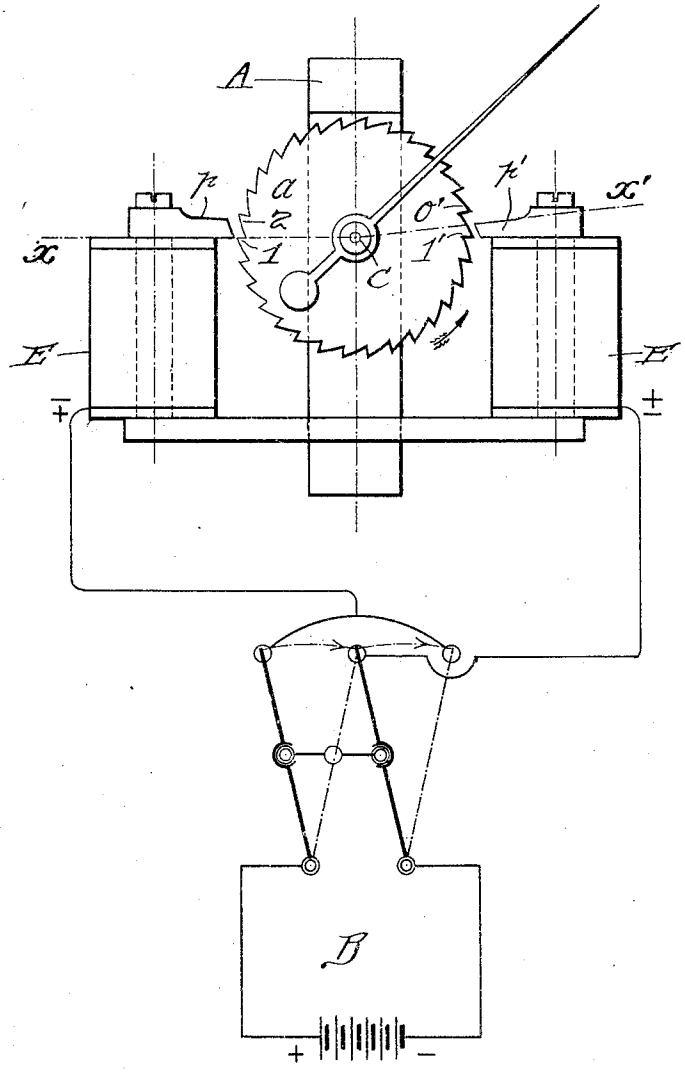
No. 788,762. PATENTED MAY 2, 1905.

A. FAVARGER.

ELECTROMAGNETIC DEVICE.

APPLICATION FILED NOV. 25, 1902.



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No. 788,762. Patented May 2, 1905.

UNITED STATES PATENT OFFICE.

ALBERT FAVARGER, OF NEUCHÂTEL, SWITZERLAND.

ELECTROMAGNETIC DEVICE.

SPECIFICATION forming part of Letters Patent No. 788,762, dated May 2, 1905.

Application filed November 25, 1902. Serial No. 132,818.

To all whom it may concern:

Be it known that I, ALBERT FAVARGER, a citizen of the Republic of Switzerland, and a resident of Neuchâtel, Switzerland, have invented certain new and useful Improvements in Electromagnetic Devices, of which the following is a specification.

Most of the electromagnets used in the numerous receiving instruments (such as electric clocks, speed-indicators, frequency-indicators, &c., and in general all the apparatus for indicating or recording at a distance the variations of any phenomenon) which must transform into motion an electric current have oscillatory armatures. If the oscillatory movements have in their turn to be transformed into angular movements, rotating always in the same direction, as is the case if they are embodied in secondary electric clocks or any other electric indicators, then it becomes necessary to have recourse to intermediate mechanical elements—such as impulsion-pawls, anchor-shanks, anchors, flat springs, &c.—working on the periphery of a toothed wheel, which is usually called the "escapement-wheel" and the axis of which carries the hand, the index, or the tracer. This mechanical transformer of an oscillatory movement into a rotary movement constitutes in its entirety an arrangement which is relatively complicated and expensive and which absorbs, among others, on account of its friction an appreciable part of the disposable energy.

In the apparatus which constitutes the object of the present application said intermediate parts have been omitted, and the armature as well as the two poles of the electromagnet are arranged in such a manner that this armature, being submitted to the direct influence of the polar attractions and repulsions, is made to describe angular intermittent movement, the more or less rapid succession of which causes its axis to turn always in the same direction. This direction can be either that in which the hands of the clock move or the opposite one, as may be desired.

The accompanying drawing represents the invention in elevation.

In the drawing, E is an electromagnet having the form of a horseshoe, the two poles p and p' of which have their ends formed with pole-pieces, each of which is provided with a point and with an inclined flat or curved side. Between the points of the two pole-pieces p and p' a disk a, of soft iron, can turn without touching the pole-pieces. Said disk is keyed on axis c and provided all over its circumference with teeth having each one a point and an inclined portion which forms one of the longer sides.

The relating positions of pole-pieces p and p' and those of the teeth of the armature-disk must be such that if the point of one of the poles coincides exactly with the point of the tooth next to it then the point of the other pole is placed precisely in the middle of the interval separating the points of the two teeth which are next adjacent. Under these conditions the two rays, cx and cx', proceeding from axis c and passing through the two points of the pole-pieces, meet each other at an angle comprising any whole number of teeth plus one half-tooth.

The permanent magnet A, on the one hand, influences by one of its ends the two legs of the electric magnet and the pole-pieces p and p', (to which it communicates the corresponding polarity.) On the other hand, by its other end it influences the toothed disk, and especially the teeth of said disk which are in the nearest proximity with the pole-pieces p and p' and to which teeth it communicates the corresponding polarity inverted as regards that of pole-pieces. This being granted, let us admit that the points of the left pole p and of tooth 1 next to it are opposite one another, or, to express it otherwise, let us admit that they coincide. Then the point of the right pole p' will be by one half-tooth in advance of the point of tooth 1. Let us also admit that the permanent magnet A communicates south polarity to armature a and north polarity to the core of electromagnet E.

As no current circulates in the wire of the bobbins of the electromagnet E, the position of the armature described heretofore and represented in the figure will be assured, owing to the permanent magnet A, through the reciprocal vigorous attraction exercised among each other by the points of the pole-piece p

(north) and of tooth 1, (south,) which are in close proximity. It is true that, on the other hand, pole-piece p', the point of which is at an equal distance from the points of the two teeth o' and $1'$, will exercise on the long side of tooth $1'$ an attraction which will tend to cause the turning of armature a in the direction of the arrow. However, this attraction is counteracted by the stronger attraction which exists between pole-piece p and that of tooth 1 and which continues as long as pole p remains a north pole. If now the position of the armature being that shown in the figure, current is passed from the alternator B into the bobbins of the electromagnet, so that p becomes a south pole and p' a north pole. Then there will be caused, on one hand, attraction between the north pole p' on the right side and tooth $1'$, (owing to the reciprocal action of the two sides and of the two points,) and, on the other hand, there will be brought about repulsion between the point of south pole p on the left side and the point of tooth 1. These two forces will aid in causing armature a to turn in the direction of the arrow for the distance of exactly one half-tooth. In fact, as soon as this angular movement has been accomplished the tangential components of the couple of magnetic forces cease, while the radia components insure the immobility of the armature in its new position as long as the current continues to pass in the same direction.

In order to pass a new current having a contrary direction to the former one, pole p', to the right, which has become a south pole, will repulse tooth $1'$, and pole p, to the left, which has become a north pole, will attract tooth 2, and so forth for the other alternate emissions.

Each time that an alternating current is passed the armature a will thus effect a rotary angular movement of one half-tooth. If the armature has thirty teeth, it will make a complete revolution during sixty passages of alternating currents. If it has sixty teeth, it will describe a revolution during one hundred and twenty passages. If it has five teeth, it will make a revolution during ten passages, and so forth. This shows that the number of teeth of the armature can always be selected, so that the index or the hand (for seconds or for minutes) may be secured right on the axis of this armature and that in this manner any intermediate gearing may be omitted, if this should be considered advantageous.

If the passages of alternating current succeed each other with a certain rapidity, the toothed armature assumes an intermittent rotary movement the angular speed of which is exactly proportionate to that with which the currents are produced. By this simple means it is possible to render at a distance two synchronous different or uniform movements of any kind, one of which (the transmitter) produces the alternating currents, while the other (the receiver) is the movement of the above-described apparatus. Moreover, the direction in which the armature a rotates may be selected at will, as it depends only on that direction given to the inclined sides of the teeth and of the pole-pieces.

Having thus described my invention, what I claim is—

An electromagnet mechanism for producing a rotary movement by means of alternating currents, comprising a polarized armature in the form of a toothed dissymmetrical wheel and an electromagnet provided with pole-pieces having positions which differ among themselves by one-half division of tooth with regard to the set of teeth of the wheel, whereby under the effect of the alternating current the pole-pieces may cause the wheel to turn always in the same direction, by intermissions of one-half division of tooth after the magnetic alternating attractions and repulsions.

In witness whereof I have hereunto set my hand in presence of two witnesses.

ALBERT FAVARGER.

Witnesses:

JULES CHAPUY,

ARMAND PERRELET.