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SECONDARY CLOCK MOTOR

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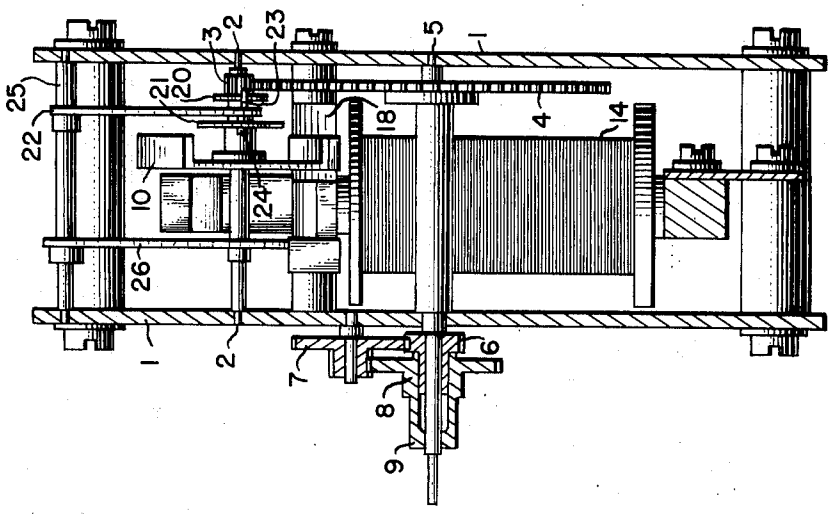

FIG.2.

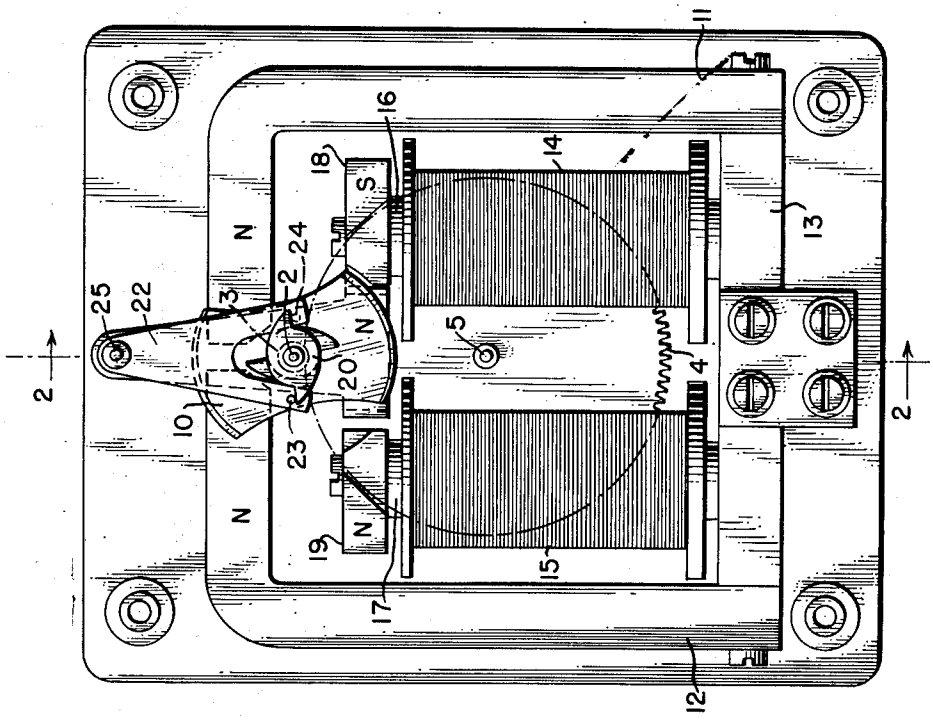

FIG.1.

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SECONDARY CLOCK MOTOR

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1 Claim. (Cl. 310—49)

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The present invention relates to a method and device for ensuring a permanent synchronisation of a main and subsidiary clocks.

In order to achieve uniform time indications of subsidiary clocks with the main clock, an arrangement has already been suggested comprising a main clock which by emitting short current impulses, repeated for instance in intervals of one minute, controls or operates any desired number of subsidiary clocks.

In consequence of the emitted impulse being, for instance, split, the driving magnet of the subsidiary clocks is actuated twice or more often. This results, of course, in an undesired movement of the minute-hand and, as according to the sensitivity of the magnet and mechanism, the effect is different in each clock-work, the inevitable consequence is a desynchronisation of the interconnected clocks in the course of time.

In order to remove the drawback arising, for instance from the splitting of the emitted impulses, as just described, a design has already been proposed using a polarised rotating armature or rotor. When in the clock-work according to this design the electromagnets receive the impulse emitted by the main clock, their armature is rotated for instance by 90 degrees, and imparts movement to the minute-hand by the intermediary of a suitable gearing. A further rotation of the armature of a clock-work arranged in this manner can be effected only by a newly emitted impulse, the character of which is given by a change of current flow. In spite of this, it is not possible to obtain a reliable synchronisation by this arrangement either. Under the influence of its own inertia, increased by the inertia of the hands, the armature exceeds the required extent of rotation and the minute-hand jumps by two or more minutes instead of by one. The same drawback is further caused by the position of the hands, unless they are exactly counterbalanced. Their counterbalancing, on the other hand, increases their inertia. This results again in desynchronisation, which fact has been proved in practice.

According to another design the synchronisation is sought to be achieved by a special device by means of which the main clock emits a series of correction impulses in certain time intervals, for instance every hour. Neither this method, which moreover requires a three-wire conductor, can warrant the reliability of the time indication within the time intervals because it does not prevent the time difference from occurring, it only removes from time to time the difference which has already arisen.

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The chief object of the present invention is to eliminate with certainty any difference in the time indication and to ensure a permanent synchronisation of subsidiary clocks with the main clock.

The main feature of the invention resides in the fact that with each reception of an impulse, repeated for instance, in one minute intervals, the subsidiary clocks are arrested. This can be carried out by a mechanical armature, which co-operates with a tripping member or disc mounted on the axis of the rotating armature or rotor. The mechanical armature is formed or actuated by an auxiliary armature polarised preferably by the same permanent magnet as the rotor. So for instance, if by each impulse the rotor is rotated through half a revolution, it is sufficient to arrange on its axis a cam with a single projection or lug co-operating with two arresting pins inserted directly into the polarised auxiliary armature which, under the influence of the current impulse, releases by one of its pins the lug of the cam, whereas the second pin is placed into the path of the cam, so that it allows only the required half revolution of the rotor, which is then safely arrested. Each current impulse emitted by the main clock causes not only the desired movement of the hands, but also, with absolute security, it prevents them from running past the correct position. By means of this very simple arrangement it has for the first time been made possible to reliably secure a permanent synchronous drive of subsidiary clocks, even of the largest sizes without any special wire or conductor. As in this way the clocks are prevented from being fast, it is also possible to prevent them from being slow, which could happen for instance by a deformation of the emitted impulse by the influence of the conduit or conductor; this can be achieved by further correcting impulses being transmitted, if desired, besides every normal impulse.

Examples of carrying out the invention will now be described, reference being made to the accompanying drawings, wherein

Fig. 1 represents diagrammatically the arrangement of a subsidiary clock in elevation, and

Fig. 2 is a vertical section taken through the axis of the clock on line 2—2 of Fig. 1.

The drawings represent only the subsidiary clockwork which comprises a frame 1 (Fig. 2) which can have any desired form for instance may consist of two parallel plates or the like, and serves as a bearing for various parts of the clockwork as will be described later. Journalled for rotation in the frame 1 is a shaft 2 carrying a

pinion 3 which meshes with a gear 4 keyed on to a shaft 5 mounted also in the frame 1 and carrying the minute hand (not shown) of the clock. Rigidly mounted on the shaft 5 is a pinion 6 meshing with a gear 7 which in turn is in engagement with a gear 8, provided with a sleeve 9 serving as a bearing for the hour hand (not shown). Mounted on the shaft 2 is a movable armature or rotor 10, the shape of which is apparent from Fig. 1.

The clockwork comprises one or two permanent magnets 11—12 connected preferably by a transverse beam 13. The poles of the magnets 11 and 12 extend to the neighbourhood of the rotor 10 and serve to premagnetise the latter.

Mounted on the beam 13 are the electromagnets 14—15, the cores 16—17 of which are preferably provided with pole extensions 18—19 which are adapted to co-operate with the rotor 10 in a manner described later. In consequence of their connection with the beam 13, the cores 16—17 and thus also the pole extensions 18—19 are premagnetized by the permanent magnets 11, 12. The electromagnets 14—15 are adapted to be energized by electric impulses emitted by the main clock (not shown) and consisting in general of current impulses of one or the other direction magnetising the cores 16—17 and pole extensions 18—19 in one or the other sense.

The two permanent magnets 11, 12 in the form of construction in accordance with Fig. 1 have the function of premagnetizing the rotating armature 10. By this premagnetization the armature becomes permanently north-magnetic or south-magnetic, the particular one being immaterial as regards the mode of operation. The important thing is only that, due to such premagnetization it reacts in the desired way on the electrical impulse of the constantly fluctuating or alternating polarity of the two electromagnets 14, 15. In order that the rotary armature 10 need not be made out of a permanent magnet, it may consist of soft iron. In this connection, however, the armature should be located in the close vicinity of the permanent magnet, i. e. in the operative range thereof. Consequently, the magnetic force must also be transmitted to the armature 10 as though it were in direct contact therewith. In case the north pole of the permanent magnet or magnets of the armature 10 is thus premagnetized it must become permanently north-magnetic and this applies to its entire extent including also the two side pieces, i. e. in other words like a pole shoe.

Now the main clock sends a current impulse through the electromagnets every minute. Let it be assumed that the permanent magnets 11, 12 are north-magnetic at the top and south-magnetic below and that the rotary armature 10 becomes north-magnetic as a result of the action of the two north poles. In that case, in the position drawn in Fig. 1, the right pole shoe 18 must be excited south-magnetically and the left pole shoe 19 north-magnetically. If it be assumed that the right pole shoe 18 now becomes north-magnetic and the left pole shoe 19 south-magnetic, then the latter attracts the permanently north-magnetic armature 10, the former repels it, so that the armature 10 is forced to execute a quarter revolution. The current impulse of an opposite direction sent by the main clock in the next minute now effects newly a change of the poles of the two electromagnets. The pole shoe 18 becomes south-magnetic and attracts the opposite pole-armature 10, while the left pole shoe 19, which has become north-magnetic, now repels the armature 10, and the latter again executes a quarter revolution, in which connection it has of course, together with the oppositely situated flange, come into the position drawn in Fig. 1. This movement is constantly transmitted by gearing to an axle which bears the minute-hand.

Rigidly mounted on the shaft 2 is a stop member, which in the example shown in Figs. 1 and 2 is formed by two cams 20, 21 the opposite projections or lugs of which are positioned alternately at an angle of 90 degrees. A mechanical armature 22 arranged for swinging movement co-operates with these cams. The armature 22 is provided at its one, for instance the left arm with an arresting pin 23, which extends towards the cam 20 and, at the other arm, with an arresting pin 24 projecting in the opposite direction. The armature 22 is rigidly connected by a shaft 25 with an auxiliary armature 26 which is adapted to be premagnetized by the same permanent magnets 11, 12 as the rotor 10. If the auxiliary armature 26 swings between the poles or pole extensions 18, 19 of the two electromagnets 14, 15, the mechanical armature 22 follows positively its movements and swings between the cams 20, 21. In consequence of the clearance or air gap between the auxiliary armature 26 and the opposite pole or pole extension being substantially smaller than the air gap between the same pole or pole extension and the rotor 10, the force attracting the auxiliary armature 26 is greater than the force attracting the rotor 10. The velocity of movement of the light auxiliary armature 26 is therefore substantially higher than that of the rotor 10 which is, moreover, braked by the gearings 3, 4 and 6, 7, 8, transmitting movement to the hands.

The device as described above operates as follows:

In the moment when the current impulse of a certain direction flows through the winding of the electromagnets 14—15, the auxiliary armature 26 and together with it also the mechanical armature 22, are swung by the influence of the magnetic field. The arresting pin 23 moves out of the path of the lugs or extensions on the cam 20, whereas the other arresting pin 24 comes into the path of the lugs or extensions of the cam 21. At the same time by the influence of the same energising impulse of the electromagnets 14 and 15 the rotor 10 is rotated too with a retardation, however, as described above. The flanges of the rotor 10 are made, in the same direction, of varying cross sectional area from one side to the other having the greatest area always at that side being shown in Fig. 1 against the active pole extension 18. This construction provides the proper rotatable pull upon the armature or rotor 10 when the electromagnet is successively energized by alternating current flow. The rotor 10 entrains both cams 20 and 21 which, by the removal of the pin 23, have been relieved of the mechanical impediment to their movement. The rotor 10 is, however, safely arrested in the moment, when the extension or lug of the disc 21 abuts against the other arresting pin 24 of the mechanical armature 22. Now it is possible to transmit one or more correction impulses with the same direction of current, which adjust the required position of the rotor 10 in a case, when the first impulse was not sufficient for instance by the influence of the conduit or conductor. These impulses remain of course, without any in-

fluence, if the rotor 10 has already reached the desired position. A change in the position of the rotor, arrested in this way, can occur only, if a current of opposite direction flows through the windings of the electromagnets 14 and 15. The auxiliary armature 26 with the mechanical armature 22 swing then in the opposite direction, the arresting pin 24 is moved so as not to hinder the movement of the disc 21, the rotor 10 is rotated through a further part of a revolution and is arrested by the other arresting pin 23, which has been moved into the path of the extension or lug of the disc 20.

In order to enable the subsidiary clock to be adjusted by hand, the lugs or extensions of the tripping member or discs are shaped in such a way so as to allow the hands to be moved backwards into the desired position.

What I claim is:

In a secondary clock adapted for actuation by electric impulses from a main clock, a rotary armature adapted for movement of the hands of said secondary clock, permanent magnetic means for premagnetizing said rotary armature, electromagnetic means for energization by the current impulses of alternate polarity from said main clock, abutment members rigidly connected with said rotary armature, an auxiliary polarized armature oscillatably mounted, said electro-magnetic means upon energization thereof moving said auxiliary armature, arresting means connected with said auxiliary armature for movement therewith and coaction with said abutment members to arrest said rotary armature in a predetermined position after the reception of each separate impulse from the main clock, a shaft mounting said auxiliary armature, said arresting means including a mechanical lever secured on said shaft

of said auxiliary armature for movement therewith and having spaced arms, said means connected with said auxiliary armature for arresting said rotary armature comprising arresting pins arranged in spaced relationship on said spaced arms on said mechanical lever adjacent the free ends thereof, said abutment members being cam shaped discs mounted for rotation with said rotary armature, the arms of said mechanical lever extending between said discs, extended ends on said cams, the extended ends on one said cam being arranged at an angle of substantially 90° with respect to the extended ends on the other of said cams, said extended ends coacting with said arresting pins on said mechanical lever upon rotation of said rotary armature and said mechanical lever on each impulse from the main clock for limiting the shifting of the rotary armature to a single step.

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