[Second Edition.]

PATENT SPECIFICATION

Application Date: March 9, 1922. No. 7008/22. 191,313

Complete Accepted: Jan. 11, 1923.

COMPLETE SPECIFICATION.

Improvements in and relating to Synchronous Motors for the Electric Drive of Clockworks.

I, ROBERT MICHL, a citizen of the Czecho-Slovakian Republic, of Eder uliza 6, Kosice, Czercho-Slovakia, 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:—

This invention relates in general to the electric drive of clockworks by means of an alternating current and in particular to a synchronous motor, which is particularly suitable for that purpose, for connection with the usual supply mains carrying alternating current.

This synchronous motor, as constructed according to this invention, comprises one or more exciting magnets with non-changing poles, at least one armature magnet which is arranged between said poles and has an alternating current coil for connection with the existing alternating current net, and a rotor with soft iron segments, the polarity at the two ends of which changes during the rotation in front of the exciting magnet and of the armature magnet which rotation is transmitted directly to the clockwork to be driven. Because of the change in polarity of the segments, the latter will hereinafter be referred to as "pole-changing segments". To change the quick revolutions of the rotor into such slow revolutions as the clockwork requires, any of the known speed-change gearings, consisting, for instance, of a worm and a worm wheel, may be employed.

The armature magnet need extend between the non-changing poles of the exciting magnets with only one of its poles, whereas the other pole may be connected with the neutral point of said latter magnet. In special cases both magnets may be magnetically insulated from each other. To utilise also in such a case the second pole of the armature magnet or the drive of the rotor, this pole is furnished with a pole shoe, which extends into the range of the motor.

To start the motor and make it attain the periodicity of the current, a speed accelerating device is provided. This device may consist of a cog wheel affixed to the shaft of the rotor and of a toothed sector which meshes with that cog wheel and is provided with a handle and connected with one end of a spring, which is put under tension by turning the sector by means of its handle in the proper direction. After the spring has been extended, the sector handle is let loose when the spring will actuate the motor in the desired manner.

There are already generating dynamos known, in which stationary exciting magnets and armature magnets alternate with each other and in front of which magnets a rotor rotates having pole-changing segments. In dynamos of this kind there is, however, driven the rotor itself and current is conducted into the machine and drawn from it. In contradistinction to such machines the present invention relates to a driving motor, which only receives the current and consumes it for driving a clockwork.

In order to make my invention more clear, I refer to the accompanying drawings, in which similar letters of reference denote similar parts throughout the several views, and in which

Fig. 1 is a vertical section, transversely to the axis of the rotor, through one form of construction of a synchronous motor constructed according to this invention.

Fig. 2 is also a vertical section through that motor, but at right angles with respect to Fig. 1, in line 2—2 of this figure and in connection with members of the clockwork.

Fig. 3 is an illustration similar to Fig. 1 showing a modified form of construction. (Section line 3—3 of Fig. 4).

Fig. 4 is an illustration similar to Fig.

[Price 1s.]

3 and relates to the modification shown in Fig. 3, the section being taken in line 4—4 of Fig. 3, the clockwork members being omitted in this figure.

Fig. 5 is a horizontal section in line 5—5 of Fig. 3.

Fig. 6 is a plan of this motor.

Figs. 7 and 8 are transverse sections in lines 7—7 and 8—8 of Fig. 4, the parts being the same in both figures, but the positions of the rotor being different.

Fig. 9 is a front view of a third form of construction.

Fig. 10 is a vertical section in line 10—10 of Fig. 9.

Fig. 11 is a horizontal section in line 11—11 of Fig. 9 and

Fig. 12 is a front view of the rotor of this form of construction.

Referring to Figs. 1 and 2, the exciting magnet b is affixed to a frame a; the magnet is in this case a permanent one; its two limbs converge like the limbs of a horseshoe and terminate closely at the rotor c. The rotor consists of non-magnetic discs c, which are affixed to the shaft d, and of pole-changing segments c^1 of soft iron. At the neutral point b^1 of the exciting magnet b is affixed the armature magnet e, the pole e^1 of which extends between the two poles of the exciting magnet and terminates also closely at the rotor c. The armature magnet e is provided with an alternating current coil f for connection with an existing alternating current net.

In the example shown in Figs. 1 and 2 the rotor has six segments c^1, and the gap between the poles of the magnet b amounts, thus, to one-sixth of the circumference of the rotor. When the circuit is closed and the motor started with aid of the speed accelerating device mentioned in the preamble (and more fully described hereinafter) then it is acted on by the varying intensity and the changing poles of the armature magnet e, and its rotary motion is maintained in correspondence with the periodicity of the alternating current. The revolutions of the motor are transmitted to the clockwork h by means of a change-speed gearing, which, in the example shown, consists of a worm gear g.

Such a synchronous motor is distinguished by its extraordinarily small consumption of current, since the poles of the exciting magnet do not change and solely the poles of the armature magnet are changed by the current. The number of revolutions of the rotor may be determined just as desired by changing the number of its segments or the number of the exciting poles and of the armature poles.

In the form of construction shown in Figs. 3—8, there are two armature magnets e e, each of which is affixed with one pole e^1 at the neutral point b^1 of the exciting magnet b. In order to be able to make use of exciting magnet poles, which lie in the same plane of revolution, as has been the case in Figs. 1 and 2, these poles are furnished with shoes b^3 extending over the two armature magnets e e. The shaft d of the rotor has, consequently, two rows of pole-change segments c^2. There rotate in this case only two segments in the same plane of revolution, these segments closing alternately, the flux of the magnetic lines of force between one pole N and S of the exciting magnet b and the pole e^1 of the armature magnet which is just situated between the respective pole and said segments. The segment pairs c^2 are staggered by 180° with respect to the shaft d. The effect of this motor is the same, as above described with respect to Figs. 1 and 2.

If also the second pole of the armature magnet shall be utilised, the form of construction illustrated in Figs. 9 to 12 is preferably employed. The armature magnet e is here attached to the frame or casing a of the clockwork by means of a bow i. The exciting magnet b is affixed to this bow, but is magnetically insulated with respect to the armature magnet by the insertion of magnetically non-conducting discs k and screws l. The poles N and S of the exciting magnets b lie in one radial plane. The bow i consists of soft iron and has a pole shoe e^2 with which it lies also in the same radial plane. The poles of the exciting magnet b alternate, consequently, in this plane. The bow i or the casing a or the casing a supports also the shaft d of the rotor which, in this case, consists of a non-magnetic disc c, which carries a plurality of pole-change segments c^1, for instance twelve, with which the rotor rotates in front of the poles of the two magnets b and e. The rotation of the shaft d is transmitted by suitable means to the clockwork, for instance by means of a worm and tooth gear g and h, as already mentioned.

In order to diminish the number of the poles, the poles b^3 of the exciting magnet b terminate as closely as possible at the poles e^1 and e^2 of the armature magnet e.

To facilitate the starting of the synchronous motor and increase its number of revolutions quickly to that corresponding to the periodicity of the alternating current, the motor may be provided with a speed accelerating device, as shown by way of example in Figs. 9 to 12. A cog wheel m is affixed to the shaft d of the rotor; it may mesh with a toothed sector

n which, however, is normally out of contact with that cog wheel owing to the pull of a spring o. The shaft n^1 of the sector n is provided with a handle p located outside of the casing. If the handle p is pushed backward, the sector n is turned in such a direction that the spring o is put under tension, and when the handle is let loose the spring swings the sector suddenly and quickly back into its former position, the sector engaging now the cog wheel m of the rotor starting the motor and accelerating the rotary speed in the manner and ratio desired.

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. A synchronous motor for the electric drive of clockworks, characterised by an exciting magnet having non-changing poles, an armature magnet arranged between the poles of the said exciting magnet and having an alternating current coil and a rotor having pole-changing segments, which rotates in front of the poles of the said two magnets and transmits its rotation to the clockwork.

2. A synchronous motor, as claimed in Claim 1, characterised by the feature, that the armature magnet is fixed to the said exciting magnet at a neutral point of the same.

3. A synchronous motor, as claimed in Claims 1 and 2, characterised by two pairs of pole-changing segments mounted on the rotor and adapted to rotate in neighbouring planes, and by juxtaposed pole pieces extending from the exciting magnet into the plane of revolution of the said segments.

4. A synchronous motor, as claimed in Claims 1 and 3, characterised by the feature, that magnetic insulation is provided between the two magnets.

5. A synchronous motor, as claimed in Claims 1, 3 and 4, characterised by a driving wheel on the shaft of the motor and a toothed sector meshing with the said driving wheel, which can be operated from without by a handle for the purpose of accelerating the motor.

6. The improved synchronous motor for the electric drive of clockworks, constructed and operating substantially as hereinbefore described and as illustrated in and by the accompanying drawings.

Dated this 9th day of March, 1922.

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[Wt. 37A.—50/2/1934.]

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

Fig. 1.

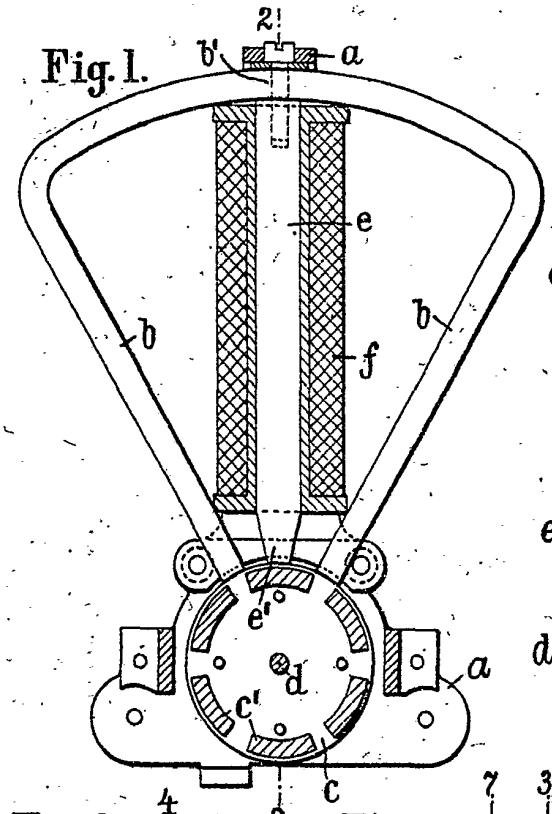

Fig. 2.

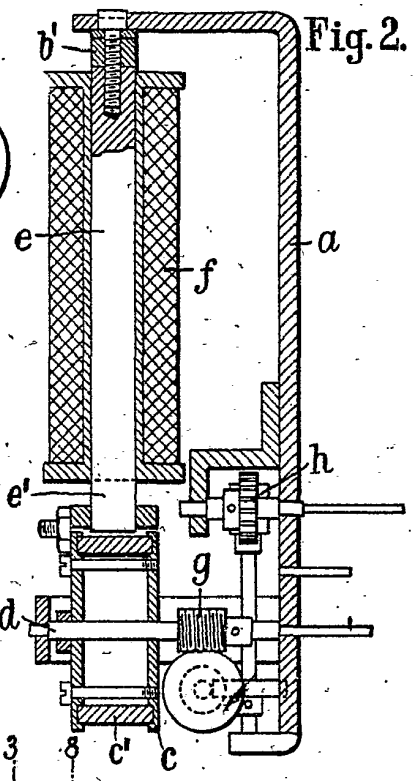

Fig. 3.

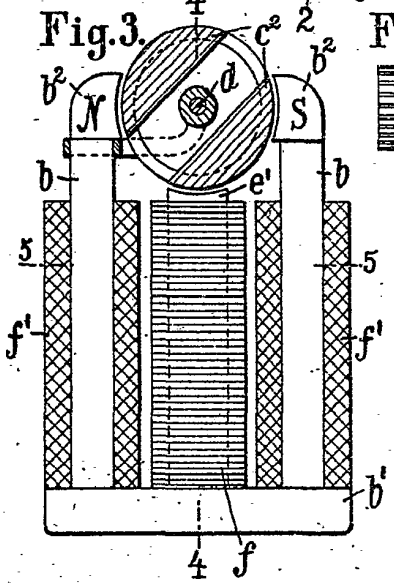

Fig. 4.

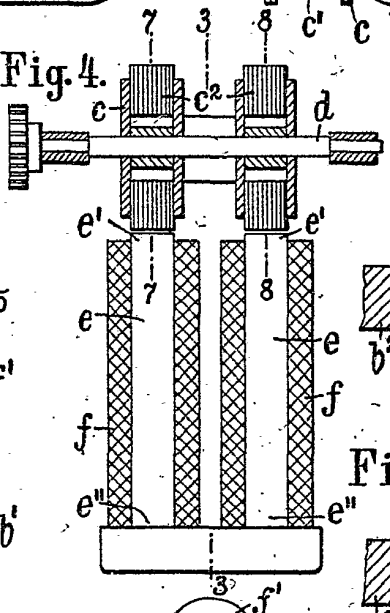

Fig. 7.

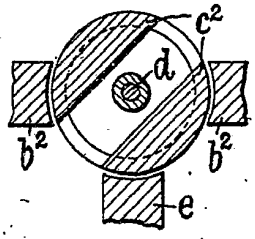

Fig. 8.

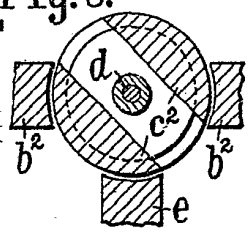

Fig. 5.

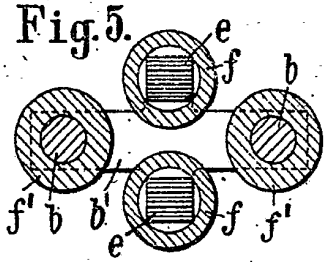

Fig. 6.

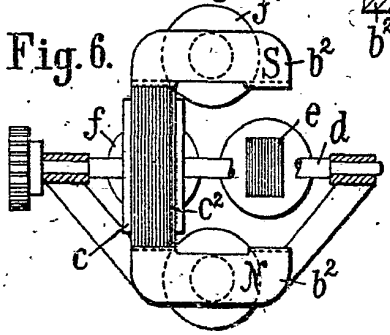

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Fig. 9.

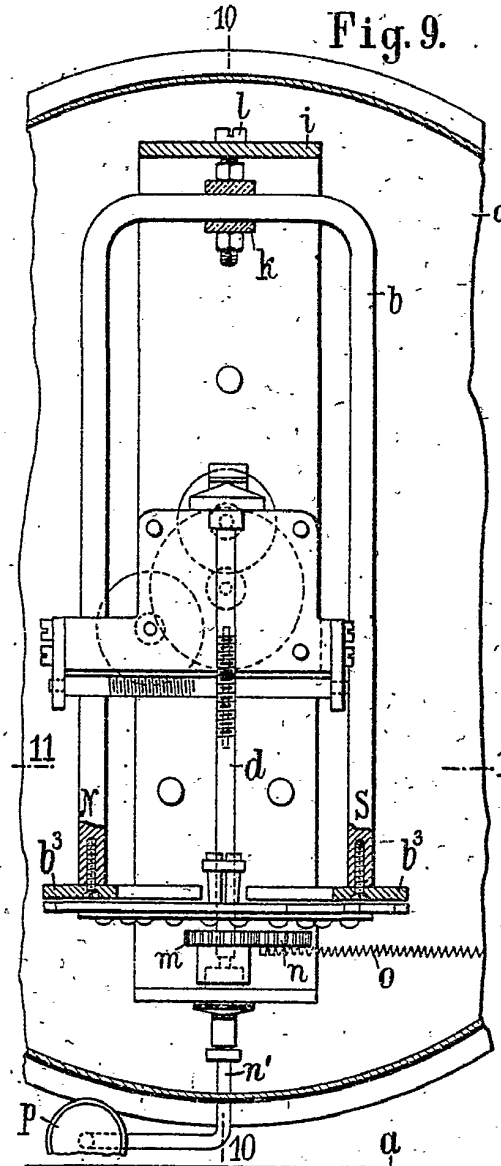


Fig. 10.

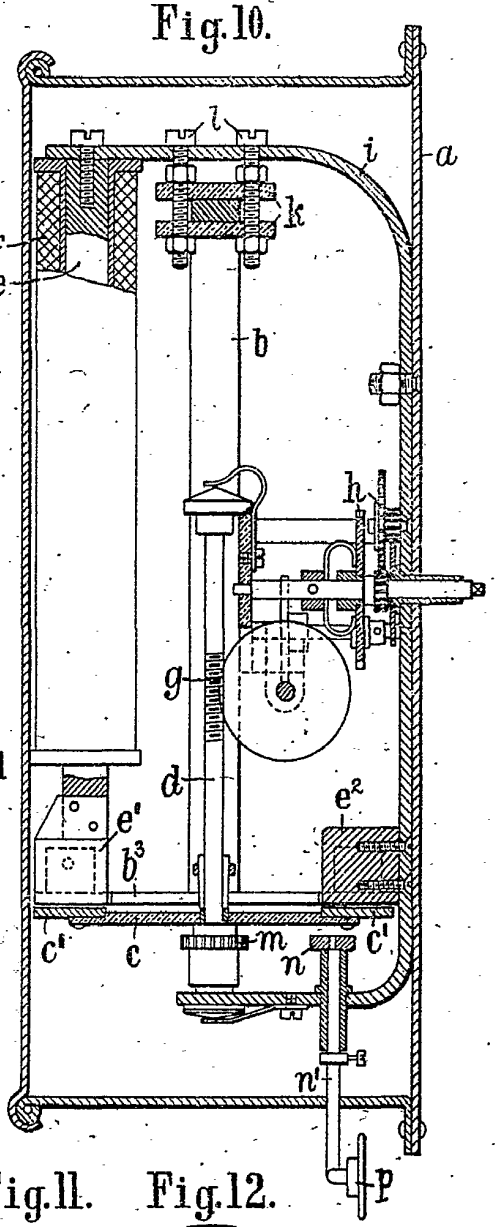


Fig. 11.

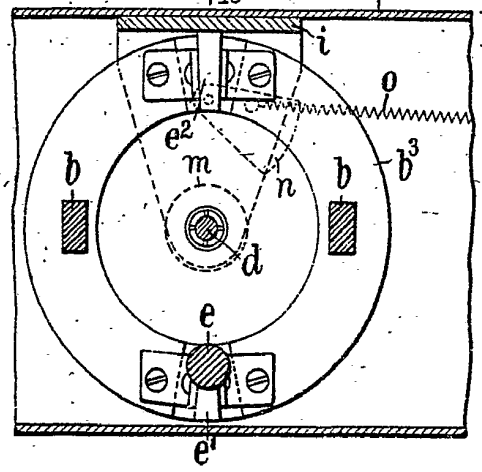
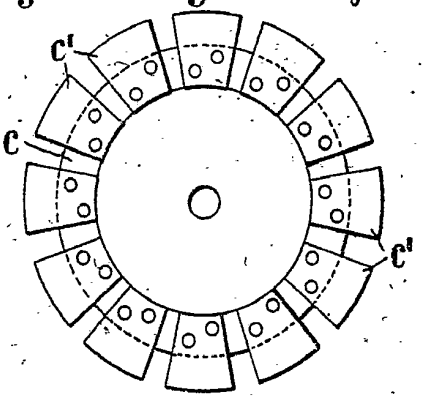


Fig. 12.



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191,313 COMPLETE SPECIFICATION

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SHEET 1

2 SHEETS

SHEET 2

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Fig. 1.

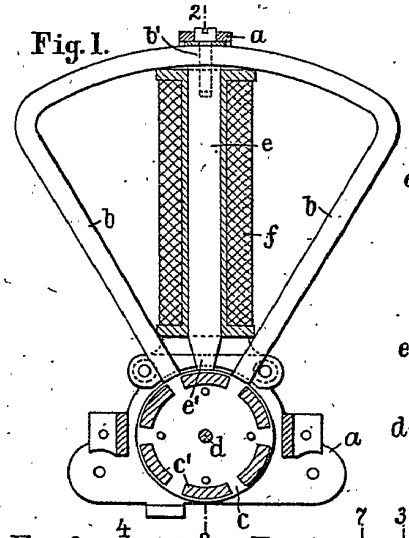
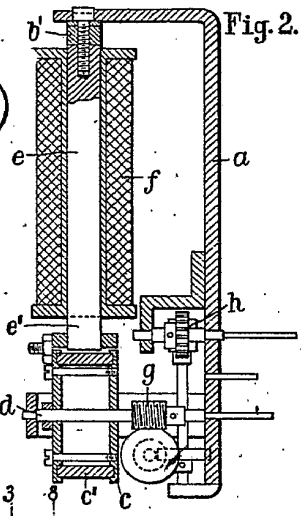


Fig. 2.



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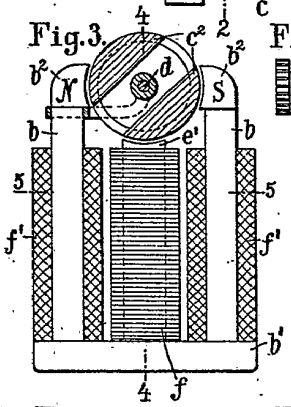
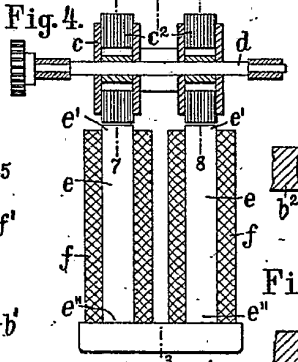


Fig. 4.



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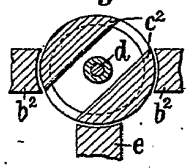

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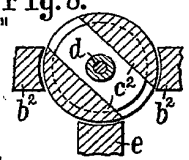

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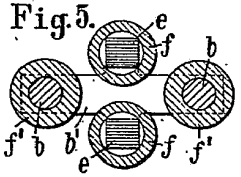

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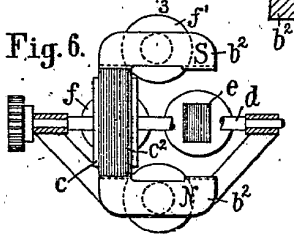

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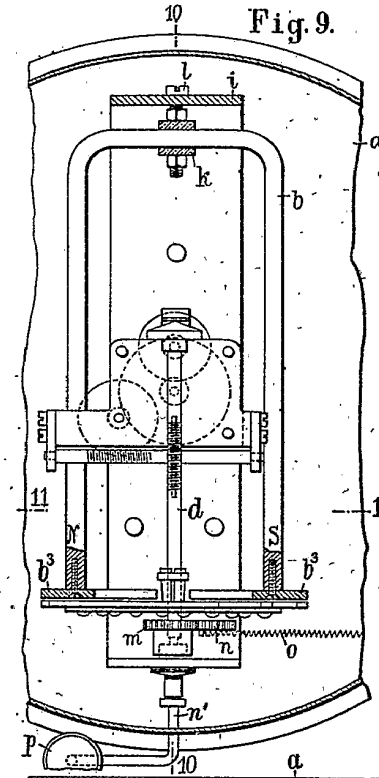

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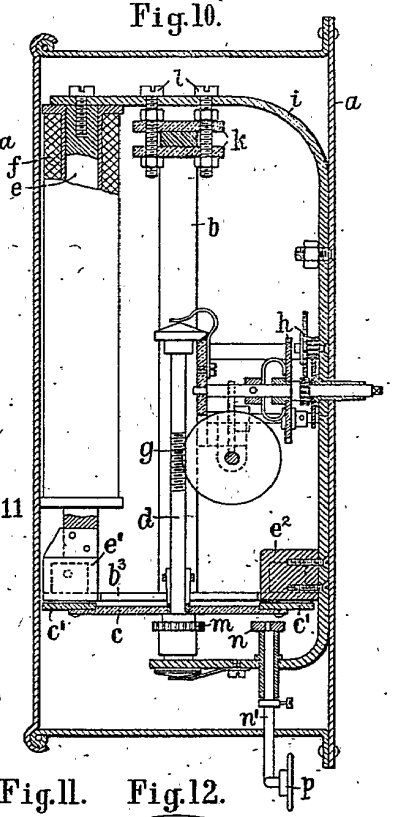

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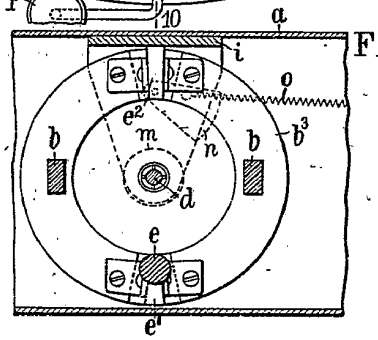

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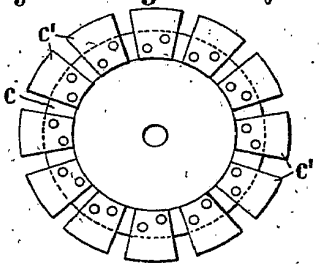

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