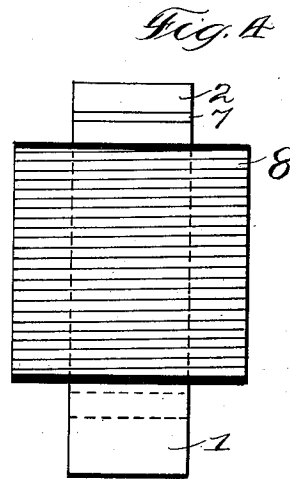
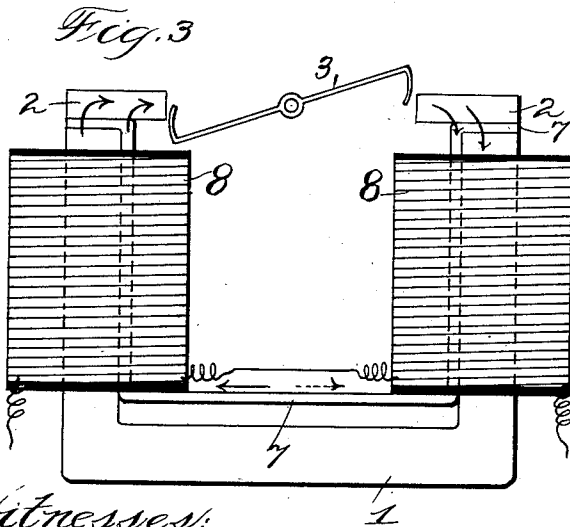
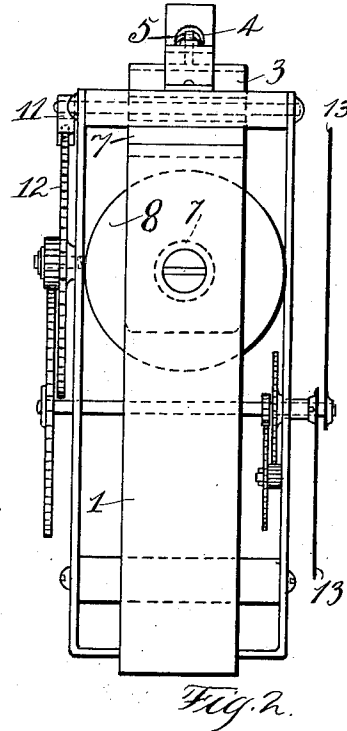
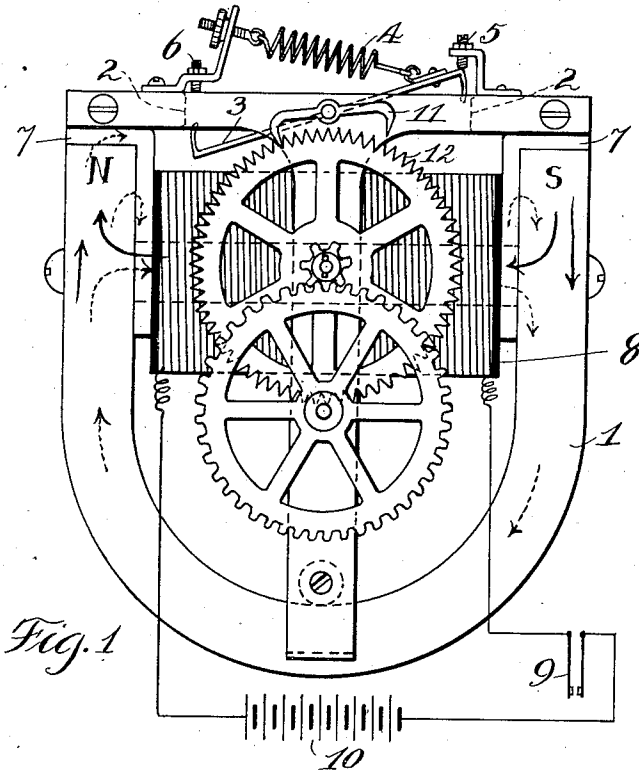


C. R. MOORE.
ELECTROMOTOR.
APPLICATION FILED MAR. 14, 1912.

1,061,624.

Patented May 13, 1913.



Witnesses:
Mr. S. Rosenzweig
Ella L. White

Inventor:
Charles R. Moore,
By G. L. Cragg
Attorney

UNITED STATES PATENT OFFICE.

CHARLES RUBY MOORE, OF LA FAYETTE, INDIANA.

ELECTROMOTOR.

1,061,624.

Specification of Letters Patent.

Patented May 13, 1913.

Application filed March 14, 1912. Serial No. 683,796.

To all whom it may concern:

Be it known that I, CHARLES R. MOORE, citizen of the United States, residing at La Fayette, in the county of Tippecanoe and State of Indiana, have invented a certain new and useful Improvement in Electromotors, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to electro-motor devices that are commonly termed electro-magnets, such electro-magnets including movable armatures, the invention having for its general object the construction of such an electro-motor device or a magnet that will have higher efficiency than electro-magnets as hitherto constructed; that will be very positive in operation as a consequence of the increased available magnetism which I am able to secure, and in which the parts may be of simple and strong construction.

The magnet of my invention includes two magnetic circuits in one of which there is a permanent flow of flux and in the other of which the flux is established when the magnet armature is to be moved. The flux in the first magnetic circuit is desirably established by means of a permanently magnetized magnetic body, such as the common horseshoe permanent magnet. The second magnetic circuit has flux established therein by means of a coil or winding included in a controlling circuit which is made and broken or otherwise modified for the purpose of energizing and deenergizing the coil respectively to operate the magnet armature and permit the restoration of such armature. The second magnetic circuit includes a portion which is in shunt of the space in which the armature moves, whereby the flux in the permanent magnetic circuit is, to a material extent, shunted from the armature space, assuming the coil to be deenergized. The coil is so wound as to establish flux in the shunting portion of the second magnetic circuit in opposition to the flux shunted from the first magnetic circuit so that the lines of force in the first magnetic circuit are caused to thread the armature space to cause the operation of the armature whenever the coil is energized. The second magnetic circuit also includes the armature space so that the flux threading the armature space in the first magnetic circuit is supplemented by the flux in the second magnetic circuit. In this way

the armature of the magnet is subjected to the operating influence of the flux due to the energized coil augmented by the flux in the permanent magnetic circuit, this augmenting flux being substantially excluded from the armature space by the shunting portion of the second magnetic circuit and being established by the coil that governs the flux in the second magnetic circuit.

My invention has other characteristics which will later appear.

The electro-magnet of my invention has a wide variety of uses as will be apparent to those familiar with the art.

The accompanying drawing shows two embodiments of the invention, in which drawing—

Figure 1 is a front view of a portion of a secondary clock structure which may be operated by a master clock, a master clock controlled circuit being diagrammatically illustrated; Fig. 2 is a front view of the structure shown in Fig. 1; Fig. 3 is a front view illustrating another arrangement of magnetic circuits; and Fig. 4 is a side view of the structure illustrated in Fig. 3.

Like parts are indicated by similar characters of reference throughout the different figures.

In each of the constructions shown a permanent U-shaped magnet 1 is employed, each magnet having soft iron pole pieces 2 that are separated by an armature space in which a centrally pivoted, swinging or oscillating soft iron armature 3 is disposed, though the construction is not to be limited to a centrally pivoted armature. The ends of the armature are turned to project upon opposite sides of the armature and are curved upon circles whose radii are less than the radii of the circle of the curvature of the pole faces so that the gaps between the armature and the pole pieces are shortened as the armature moves into alinement with the pole pieces.

In Fig. 1 I have shown a restoring coil spring 4 for bringing the armature to rest against the stop 5, another stop 6 serving to limit the extent to which the armature may be magnetically attracted. The spring is mounted as shown so that as the armature is magnetically attracted in a clockwise direction the length of the lever arm between the armature and spring becomes shorter whereby the increasing tension of the spring resulting from the magnetic attraction of

the armature is compensated for to enable the torque furnished by the armature to remain constant.

The space in which the flux passes for causing the operation of the armature, commonly called the armature space and constituting the space between the soft iron poles of the permanent magnet in the embodiment of the invention illustrated, is shunted by a shunting core 7, the ends of this core being preferably laterally and outwardly projected and interposed between the soft iron pole pieces 2 and the ends of the permanently magnetized element 1.

In the form of the invention shown in Figs. 1 and 2 the shunting device 7 includes a central cylindrical winding core surrounded by a winding that constitutes a single coil 8. In the form of the invention shown in Figs. 3 and 4 the winding is subdivided into two coils, these coils surrounding the end portions of the permanent magnet element 1 and end portions of the shunting device 7. Any suitable means is employed for governing the circuit of the magnet, a circuit opening and closing switch 9 being shown in Fig. 1 in serial relation with the coil and a battery 10. The switch 9 may be intermittently operated, for example, by a master clock.

In the form of the invention shown in Figs. 1 and 2, each time the circuit for the battery 10 and coil 8 is closed the armature is attracted against the force of the spring 4 to turn the pallet 11 in a clockwise direction which moves the toothed wheel 12, the spring 4 moving the armature and pallet in a counter clockwise direction when the circuit is opened at 9. The secondary clock hands 13 are driven by a clock train of which the toothed wheel 12 forms a part.

In Figs. 1 and 3 the flux which is due to the permanent magnet flows in the directions indicated by the arrows shown by dotted lines, the directions of the flux due to the energization of the winding 8 is shown by the arrows in solid lines, though of course this latter flux is not flowing unless the winding circuit is closed. When flux is flowing in both magnetic circuits opposing magneto-motive forces are present in the shunt 7, the winding then operating to furnish magneto-motive force to oppose the flux from the permanent magnet so that permanent magnet flux is forced to traverse the armature space. Fluxes from both magnetic circuits traverse the armature space in the same direction so that the armature responds not only to magnetism that is due to the battery in the ordinary operation of electro-magnets, but also responds to the additional magnetism that is held in reserve but to which the armature is subjected as a result of the energization of the electro-magnetic winding.

The magnet 1 is shown as being made of hard steel that has been subjected to the magnetizing influence of a coil so as to be permanently magnetized without the continuing presence of a magnetizing coil. I do not wish to be limited, however, to a magnet formed of hard steel thus permanently magnetized and which lacks a constantly energized coil for imparting magnetization permanently to the magnet. I therefore use the term "permanent magnet" in the broad sense of a permanently or constantly magnetized bar or body irrespective of the method employed for imparting the permanent magnetization.

While I have herein shown and particularly described the preferred embodiment of my invention, I do not wish to be limited to the precise details of construction shown as changes may readily be made without departing from the spirit of my invention.

Having thus described my invention, I claim as new and desire to secure by Letters Patent the following:—

1. An electro-motor including a swingingly mounted armature; a permanent magnet element for supplying flux to the armature space; a magnetizable element in shunt of the armature space; a winding for said magnetizable element; a source of current for energizing said winding; means for governing the association of said source of current with said winding to energize and deenergize the same, the winding being so directed as to set up flux opposing the permanent magnet flux in the shunt and augmenting the flux flowing across the armature space when the winding is energized to cause the armature to swing in one direction; and means for reversing the movement of the armature when the winding is deenergized.

2. An electro-motor including an armature; a permanent magnet element for supplying flux to the armature space; a magnetizable element in shunt of the armature space; a winding for said magnetizable element; a source of current for energizing said winding; means for governing the association of said source of current with said winding to energize and deenergize the same, the winding being so directed as to set up flux opposing the permanent magnet flux in the shunt and augmenting the flux flowing across the armature space when the winding is energized to cause the armature to move in one direction; and means for reversing the movement of the armature when the winding is deenergized.

3. An electro-motor including an armature; a permanent magnet element for supplying flux to the armature space; a magnetizable element in shunt of the armature space; a winding for said magnetizable element; a source of current for energizing

said winding; and means for governing the
association of said source of current with
said winding to energize and deenergize
the same, the winding being so directed as
5 to set up flux opposing the permanent mag-
net flux in the shunt and augmenting the
flux flowing across the armature space when
the winding is energized.

In witness whereof, I hereunto subscribe
my name this 12th day of March A. D., 10
1912.

CHARLES RUBY MOORE.

Witnesses:

ALBERT E. BRADBURY,
WIBLE HINER.