These parts are pivoted between plates spaced by the pillars *l l l*. The pinion *e* has two of its opposite leaves or pins provided longer than the others and a spring *m* is fixed as shown in such a manner as to always bring armature *c* into the position shown after it has been released by the breaking of the electrical circuit at the master clock.

The action of the apparatus is as follows:—Upon the electro-magnet being excited, armature *c* is rotated (counter-clockwise in Fig. 2) on account of its shape until it has moved through nearly half a revolution and presents its maximum diameter to the magnetic circuit. Upon cessation of the magnetising current the resilient spring *m* which had previously been deflected by the turning of armature *c*, in returning to its normal position completes the exact half revolution of armature *c*, and therefore holds the train of wheels in that position until the next periodic working current causes a repetition of this cycle of operations.

The spring *m* may be substituted by a weighted lever, or a lever deflected by

a spiral spring in tension; the operation remains precisely the same as above described.

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. The electro-magnetic rotary step-by-step device, consisting of an electro-magnet, an iron disc with shaped projections or contour mounted to rotate in the field of the electro-magnet on the make of the electrical controlling circuit, and an all-or-nothing device that on the break of the electrical circuit moves the disc further forward so as to bring it in its most favourable starting position for the next similar cycle of operation.

2. The electro-magnetic rotary step-by-step device, consisting of an electro-magnet, an iron disc with shaped projections or contour mounted to rotate in the field of the electro-magnet on the make of the electrical controlling circuit, a locking detent or all-or-nothing device and an additional armature operating the locking device to bring the disc in its most favourable starting position for the next similar cycle of operation.

3. The electro-magnetic rotary step-by-step device, consisting of an electro-magnet, an iron disc with shaped projections or contour mounted to rotate in the field of the electro-magnet on the make of the electrical controlling circuit, and a spring all-or-nothing device to bring the disc in its most favourable starting position for the next similar cycle of operation.

4. The improved electric clock substantially as described with reference to the drawings.

Dated this 18th day of October, 1905.

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

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BOWELL'S Complete Specification.

(1 SHEET)

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

Fig. 1.

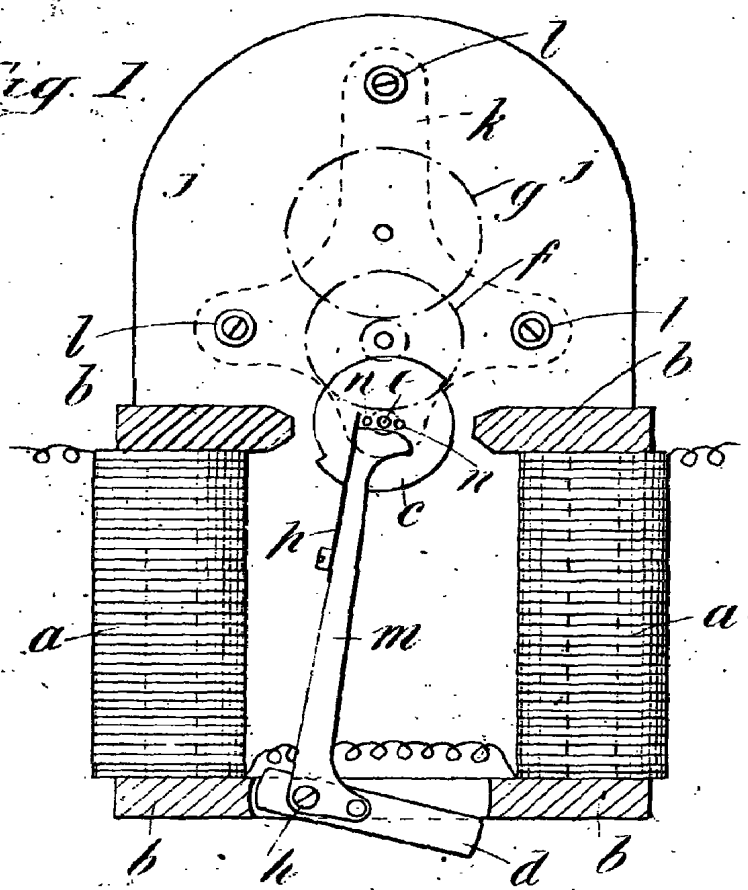
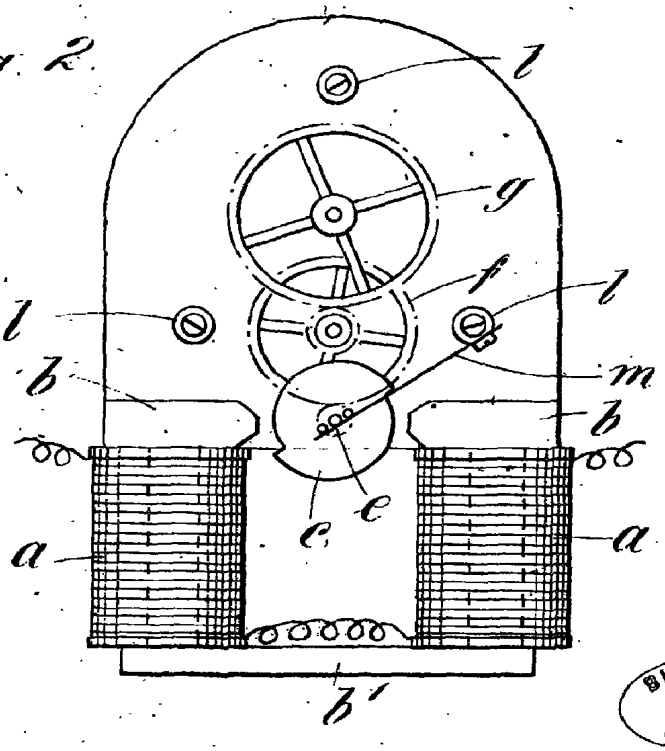


Fig. 2.



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