

June 12, 1934.

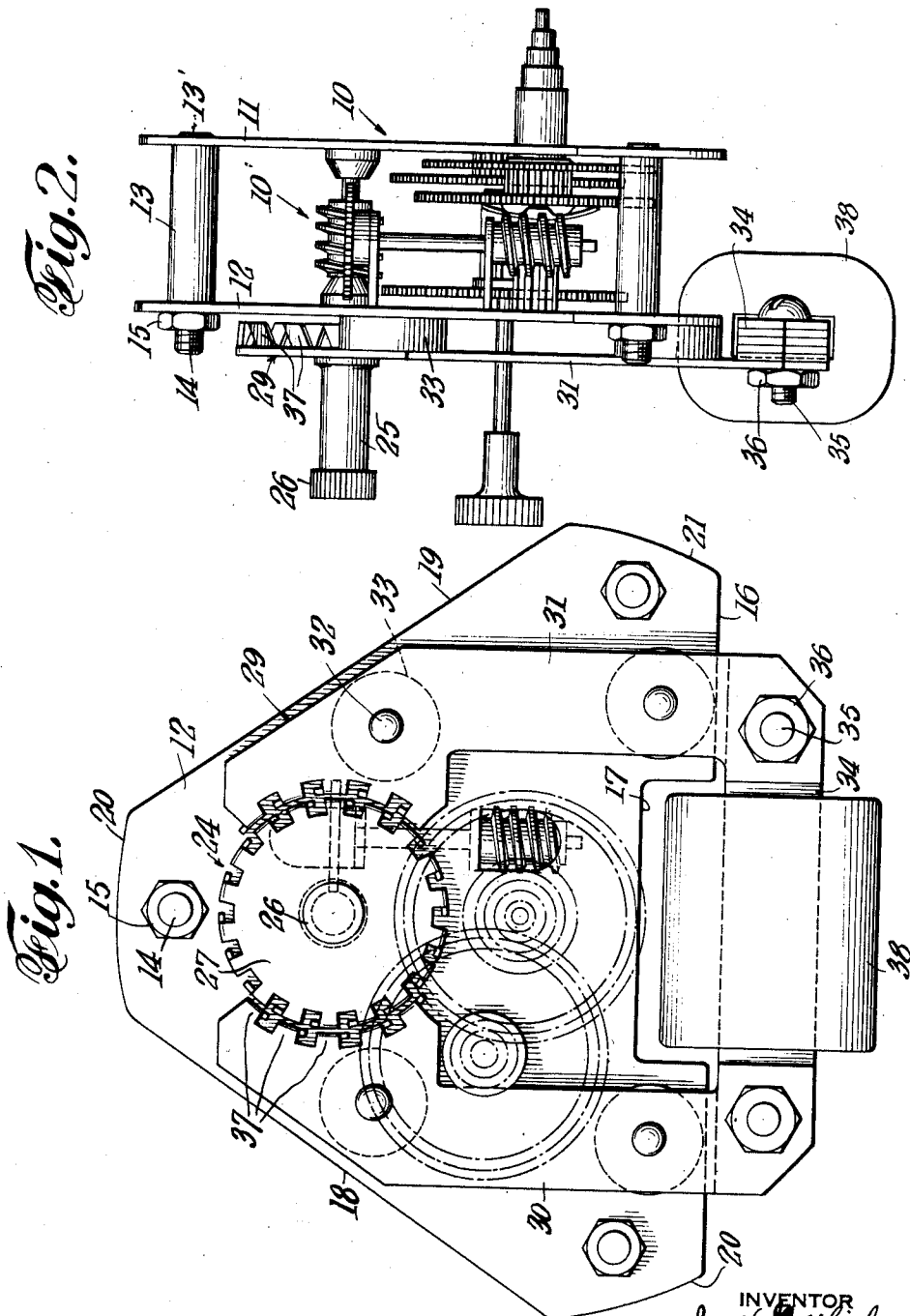
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SYNCHRONOUS MOTOR FOR DRIVING ELECTRICAL CLOCKS AND THE LIKE

Filed Dec. 4, 1931

2 Sheets-Sheet 1



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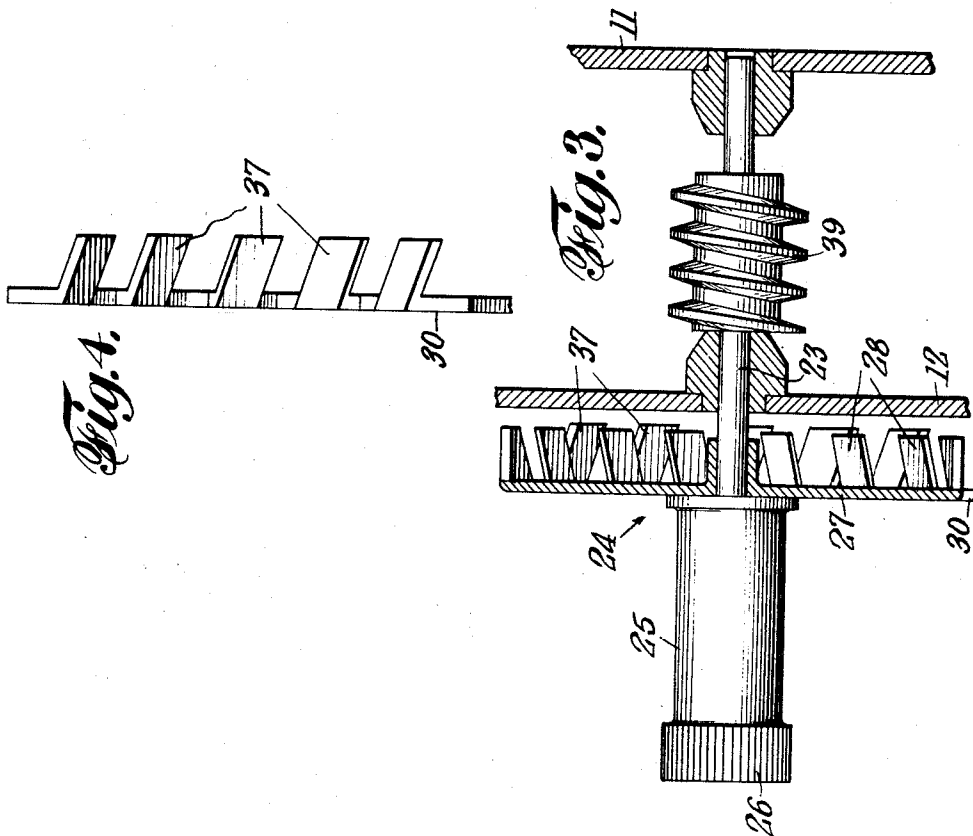
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SYNCHRONOUS MOTOR FOR DRIVING ELECTRICAL CLOCKS AND THE LIKE

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UNITED STATES PATENT OFFICE

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SYNCHRONOUS MOTOR FOR DRIVING
ELECTRICAL CLOCKS AND THE LIKE

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10 Claims. (Cl. 172-275)

My present invention relates to electric clocks and aims to devise time-keeping mechanisms of the general character specified which are simple in construction, easy and economical to fabricate and assemble, which are compactly and neatly arranged, and which perform their intended functions in an exceedingly accurate manner. My present invention involves particularly a novel type of rotor or armature and pole pieces by means of which I eliminate the necessity for any separate means for maintaining such rotor in synchronism with the alternating current, all of the existing synchronous motors requiring such means.

In the accompanying specification I shall describe, and in the annexed drawings show, an illustrative embodiment of the present invention. However, it is to be clearly understood that I do not wish to be limited to the exact details described herein or shown in the accompanying drawings, inasmuch as alterations may be made without departing from the spirit and scope of the present invention as set forth in the appended claims.

In the accompanying drawings:

Fig. 1 is a rear elevational view of a clock-mechanism frame and associated electric clock mechanism, constituting the aforesaid illustrative embodiment of the electric clocks of the present invention;

Fig. 2 is a side elevational view of the same;

Fig. 3 is an enlarged, fragmentary, plan view, partly in elevation and partly in section, showing, in detail, the armature arrangement employed in the aforesaid illustrative embodiment of the electric clocks of the present invention; and

Fig. 4 is an enlarged, edge view of one of the pole pieces preferably employed in the electric clocks of the present invention.

Referring now more in detail to the aforesaid illustrative embodiment of the electric clocks of the present invention, and with particular reference to the drawings illustrating the same, the numeral 10 generally designates a clock-mechanism frame which carries the clock mechanism, generally indicated by numeral 10'. The frame 10 consists of a front plate 11 and a rear plate 12, both of which are substantially triangular in shape. The plates 11 and 12 are separated by spacers 13, one of the ends of which are riveted at 13' to the front plate 11 and the other ends of which are threaded at 14 to receive the nut 15.

Inasmuch as both the front plate 11 and the rear plate 12 are similar in construction, I shall

described only the rear plate at this point. Such plate 12 is, as already stated, substantially triangular in its outer contour and is provided with the lower substantially straight edge 16 having the indented portion 17, the purpose of which will be brought out later in this specification. The plate is also provided with converging upper side edge portions 18 and 19 and arcuate lower side edge portions 20 and 21 connecting the lower straight edge 17 with the converging upper side edge portions 18 and 19. The plate is completed by an upper arcuate edge 20 connecting the converging upper side edge portions 18 and 19 with each other.

The plates 11 and 12 are provided with oil impregnated bushings 22 constituting bearings in which is rotatably mounted an armature shaft 23. The armature shaft 23 carries, adjacent the outer surface of the plate 12, a rotor armature 24 and said shaft also carries adjacent the armature 24, a sleeve 25 terminating in a knurled knob 26.

The armature 24 consists of a disk 27 having a multiplicity of teeth 28 formed at the outer periphery thereof, the teeth extending outwardly from the periphery of the disk at angles other than right angles to the plane of the axis of the disk and being arranged in the plane of a cylinder likewise extending outwardly from the periphery of the disk. The teeth of existing armature of synchronous rotors are arranged radially to the axis of the rotor and in the same plane as the diameter of the rotor. However, I have found that with such rotors, it is necessary to employ some separate means in conjunction therewith in order to assure the rotor keeping in phase with the alternating current. If such separate devices are not used the rotor stops if the frequency of the current even momentarily varies from its normal frequency. In other words, if the frequency varies, the rotor becomes out of phase and unless some means are employed to overcome this momentary variation of the current, the rotor stops. Such devices, I have found, needlessly add to the labor, material and the cost of the motor. However, by utilizing the rotors of the present invention such separate devices are unnecessary and the rotor keeps in phase with the current notwithstanding the variation of the frequency thereof.

The rotor or armature 24 of the present invention is here shown as being provided with 18 teeth 28. The reason for providing the armature 24 with 18 teeth is as follows: The electric clocks of the present invention are preferably operated

by sixty (60) cycles alternating current, which has a vibration of thirty-six hundred (3600) alternations per minute. In view of the gearing which I prefer be employed in the electric clocks of the present invention, it is necessary to have the armature 24 of the synchronous motor 29 rotate at a speed of four hundred (400) revolutions per minute. Hence, by using the formula

$$\frac{2C. P. M.}{R. P. M.} = \text{number of teeth,}$$

the calculations are as follows:

$$\frac{7200}{400} = 18.$$

Thus, in order that the synchronous motor 29 employed in the electric clocks of the present invention rotate at four hundred (400) R. P. M., the armature 24 is provided with eighteen (18) teeth 28. I shall now complete the description of the synchronous motor 29.

A pair of unitary poles 30 and 31 are secured to the outer surface of the rear plate 12 of the frame 10 by rivets 32, the poles being spaced from the plate 12 by the washers 33. The poles 30 and 31 are connected with each other by the laminated yoke 34 by means of the bolts 35 and cooperating nuts 36. The poles 30 and 31 are each provided with a plurality of teeth 37 which are oppositely disposed and surround a portion of the armature 24. The teeth are arcuately arranged and are formed at the outer edges of the pole pieces, extending outwardly from such outer edges at angles other than right angles to the longitudinal plane of the pole pieces and are further arranged in the plane of a cylinder likewise extending outwardly from the outer edges of the pole pieces.

It should be noted, however, that the teeth 37 of the pole pieces 30 and 31 extend in a direction opposite to that in which the teeth 28 of the armature 24 extend. I have found that by arranging the teeth of the pole pieces and the armature as just described, the pull or cooperation between the pole pieces and the armature is greatly magnified, thus assuring more positive openings than has heretofore been possible. While it is not necessary that the number of teeth shown in the accompanying drawings be utilized with the poles 30 and 31, I prefer to use five (5) teeth on each pole.

The synchronous motor 29 is completed by the coil 38 constituting the pole windings and being wound about the laminated yoke 34. The coil 38 is connected in the usual manner by a cable and plug, not deemed necessary to be here shown, to a source of sixty (60) cycles alternating current. This completes the description of the clock-mechanism frame and the synchronous motor attached thereto employed in the electric clocks of the present invention.

The electric clocks of the present invention are provided, as usual, with second, minute and hour hands and the latter are driven from the rotor shaft 23 by means of any preferred gearing arrangement, the gearing arrangement being no part of this invention and therefore not being described.

This completes the description of the aforesaid illustrative embodiment of the electric clocks of the present invention. It is believed that the operation thereof will be clearly understood by those skilled in the art to which the present inven-

tion relates, but, for the sake of clarity, the same may be briefly summarized as follows:

As soon as the synchronous motor 29 is connected to a source of sixty (60) cycles alternating current, the armature shaft 23 is given a slight spin by rotating the knurled knob 26, this starting twirl being for the purpose of placing the armature 24 in step with the alternations of the alternating current. The rotation of the armature shaft 23, through the conventional gearing drives the second, minute and hour hands in a manner well known to those skilled in the art to which the present invention relates.

This completes the description of the mode of operation of the electric clocks of the present invention. It will be obvious to those skilled in the art to which the present invention relates that such clocks are simple in construction, easy and economical to fabricate and assemble, compactly and neatly arranged, and admirably adapted to perform their intended functions in an exceedingly accurate manner. Other superiorities and advantages of the electric clocks of the present invention will readily occur to those skilled in the art to which the present invention relates.

What I claim as my invention is:

1. In a synchronous motor for driving alternating electrically operated clocks and the like, a pole piece comprising a substantially circular segmental portion in the form of a web portion and a plurality of depending spaced tooth-like portions extending from said web portion and integral therewith, said spaced tooth-like portions lying substantially in the surface of a portion of a right cylinder of revolution whose axis is substantially perpendicular to the plane of the surface of said web portion but extending in said surface at an angle to the plane of said web portion other than a right angle.

2. In a synchronous motor for driving alternating electrically operated clocks and the like, a pole piece comprising a substantially circular segmental portion in the form of a web portion and a plurality of depending spaced tooth-like portions, said spaced tooth-like portions lying substantially in the surface of a portion of a right cylinder of revolution whose axis is substantially perpendicular to the plane of the surface of said web portion but extending in said surface at an angle to the plane of said web portion other than a right angle.

3. In a synchronous motor for driving alternating electrically operated clocks and the like, a plurality of opposed pole pieces each consisting of a substantially circular segmental portion in the form of a web portion and a plurality of depending spaced tooth-like portions, said spaced tooth-like portions lying substantially in the surface of a portion of a right cylinder of revolution whose axis is substantially perpendicular to the plane of the surface of said web portion but extending in said surface at an angle to the plane of said web portion other than a right angle.

4. In a synchronous motor for driving alternating electrically operated clocks and the like, a pole piece comprising a substantially circular segmental portion in the form of a web portion and a plurality of depending spaced tooth-like portions extending from said web portion and integral therewith, said spaced tooth-like portions lying substantially in the surface of a portion of a right cylinder of revolution whose axis is substantially perpendicular to the plane of the surface of said web portion but extending in said

surface at an angle to the plane of said web portion other than a right angle, in combination with a rotor lying within the circle defined in part by the segments of said substantially circular segmental portions and comprising a cup-shaped armature portion of magnetizable metal and having a substantially central substantially disk-like portion and a series of spaced tooth-like segments integral therewith and extending transversely thereto substantially in the surface of a right cylinder of revolution generated about an axis substantially perpendicular to the plane of said disk-like portion, said tooth-like segments extending in said last-mentioned surface at an angle to the plane of said disk-like portion other than a right angle and extending also in a direction substantially opposite to the direction in which said first-mentioned tooth-like portions extend.

5. In a synchronous motor for driving alternating electrically operated clocks and the like, a pole piece comprising a substantially circular segmental portion in the form of a web portion and a plurality of depending spaced tooth-like portions, said spaced tooth-like portions lying substantially in the surface of a portion of a right cylinder of revolution whose axis is substantially perpendicular to the plane of the surface of said web portion but extending in said surface at an angle to the plane of said web portion other than a right angle, in combination with a rotor lying within the circle defined in part by the segments of said substantially circular segmental portions and comprising a cup-shaped armature portion of magnetizable metal and having a substantially central substantially disk-like portion and a series of spaced tooth-like segments integral therewith and extending transversely thereto substantially in the surface of a right cylinder of revolution generated about an axis substantially perpendicular to the plane of said disk-like portion, said tooth-like segments extending in said last-mentioned surface at an angle to the plane of said disk-like portion other than a right angle and extending also in a direction substantially opposite to the direction in which said first-mentioned tooth-like portions extend.

6. A pole piece for synchronous motors, comprising a web portion and a plurality of tooth-like portions extending from said web portion, said tooth-like portions lying in the surface of a right cylinder of revolution whose axis is perpendicular to the plane of the surface of said web portion but extending in said cylinder surface at an angle to the plane of said web portion other than a right angle.

7. As a new article of manufacture, an armature for a synchronous motor, comprising a disc of magnetic material on the periphery of which are provided polar projections arranged substantially at right angles to the body portion of the disc, said projections being so disposed as to have their rear and forward portions lie in different radial planes.

8. As a new article of manufacture, an armature for a synchronous motor formed from a single disc of magnetic material on the periphery of which are provided polar projections arranged at right angles to the body portion of the disc, said projections being so disposed that the rear edge of the trailing end of one projection is in substantially the same radial plane as the forward edge of the leading end of the next adjacent projection.

9. As a new article of manufacture, a stator structure for a synchronous motor, including a lamination of magnetic material having on one edge thereof an arcuate row of polar projections, said projections being arranged substantially at right angles to the body portion of the lamination, and being disposed so that the forward and rear portions thereof will be in different horizontal planes.

10. As a new article of manufacture, a stator structure for a synchronous motor, including a lamination of magnetic material having on one edge thereof an arcuate row of polar projections arranged at an angle to the body portion of said lamination, said projections being so disposed that the rear edge of the leading end of one polar projection will be in the same horizontal plane with the forward edge of the trailing end of its next adjacent polar projection.

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