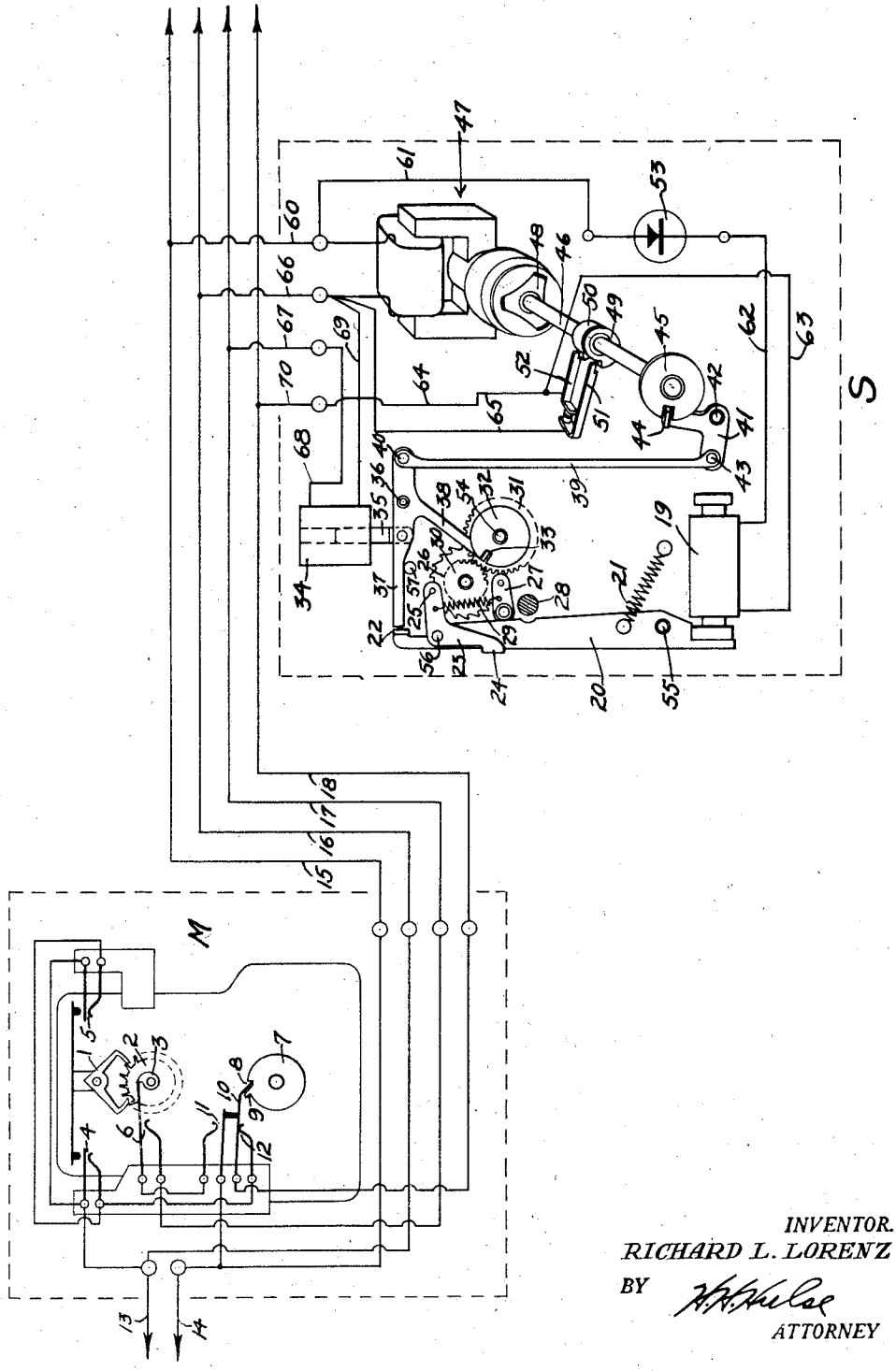
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TIME SYSTEM

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## TIME SYSTEM

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This invention relates in general to time systems and more particularly to a time system in which the secondary devices are operated and controlled by individual synchronous motors. The main object of the present invention is to provide means for synchronizing the secondary devices in a system of this type.

Two methods of operation are employed in the secondary devices of synchronous motor systems. In the first method the clock hands, type wheels or other time mechanism are operated directly from the motor by mechanical connections such as the regular time train gears, cams, or ratchet and pawl drive. However, it has been found that the second method of operation, in which the time mechanisms are operated by electromagnetic means and the synchronous motor is used to periodically close a circuit to the electromagnetic means, is much more satisfactory, especially in systems including time stamps, recorders, etc., which incorporate type wheels requiring step by step operation.

In systems such as described above, current interruptions will cause the secondary devices to run slow. Furthermore, the stopping and starting of the motors because of interruptions in current may cause the secondaries to scatter due to differences in the coasting and acceleration rates of the different motors.

It is an object of the present invention, therefore, to provide a master clock control for a synchronous motor system, which control will periodically synchronize the secondary devices so that they will all operate simultaneously.

It is a further object of the invention to provide means for automatically compensating for current interruptions in a synchronous motor secondary system.

The above and other objects and features of the invention will be clearly understood from a perusal of the following specification when read in connection with the accompanying drawing, comprising one figure only, which diagrammatically discloses a secondary time system incorporating the present invention.

In the drawing, only sufficient parts have been shown to enable one to obtain a clear understanding of the invention. The master clock M is shown diagrammatically and is of standard construction except that it is equipped with the various cams and contacts necessary to effect the periodic correction of the secondary devices. Leads 13 and 14 are connected to a regulated frequency alternating current supply source.

The secondary device S may be a secondary clock, time stamp or recorder, the timing element of which consists of the synchronous motor 47. This motor controls the operation of the clock hands or type wheels by means of the impulse magnet 19, the circuit of which is controlled through contacts 51—52. This secondary device is also provided with the secondary mechanism for periodically correcting same by means of control exercised from the master clock M.

Referring to the drawing in detail, master clock M is provided with the usual verge 1 and escape wheel 2. The verge 1 controls the alternate closure of contacts 4 and 5 for the purpose of transmitting rapid accelerating impulses to the secondary devices. The cam 3 revolves at the rate of one revolution per minute and controls the minute impulse contact 6. Cam 7 is arranged to rotate at the rate of one revolution per hour and is provided with a notch 8 in its periphery which notch is immediately followed by a rise or lobe 9. This cam through the cam follower 10 controls the contacts 11 and 12.

The master clock is connected to the secondary system by means of a four conductor circuit comprising lines 15 to 18 inclusive. Lines 15 and 16 are permanently connected to the power lines 13 and 14 and supply the regulated frequency alternating current to the synchronous motors of the secondary units. Synchronous motor 47 of the secondary device S revolves shaft 46 at the rate of one revolution per minute through a friction drive connection including the spider 48. Mounted on shaft 46 are two cams 49 and 50 which control the cam followers and contact springs 51 and 52 in such a manner that the circuit through these contacts is closed for about one second during each revolution of shaft 46. The shaft also bears at its outer end a disc 45 having a notch in its periphery which notch is adapted to be engaged by the projection 44 of bell crank lever 41. The position of disc 45 with respect to cams 49 and 50 is such that the projection 44 enters the notch in the disc immediately after contacts 51 and 52 have been opened.

The secondary time element, which may be clock hands or type wheels, is advanced in all its movements by means of the impulse magnet 19. This magnet is provided with an armature 20 pivoted at 55 which armature carries at its upper end an operating pawl 23 pivoted at 56. Counter-clockwise rotation of this pawl on the armature is limited by means of the lug 24 which is in engagement with the arm 20 in the position shown on the drawing.

The pawl 23 is provided at its outer end with the ratchet engaging pin 25 which is in engagement with the teeth of ratchet wheel 26. A stationary click or retaining pawl 27 is provided to prevent retrograde movement of ratchet wheel 26 and the two pawls are connected by the tension spring 29 which maintains them in engagement with the ratchet wheel.

The shaft mounting the ratchet wheel 26 also mounts gear 30 which is in mesh with the gear 31 mounted on shaft 54. The gearing is such that shaft 54 rotates at the rate of one revolution per hour.

Also mounted on shaft 54 is the timing disc 32 provided with a notch 33 in its periphery. This notch is adapted to be engaged by a lateral extending projection on arm 38 which forms part of the lever system pivoted at 36. This lever system also includes the arm 37 which is arranged to engage the projection 22 on armature 20 and block the armature in its energized position when the projection on lever 38 enters notch 33 and permits the lever system to rotate counterclockwise about pivot 36 until arm 37 engages stop 57.

Also mounted on this lever system is a link 39 pivoted at 40 which extends to the bell crank lever 41 and controls the oscillation thereof about its pivot 42. The levers or arms 37 and 38 are adapted to be raised from the position shown in the drawing by means of the solenoid magnet 34 operating plunger 35.

Each time magnet 19 is energized, armature 20 is operated and the pawl 23 is withdrawn to engage the succeeding tooth of the ratchet wheel 26. When the magnet is de-energized, operating spring 21 returns the armature to its normal position, at the same time advancing the ratchet wheel 26 the space of one tooth.

A half-wave rectifier 53 is provided in the circuit of magnet 19 to rectify the current for the magnet for more practical and efficient operation.

During normal operation of the system, the synchronous motor 47 rotates shaft 46 and the contacts 51 and 52 are momentarily closed once each minute. Closure of these contacts completes a circuit from the power supply line 13, line 16, conductors 66 and 65, contacts 51 and 52, conductor 63, winding of impulse magnet 19, conductor 62, rectifier 53, conductors 61 and 60, line 15, back to the other side of the power supply 14. Magnet 19 energizes, operating its armature, and upon release of the armature, the ratchet wheel 26 is advanced to advance the clock hands or type wheels. The levers 37 and 38 are normally held in their upper positions by the engagement of the projection on arm 38 with the periphery of disc 32. This also keeps the projection 44 out of engagement with disc 45.

When the secondary timing element reaches its 59th minute position, the notch 33 is in position to be engaged by the projection on arm 38 but is prevented from entering the notch since the arm 37 is resting on top of the end of armature 20. When the magnet 19 is again energized and armature 20 is operated, the projection drops into the notch lowering arms 37 and 38, whereupon the end of arm 37 is lowered into the path of movement of projection 22 thereby blocking armature 20 in its energized position. The raising of link 39 brings the projection 44 into engagement with the periphery of disc 45 which limits the extent of movement of arms 37 and 38. However, this movement is sufficient to enable arm 37 to block the armature as described above. Synchronous motor 47 continues to rotate shaft 46 until the notch in disc 45 is presented to projection 44 immediately after contacts 51 and 52 have been opened. The closing of contacts 51 and 52 can not advance the secondary time element, although such closure does complete a circuit to magnet 19 and energizes this magnet. However, as stated above, the element 20 is already blocked in its operative position, so such energization has no effect on the apparatus.

When projection 44 drops into the notch in disc 45, it permits the levers 37 and 38 to move to their lowermost position with lever 37 in contact with stop 57. Projection 44 holds the disc 45 and shaft 46 in this position, although the motor 47 continues to operate. This is accomplished by means of friction drive connection 48.

Referring now to the master clock M, the closure of contact 6 each minute by means of cam 3 is ineffective since the circuit to the secondary system is open at contacts 11. When the cam follower 10 is in engagement with the periphery of cam 7, both contacts 11 and 12 are open. Shortly after the master clock has passed its 59th minute position, for example, at 59 minutes and 10 seconds after the hour, the cam follower 10 drops into the notch 8 in cam 7, thereby closing contacts 12. This throws the fast impulsing contacts 4 and 5 into circuit with the impulse magnet 19 of the secondary devices over the following circuit connections: from the power supply line 13, alternately through contacts 4 and 5, contacts 12, line 18, conductors 70, 64 and 63, winding of the impulse magnet 19, conductor 62, rectifier 53, conductors 61 and 60, line 15, to the other side of the power source 14. Rapidly recurring impulses are transmitted over this circuit to rapidly advance any secondary device which may be slow with respect to the master clock. As each of such slow secondary devices reaches its 59th minute position, the armature of its driving magnet is blocked and the impulsing contacts controlled by its synchronous motor are rendered ineffective in the manner described above.

At about 59 minutes and 50 seconds after the hour, the cam follower 10 is raised to the top of projection or lobe 9, thereby opening contacts 12 and closing contacts 11. This connects the minute impulse contact 6 in circuit with the secondary clock. Exactly on the hour, contacts 6 are closed completing a circuit from the supply line 14, contacts 11 and 6, line 17, conductors 67 and 68, winding of solenoid magnet 34, conductors 69 and 66, line 16 to the other side of the supply source over power line 13. Solenoid magnet 34 is energized, raising its plunger 35 and revolving the lever system in a clockwise direction around its pivot 36. This raises the projection of lever 38 out of notch 33 and moves the end of lever 37 out of its blocking position with respect to armature 20.

During this clockwise movement of the lever system, the link 39 is depressed, thereby rotating the bell crank lever 41 in a counter-clockwise position to lift projection 44 out of the notch in disc 45. As soon as the armature 20 is released, the operating spring 21 restores it to its normal position, thereby advancing the secondary time element to position 60 and moving the notch 33 out of the path of the projection on lever 38.

At the end of the impulse the contacts 6 are opened, magnet 34 de-energizes and lever 38 is lowered so that the projection on this lever again

engages the periphery of disc 32. This maintains the lever system in such position that arm 37 cannot interfere with the back and forth movement of armature 20. When the bell crank lever 41 is rotated in a counterclockwise position as described above, disc 45 is released and the synchronous motor 47 again drives shaft 46 through the friction connection 48. The motor therefore resumes control of the time element and advances same step by step once each minute through closure of contacts 51 and 52. At approximately 10 seconds after the hour, the cam follower 10 drops off of the lobe 9 of cam 7, thereby opening contacts 11 to prevent the transmission of minute impulses during the remainder of the hour.

From the foregoing explanation, it will be seen that this system provides for hourly correction of secondary devices which are normally timed or controlled by means of individual synchronous motors. Once each hour the master clock transmits rapid accelerating impulses over the system to rapidly advance any secondary device which may have become slow due to current interruptions or which may have been improperly set when originally connected to the system. All secondary devices are stopped in a pre-determined position and the impulsing contacts controlled by the motor are also held in a pre-determined position until simultaneously released by the master clock when same reaches the even hour position. Thus, the device will correct not only the proper minute position as determined by the master clock, but the time of advance of each secondary device by its individual motor is synchronized with the second hand of the master clock.

Although only one particular embodiment of the invention has been disclosed and described in this application, it will be apparent to those skilled in the art that various modifications may be made without departing from the spirit of the invention.

What is thought to be new and is desired to have protected by Letters Patent is pointed out in the following claims.

What is claimed is:

1. In a time system, a secondary apparatus comprising an impulse magnet and an armature therefor for effecting all advancing movement of said apparatus, a circuit for said magnet, a synchronous motor, means controlled by said motor for periodically closing said circuit to advance said apparatus step by step, means controlled by the chronological condition of said apparatus for blocking said armature to prevent advance of said apparatus, and means rendered effective by said blocking means for rendering said circuit closing means inoperative at a predetermined point in its cycle of operation.

2. In a time system, a secondary apparatus comprising an impulse magnet and means controlled thereby for effecting advance of said apparatus, a circuit for said magnet, a synchronous motor and means controlled thereby for periodically closing said circuit, means controlled by the chronological position of said apparatus for rendering said advancing means ineffective, means partially controlled by said last means for rendering said circuit closing means inoperative, and means for simultaneously removing said last two means from operative positions.

3. In a time system, a secondary apparatus including time registering mechanism, an impulse magnet and means controlled thereby for effecting all advancing movements of said mechanism, a circuit for said magnet, a synchronous motor and means controlled thereby for closing said circuit at regular intervals, means controlled by the chronological condition of said mechanism for rendering said advancing means ineffective, means rendered operative by said last means for rendering said circuit closing means inoperative, an incoming control circuit, and means controlled over said control circuit for removing said last two means from operative positions.

4. In a time system, a secondary apparatus including time registering mechanism, an impulse magnet and means controlled thereby for effecting all advancing movements of said mechanism, a synchronous motor and means controlled thereby for transmitting periodic impulses to said magnet, means automatically effective to block said advancing means when said mechanism reaches a pre-determined chronological position, a second blocking means for blocking said impulse transmitting means at a pre-determined point in its cycle of operation, said second blocking means being rendered operative by said first blocking means, an incoming control circuit, and means controlled over said control circuit for simultaneously removing said first and said second blocking means from blocking positions.

5. In a time system, control apparatus and secondary apparatus connected by a control circuit, time registering mechanism in said secondary apparatus, a synchronous motor and means controlled thereby for effecting all advancing movement of said mechanism, means in said secondary apparatus automatically operated when said mechanism reaches a pre-determined chronological position for rendering said advancing means ineffective irrespective of continued operation of said motor, and means periodically operated over said control circuit by said control apparatus for rendering said last means ineffective whereby said advancing means is again operative to advance said mechanism under control of said motor.

6. In a time system, master apparatus and secondary apparatus connected by a control circuit, time registering mechanism in said secondary apparatus, an impulse magnet for advancing said time registering mechanism, a circuit for said magnet, a synchronous motor, a shaft rotated by said motor, cam means on said shaft, contacts controlled by said cam means to transmit regular periodic impulses over said circuit to said magnet, means in said master apparatus for transmitting rapid accelerating impulses over said control circuit to rapidly advance slow secondary apparatus, means automatically effective when said time registering mechanism reaches a pre-determined chronological position for blocking said armature, means rendered operative by said last means for stopping rotation of said shaft and cam means at a pre-determined point irrespective of continued operation of said motor, and means controlled by said master apparatus over said control circuit for simultaneously rendering said last two means ineffective.

7. In a time system, master apparatus and secondary apparatus connected by a control circuit, time registering mechanism in said secondary apparatus, a synchronous motor and means controlled thereby for effecting normal advance of said mechanism, means in said master apparatus for controlling said advancing means over said control circuit to effect accelerated advance of said mechanism, means automatically effective when said mechanism reaches a pre-determined chronological position for blocking said advancing means to render it non-responsive to

control from said master apparatus and said motor, and means controlled by said master apparatus over said control circuit for removing said blocking means from blocking position.

8. In a time system, master apparatus and secondary apparatus connected by a control circuit, time registering mechanism in said secondary apparatus, a synchronous motor, advancing means for said time registering mechanism controlled by said motor to effect normal advance of said mechanism, means in said master apparatus for exercising control of said advancing means over said control circuit independently of said motor to effect accelerated advance of said mechanism, means in said secondary apparatus for automatically blocking said advancing means in a predetermined position of said mechanism, and means controlled by said master apparatus for releasing said blocking means.

9. In a time system, control apparatus and a plurality of secondary devices each having a time element, a synchronous motor in each secondary device, electromagnetic means controlled by each of said motors for effecting normal advance of the associated time element, means in each device for periodically blocking said electromagnetic advancing means irrespective of continued operation of the associated motor, and means controlled by said control apparatus for simultaneously releasing said blocking means in each secondary device to bring said devices into synchronism with each other.

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