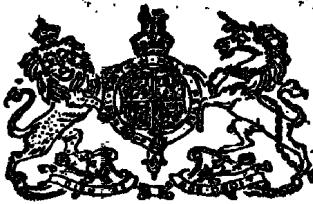


N° 8039



A.D. 1911

*Date of Application, 30th Mar., 1911*

*Complete Specification Left, 20th May, 1911—Accepted, 1st Apr., 1912*

#### PROVISIONAL SPECIFICATION.

#### Improvements in Electro Magnetic Step by Step Mechanism for Electric Clocks and other purposes.

We, HERBERT TAYLOR WAKE BOWELL and GEORGE BENNETT BOWELL, of 192, Goswell Road, in the County of London, Electric Clock Manufacturers, do hereby declare the nature of this invention to be as follows:—

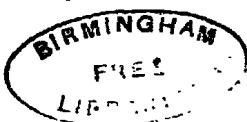
5 Bowell's Patent 20,496 of 1909 described an electro-magnetic step by step apparatus in which an electro-magnet and a permanent magnet act in turn upon a double cam-shaped armature pivoted between the magnetic poles and this invention has for its object to increase the turning movement of such step by step action and consists in employing two armatures mounted on the driving arbor and each acting in turn, and one operated by an electric magnet and 10 the other by a permanent magnet that is neutralised by coils in circuit with the electric magnet so that as in my previous patent the driving arbor is positively rotated throughout a whole step on the completing and cessation of the current and is held locked by the permanent magnet when not being operated.

15 The worm wheel of the clock train is mounted upon an arbor and driven by a worm on an arbor which also carries two armatures one at either end and adapted to rotate within the pole pieces of an electric magnet and a permanent magnet respectively. The contour of the internal faces of the pole pieces of the magnets being such as to produce upon magnetisation a turning effort extending through more than 90 degrees, the variation of this contour from an arc 20 of a circle concentric to the driving arbor may also be so determined and formed as to equalise in each advancing position of the armature the torque which would otherwise tend to increase with the decreasing reluctance of the magnetic circuit as described with reference to Patent No. 5758/05 and No. 20,496/09. The 25 armatures are made of suitable section and preferably of contour concentric to the driving arbor though they may have a graded contour as described in Specifications 5758/05 and 20,496/09 in which case the pole pieces need not have other than concentric contours and would preferably extend for but a small angular length about the armatures.

30 The action of the apparatus is as follows:—

When a current is sent through the coil of the electro-magnet a torque is exerted upon the driving arbor of the action of the electro-magnet, and at the same epoch the magnetic pull on the armature in the field of the permanent magnet is relaxed by reason of the demagnetising coil in circuit with the electro-magnet. The armatures and the driving arbor therefore advance through an angle of 90 degrees and are there held until the epoch of cessation of current which results in a dying away of the magnetic flux across the pole pieces of the electro-magnet and a corresponding and simultaneously occurring rise in the magnetic flux across the pole pieces of the permanent magnet, 35 thereupon the driving arbor, is advanced a further 90 degrees, and there held until the next occasion of repeating the cycle of operations. This 40 usually occurring at each half minute in an electric clock system the actuating current being transmitted by a master clock. The same

[Price 8d.]



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mechanism can, with the addition of a contact device actuated by the rotation of the driving arbor, be employed for other purposes such as for the periodic winding up of a spring or weight for driving a clock or for the purpose of providing a convenient form of motor for driving other small mechanisms. The demagnetising coil may for some purposes be omitted in which case the action of the apparatus remains substantially as above described excepting that the field due to the permanent magnet is not relaxed but its armature is forcibly advanced by the pull of the electro-magnet's armature. 5

The arrangement of mechanical parts is described in the above form for the sake of clearness but we do not bind ourselves to its use to the exclusion of other modifications to secure the same result. 10

Dated this 30th day of March, 1911.

WHEATLEY & MACKENZIE,  
40, Chancery Lane, London, W.C.,  
Agents. 15

## COMPLETE SPECIFICATION.

**Improvements in Electro Magnetic Step by Step Mechanism for Electric Clocks and other purposes.**

We, HERBERT TAYLOR BOWELL and GEORGE BENNETT BOWELL, of 192, Goswell Road, in the County of London, Electric Clock Manufacturers, do 20 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:—

In Bowell's Patent No. 20,496 of 1909 an electro magnetic step by step mechanism is described in which an electro-magnet and a permanent magnet 25 act in turn upon a double cam shaped armature pivoted between magnetic poles and this invention has for its object to increase the turning moment of such step by step mechanism and consists in employing two armatures mounted on the driving arbor and each acting in turn, and one operated by an electro-magnet and the other by a permanent magnet that is adapted to be neutralised by coils 30 in circuit with the electro-magnet so that as in the previous Patent No. 20,496/09 the driving arbor is positively rotated throughout a whole step on the completion and cessation of the current and held locked by the permanent magnet when not being operated.

One method of carrying out this invention is clearly shewn in the accompanying sheet of illustrative drawings in which:— 35

Fig. 1 is an elevation of the step by step apparatus according to this invention.

Fig. 2 is an elevation of one armature and pair of pole pieces.

Now according to this invention the driving arbor *a* and the armatures *b* and *c* are mounted to rotate between the two pairs of pole pieces *d* *d'* and *e* *e'*. 40

Figure 2 shows a side elevation of the pole pieces *d* *d'* and the armature *b* mounted upon the arbor *a*. The contour of the internal faces of the pole pieces is such as to produce upon magnetisation, a turning effort extending through more than 90 degrees. The variation of this contour from an arc of a circle concentric to the arbor *a* may also be so determined, and formed as to equalise, in each advancing position of the armature *b*, the torque which would otherwise tend to increase with the decreasing reluctance of the magnetic circuit. The armatures *b* and *c* are made of suitable section and preferably of contour concentric to the arbor *a* though they may have a graded contour as described in Specifications 3758/05 and 20,496/09 in which case the pole pieces *d* *d'* 45 and *e* *e'* 50

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and  $e\ e^1$  need not have other than concentric contours and would preferably extend for but a small angular length about the armatures.

The electro magnet  $f$  is provided with magnetising coils  $g\ g^1$  and is connected to the pole pieces,  $e\ e^1$ .

5 The permanent magnet  $h$  is provided with a demagnetising coil  $i$  whilst its poles are connected to the pole pieces  $d\ d^1$ . The coils  $g\ g^1$  and the coil  $i$  are connected in series and the current is passed through them in such a direction that magnetises the field of the magnet  $f$  and demagnetises the field of the magnet  $h$ . The armatures are arranged at right angles on the arbor  $a$  and 10 normally the armature  $b$  is held locked by the poles  $d\ d^1$  of the permanent magnet  $h$ .

The action of the apparatus is as follows:—

When a current is sent through the coil  $g$  of the electro-magnet  $f$  a torque is exerted upon the driving arbor  $a$  by the action of the electro-magnet  $f$ , and 15 at the same epoch the magnetic pull on the armature  $b$  in the field of the permanent magnet  $h$  is relaxed by reason of the demagnetising coil  $i$  in circuit with the electro-magnet. The armatures  $b$  and  $c$  and the driving arbor  $a$  therefore advance through an angle of 90 degrees and are there held until the epoch of cessation of current which results in a dying away of the magnetic flux 20 across the pole pieces  $e\ e^1$  of the electro-magnet  $f$  and a corresponding and simultaneously occurring rise in the magnetic flux across the pole pieces  $d\ d^1$  of the permanent magnet  $h$  thereupon the driving arbor  $a$  is advanced a further 90 degrees, and there held until the next occasion of repeating the cycle of operations, this usually occurring at each half minute in an electric clock system 25 the actuating current being transmitted by a master clock. The same mechanism can, with the addition of a contact device actuated by the rotation of the driving arbor, be employed for other purposes such as for the periodic winding up of a spring or weight for driving a clock or for the purpose of providing a convenient form of motor for driving other small mechanisms.

30 The contact device is connected through a switch to a source of energy and to the coils of the electromagnet, so that when the switch is closed the arbor is turned a quarter turn opening the battery circuit, when the permanent magnet drives the arbor another quarter turn thus closing again the circuit and again operating the arbor. The automatic switch is automatically closed when the 35 driving spring of the clock is run down and automatically opened when the spring is wound up.

The driving arbor may be connected to the driven mechanism by a suitable means such as a worm gearing.

Having now particularly described and ascertained the nature of our said 40 invention, and in what manner the same is to be performed, we declare that what we claim is:—

1. The step by step mechanism comprising a driving arbor and two armatures, which are acted on one by an electro-magnet and the other by a permanent magnet, the latter holding the driving arbor locked when not in operation.

45 2. An electro-magnetically operated mechanism for producing a step by step rotary motion suitable for actuating electric clock system devices and the like, as claimed in Claim 1 each armature being adapted to rotate within a magnetic field having pole pieces formed so as to impart upon magnetisation a steady rotary effort to the said spindle, the formation of these pole pieces relatively 50 to each armature being such as to provide for maintaining the turning effort through an angular distance in excess of that needed to produce the rotary motion; whereby the motion imparted to the said spindle is of a positive nature, and dead centres are avoided.

3. The step by step mechanism as claimed in Claim 1, the distinguishing 55 feature being the arrangement of the magnet coils so that the passage of an

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electric current reduces the effect of the permanent magnet and excites the electro-magnet substantially as described.

4. The improved electro-magnetic step by step mechanism substantially as described with reference to the drawings.

Dated this 25th day of May, 1911.

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

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1912.

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

Fig. 1.

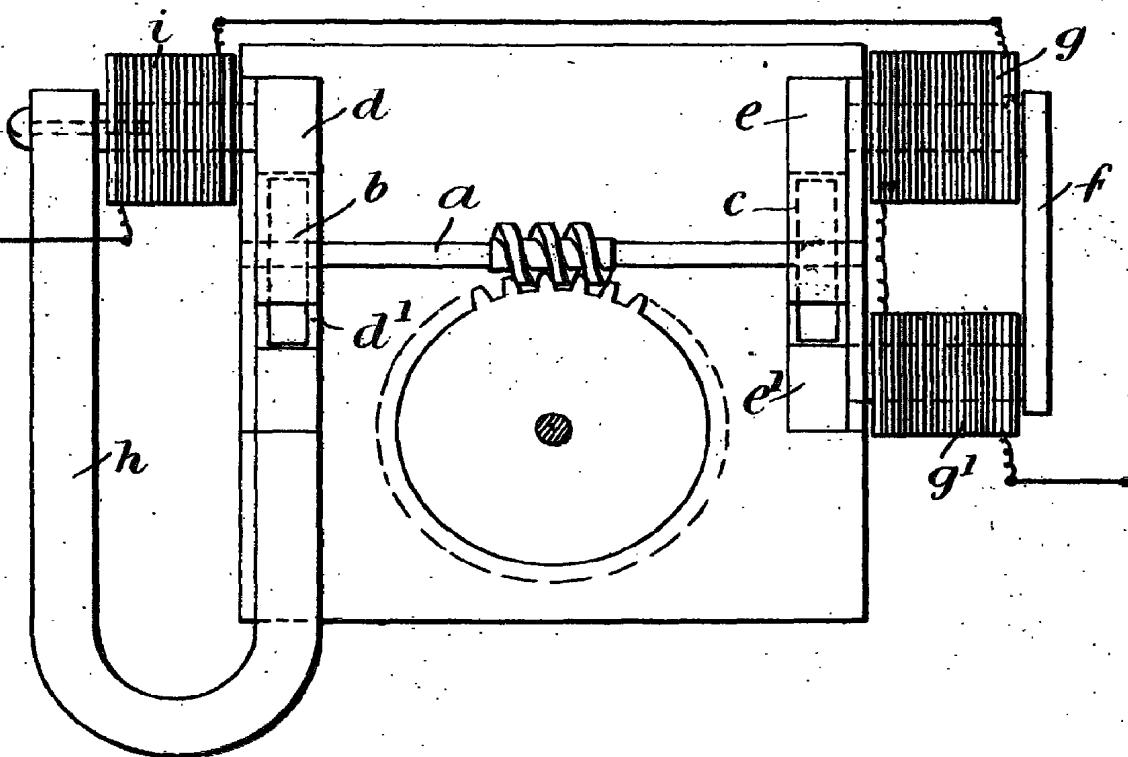


Fig. 2.

