Jan. 12, 1943. W. W. LUNDEN 2,308,243

ELECTRIC-IMPULSE TIME-INSTRUMENT SYSTEM

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Fig. 1.

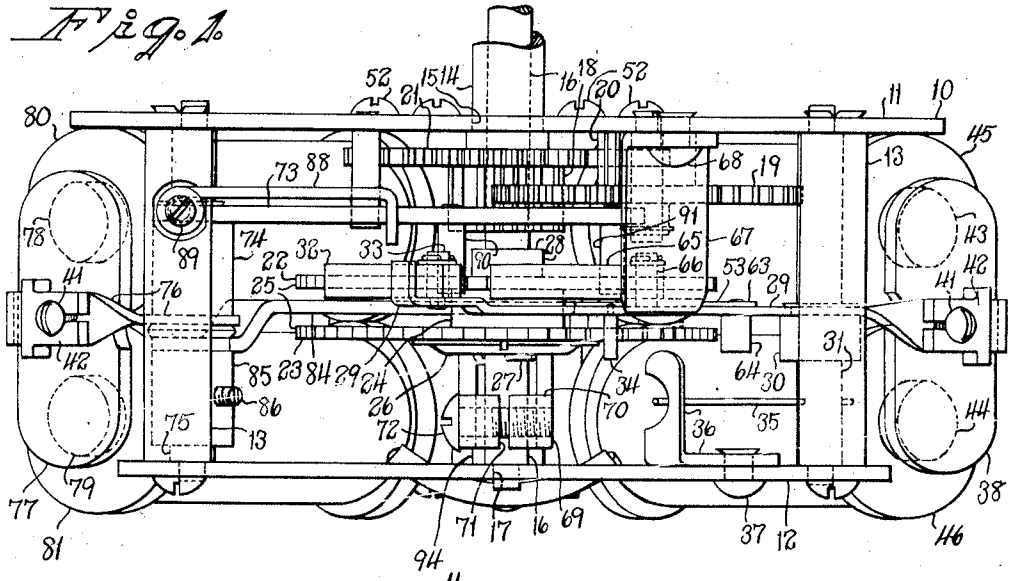
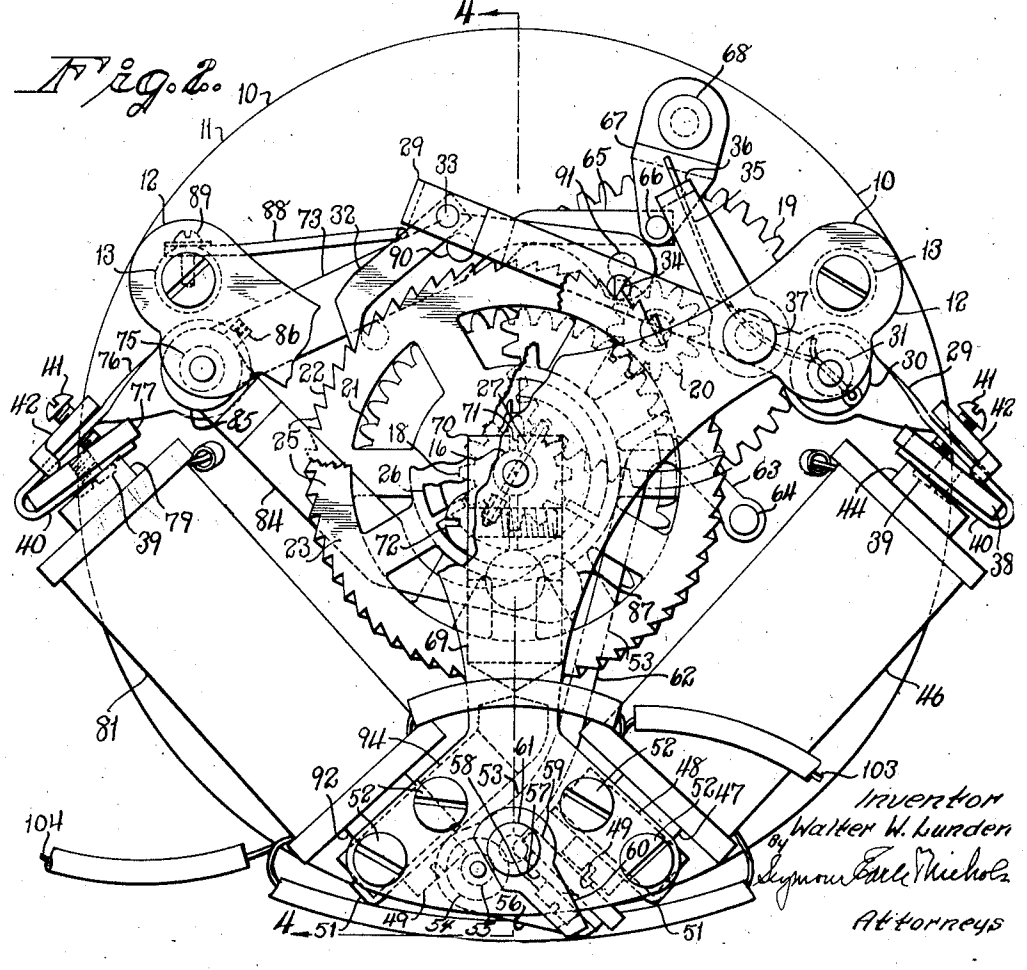


Fig. 2.



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Fig. 4.

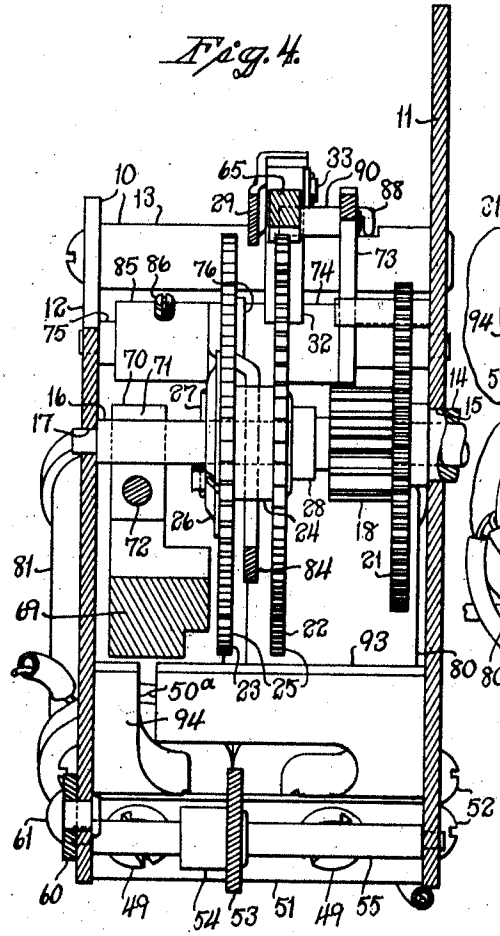


Fig. 3.

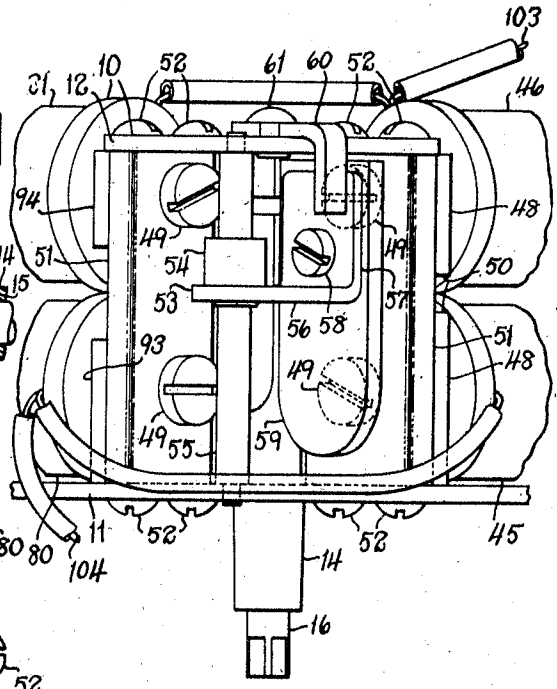
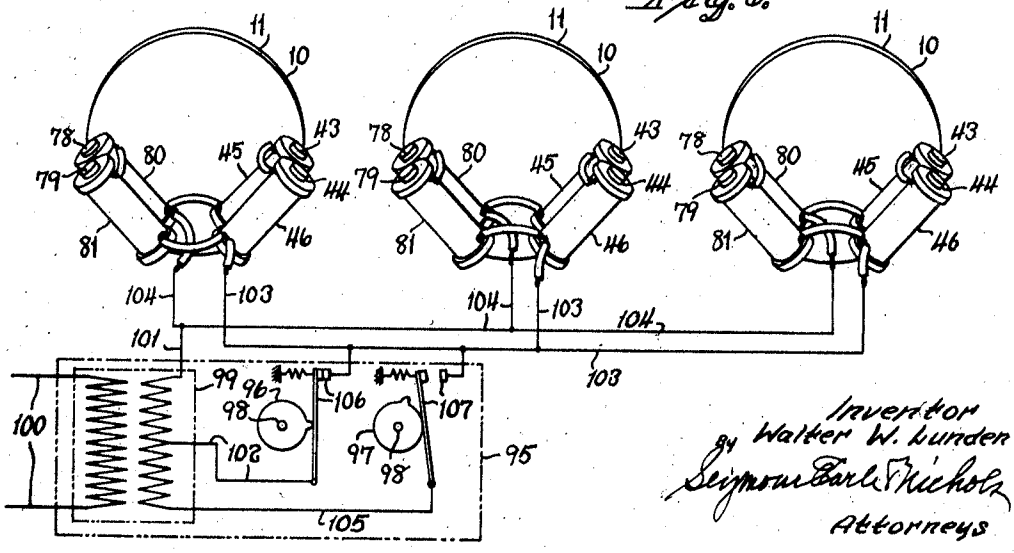


Fig. 5.



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UNITED STATES PATENT OFFICE

2,308,243

ELECTRIC-IMPULSE TIME-INSTRUMENT SYSTEM

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Application June 17, 1940, Serial No. 340,927

4 Claims. (Cl. 58—24)

This invention relates to improvements in electric-impulse time-instrument systems in which one or more impulse or secondary time-instruments are controlled by a master time-instrument.

One object of this invention is to provide an improved electric-impulse time-instrument system in which one or more secondary time-instruments are controlled in all their time-indicating and resetting phases from a master time-instrument with only two conductors interconnecting the secondary and master time-instruments and without requiring the use of switch contacts in the secondary time-instruments.

Another object of this invention is to provide an improved electric-impulse time-instrument system in which one or more secondary time-instruments are actuated by a master time-instrument formed of simple elements readily manufactured and readily assembled to produce an efficient durable construction at minimum cost.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art.

In the accompanying drawings forming a part of the present disclosure, in which one way of carrying out the invention is shown for illustrative purposes:

Fig. 1 is a top plan view of an impulse or secondary time-instrument or clock movement made in accordance with this invention;

Fig. 2 is a front elevation of Fig. 1;

Fig. 3 is a fragmental bottom plan view of Fig. 2;

Fig. 4 is a vertical sectional view on line 4—4 of Fig. 2; and

Fig. 5 is a schematic view illustrating three secondary clocks controlled by a master-clock in accordance with the present invention.

The present embodiment discloses improvements upon the clock disclosed in Patent No. 1,957,543 granted to S. M. Kenerson on May 8, 1934.

In the description and claims, the various parts are identified by specific names for convenience, but they are intended to be as generic in their application as the prior art will permit.

Referring to the drawings showing the particular form of the invention chosen for illustration, the secondary-clock movement 10 has front and rear movement-plates 11 and 12 connected together in spaced relation by two upper pillars 13 and two lower spacer-members to be later described.

An hour-sleeve 14 is journaled for rotation in a bearing or hole 15 in the front movement-plate 11. A minute-arbor or shaft 16 is journaled at the front end in the hour-sleeve 14 and in a bearing or hole 17 in the rear movement-plate 12. The minute-arbor 16, which carries a minute-hand (not shown), has driving relation with the hour-sleeve 14 which carries an hour-hand (not shown), by means of any suitable reduction-gearing which causes the hour-sleeve to rotate at one-twelfth the speed of the minute-arbor. Such reduction-gearing may consist of gears such as 18, 19, 20, 21.

A drive ratchet-wheel 22 and a holding or locking ratchet-wheel 23 are staked to or integrally formed with a bushing 24 to form a ratchet-wheel unit 25 which is rotatably mounted on the minute-arbor 16. A sheet-metal disk-spring 26 is held pressed against the adjacent face of the holding ratchet-wheel 23 by means of a pin 27 which extends transversely through the minute-arbor 16 to frictionally press the ratchet-wheel unit 25 against a collar 28 integrally formed on or firmly secured to the minute-arbor 16. Thus, the ratchet-wheel unit 25, owing to being held frictionally between the spring 26 and collar 28, normally rotates with the minute-arbor 16, but can be shifted or adjusted rotationally relatively to the arbor 16 for adjustment purposes.

A driving-lever 29 is staked to a bushing 30 which is firmly secured to a shaft 31 which is pivotally mounted in the movement-plates 11 and 12. One end of the lever 29 has a driving-pawl 32 pivoted at 33 and normally engaged with the teeth of the drive ratchet-wheel 22, and a holding or locking pawl 34 rigidly secured to the lever. The lever 29 is normally urged in a counterclockwise or driving direction as viewed in Fig. 2, by a spring 35 which has one end extending through the shaft 31 and has its other end engaged beneath an arm 36 which is riveted at 37 to the rear movement-plate 12, to thus resiliently urge the pawl 32 in driving direction. The pawl 32 is withdrawn in the opposite direction from driving, that is, in the retracted direction, by means of an armature 38 of magnetic material which is secured to the opposite end of the lever 29 by a screw 39 which passes through the bent-over end 40 and threads into the armature 38. A screw 41 is threaded through a split lock-nut 42 and through the lever 29 to adjust the pressure of the screw 41 on the armature 38, and thus

adjust the amount of distortion given to the end 40, and in consequence to adjust the armature 38 toward the upper magnetic poles 43 and 44 of a pair of electro-magnets 45 and 46. By unscrewing the screw 41, the spring-action of the bent-over end 40 adjusts the armature 38 away from the magnetic poles 43 and 44.

The electromagnet 45 has a lower magnetic pole 47 to which a supplemental magnetic pole-piece 48 is secured by a screw 49 of magnetic material which forms a pole-extension of the pole 47. The other electromagnet 46 of the pair of electromagnets 45, 46 has similar correspondingly-numbered parts 47, 48 and 49, there being a space 50 between the pole-pieces 48. A non-magnetic sheet-metal spacer-member 51 holds the movement-plates 11 and 12 spaced apart, and connects them together by the screws 49 which extend through holes in the member 51 and thread into the pole-pieces 48 to thus clamp the member 51 to the pole-pieces 48, and by screws 52 which extend through holes in the movement-plates 11 and 12 and thread into the pole-pieces 43.

A brake-lever 53 (Fig. 3) is staked to a bushing 54 which is firmly secured on a shaft 55 pivotally mounted in the movement-plates 11 and 12. One end of the brake-lever 53 has an arm 56 provided with a right-angled extension-plate 57 which is secured by a screw or bolt 58 to an armature 59 which spans and is attracted by the pole-screws 49. A limit-arm 60 riveted at 61 to the movement-plate 12 is frictionally adjustable to serve as a limit-member to limit the amount of the movement of the armature 59 down away from the pole-screws 49.

The other end of the brake-lever 53 forms a brake-arm 62 having an angled extension 63 to which is secured a pin 64 which is adapted to engage the ratchet-teeth of the holding ratchet-wheel 23, to prevent counterclockwise rotation of the ratchet-wheel unit 25 under certain circumstances to be hereinafter explained.

A holding pawl 65 is pivotally connected at 66 to an arm 67 riveted at 68 to the movement-plate 11, the holding pawl 65 engaging the ratchet teeth of the drive ratchet-wheel 22 to prevent clockwise rotation of the ratchet-wheel unit 25. The holding pawls 34 and 65 together with the brake-means may be referred to as holding-means.

A weight 69 of magnetic material has an arm-portion 70 provided with a split 71, the two portions of the arm-portion being drawn together by a screw 72 to clamp the arm-portions firmly to the minute-arbor 16.

A reset or resetting-lever or arm 73 is staked to a bushing 74, which latter is firmly secured in any suitable way on a shaft 75 which is pivoted in the movement-plates 11 and 12. A lever or arm 76 is also securely staked to the bushing 74 and has its end secured to an armature 77 of magnetic material which spans and is adapted to be attracted by the upper magnet poles 78 and 79 of a pair of electromagnets 80 and 81. The armature 77 is secured to be adjusted with respect to the resetting-lever 76 and the magnet poles 78 and 79 by means of a screw 39, a bent-over end 40, a screw 41 and a lock-nut 42, the same as previously described for the parts 39, 40, 41 and 42 in connection with the driving-lever 29.

A brake-release lever 84 is staked securely to a bushing 85 which is adjustably secured on the shaft 75 by a set screw 86, the brake-release lever 84 extending around to a position to have its end 87 closely adjacent the brake-arm 62 for a purpose to be later described. A spring 88 secured by a screw 89 to the adjacent one of the two pillars 13—13 pushes on the reset-arm 73 to tend to rotate it and its connected parts in a clockwise direction. The reset-arm or lever 73 has a pin 90 beneath, and adapted to raise, the driving-pawl 32 out of engagement with the ratchet-wheel 22, and also has a pin 91 beneath and adapted to raise the holding pawl 65 out of engagement with the teeth of the ratchet-wheel 22.

The electromagnets 80 and 81 have lower magnetic poles 92 to which are secured supplemental magnetic pole-pieces 93 and 94 of different shape from each other and of different shape from supplemental pole-pieces 48 of the electro-magnets 45 and 46, the space 50a between the pole-pieces 93 and 94 being directly below the resetting-weight 69. Screws 49, a spacer-member 51 and screws 52 perform the same structural functions in connection with the poles 92 of the electromagnets 80 and 81 as the same numbered similar parts perform in connection with the poles 47 of the electromagnets 45 and 46.

In the particular form of construction shown in the drawings, the effective strength of the spring 88 is greater than the effective strength of the spring 35. In other words, what is meant is that it requires a greater magnetic pull on the armature 77 in order to cause it to move downward than is needed to cause the armature 38 to move downward.

While a single secondary clock or clock-movement 10 could be employed in accordance with the present invention, ordinarily a plurality of such secondary clocks 10, as illustrated in Fig. 5 of the drawings, are employed in connection with one master clock indicated in Fig. 5 by the broken-line outline 95. The master clock 95 contains two cam switch-closers 96 and 97 mounted on one or more shafts 98, the shafts 98 being actuated by any suitable master clock mechanism such, for example, as a pendulum clock. A suitable transformer indicated diagrammatically as enclosed within the broken-line outline 99, is adapted to take ordinary 110 volt alternating current from the line wires 100, the secondary of the transformer supplying suitable low-voltage current through the wires 101 and 102 to the two main wires 103 and 104 of the clock system leading to the secondary clocks 10, and the wires 105 and 101 supplying suitable higher-voltage electric current to the main wires 103 and 104 leading to the secondary clocks. Ordinarily, the cam switch-closer 96 will be operated once per minute to close the switch 106 to supply low-voltage current to the wires 103 and 104 to deliver impulses once per minute to the electric impulse driving-means of the secondary clocks 10, and the cam switch-closer 97 will ordinarily be rotated once an hour to close the switch 107 to reset the clock to accurate time.

The two wires 103 and 104 are permanently connected to all of the wire coils of the electromagnets of all of the secondary clocks in any suitable formation such that at all times all low-voltage electric impulses through the switch 106 and all high-voltage impulses through the switch 107 will be delivered to all of the said wire coils of all of the electromagnets without any switches in the secondary clocks needing to be closed or opened. In the particular ar-

rangement shown in Fig. 5, the wire 103 is connected to the coils of the electromagnets 45 and 46, and the wire 104 is connected to the coils of the electromagnets 80 and 81.

All of the electromagnets in the construction illustrated in the drawings are of equal electromagnetic strength, but it will be appreciated that instead of having them all of equal strength in connection with using springs 88 and 35 of unequal strength, the springs 88 and 35 could be of equal effective strength and the electromagnets 45 and 46 could be stronger than the electromagnets 80 and 81 so that the electromagnets 80 and 81 would only actuate the armature 77 when the high-voltage current is applied.

Instead of using a transformer such as indicated at 99, one or more batteries arranged to provide two different voltages could be used.

When the switch-closer 96 of the master clock 95 closes the switch 106, low-voltage current passes through the wires 103 and 104 to the four electromagnets of each one of the secondary clocks 10. The low-voltage current passed by the switch 106 is of such voltage as to produce a sufficient current to cause the electromagnets 45 and 46 to pull down the armature 38, but of insufficient current to cause the electromagnets 80 and 81 to pull down the armature 77. Thus, the switch-closer 96 which closes the switch 106 once each minute, causes the armature 38 to be pulled down once each minute to thus swing the upper left end of the driving-lever 29 to thus drag the pawl 32 to the right and permit it to drop in the next tooth notch of the drive ratchet-wheel 22 ready for the next downward movement. Immediately upon the switch-closer 96 turning to a position to permit the switch 106 to spring open, the current to the electromagnets 45 and 46 is broken with consequence that the spring 35 causes the left end of driving-lever 29 to swing downward thus pushing the pawl 32 to the left and advancing the ratchet-wheel unit 25 counterclockwise, and consequently rotating the minute-arbor 16 a distance indicating one minute of time. The parts 29, 32, 35, 38, 45 and 46 may be referred to as step-by-step impelling-means. At the same time that the left end of the lever 29 moves the pawl 32 down, it also moves the holding pawl 34 into a notch of the holding ratchet-wheel 23 to thus lock the ratchet-wheel unit 25 against further counterclockwise movement. At each minute-indication-distance-of-movement counterclockwise that is made by the ratchet-wheel unit 25 and minute-arbor 16, the resetting-weight 69 carried by the minute-arbor 16 is also rotated in a counterclockwise direction.

Each time that the armature 38 is drawn downward, the brake-actuation armature 59 is drawn upward, to thus cause the brake-pin 64 to be swung to the left to braking position (Fig. 2) and engage the teeth of the ratchet-wheel 23, and when the current is broken to the electromagnets 45 and 46, the armature 59 swings down by gravity to its open position at the same time that the armature 38 is raised by the spring 35. During the approximately half-hour period of time during which the resetting-weight 69 is moving from its lowermost position to its topmost position, the action of the brake-pin 64 is of no consequence, as the tendency of the weight 69 to rotate the arbor 16 and the ratchet-wheel unit 25 clockwise is resisted by the holding pawl 65. But when the weight 69 has moved beyond the top central position and starts its downward movement, it is constantly urging the arbor 16 and the ratchet-wheel unit 25 into counterclockwise rotational action, and if the brake-pin 64 or equivalent means were not employed, each time that the armature 38 was pulled down by the electromagnets 45, 46 and thus lifts the holding-pawl 34 out of engagement with the ratchet-wheel 23, the weight 69 would cause the entire ratchet-wheel unit 25 to rotate counterclockwise until the weight 69 reached its bottommost position shown in Fig. 2, which undesired rotation of the weight 69 is prevented during its downward travel by the brake-pin 64 which is moved into braking position by the armature 59 being pulled up every time the armature 38 is pulled down.

Once each hour, or any period that it is desired to reset the clocks or insure that they are all reset to proper time to make up for any defects or causes which may have resulted in one or more of them indicating incorrect time, the switch-closer 97 is caused by the master clock to close the switch 107 which sends high-voltage electric current through the wires 103 and 104 to all of the electromagnets. This high-voltage current actuates the electromagnets 45 and 46 just the same as the low-voltage current, except possibly more vigorously, but results in no different actuation. But this high-voltage current now for the first time actuates the electromagnets 80 and 81, thus pulling down the armature 77 and swinging the right end (Fig. 2) of the resetting-lever 73 upward to thus cause the pins 90 and 91 to respectively lift the driving-lever 29 with its pawl 32, and the holding pawl 65, and also causing the brake-release lever 84 to push against the brake arm or lever 62 and thus swinging the brake-pin 64 out of contact with the ratchet-wheel 23, thus completely freeing the minute-arbor 16 and the ratchet-wheel unit 25 from all restraint against rotation in any direction, whereupon the weight 69, if not already at its lowermost or predetermined reset position, swings down toward lowermost position and the current which is coursing through the electromagnets 80 and 81 energizes the magnetic pole-pieces 93 and 94 to thus strongly attract the weight 69 of magnetic material, so as to center it in its lowermost position to thus cause the minute hand (not shown) on the minute-arbor 16 to be moved to its uppermost central position. When the switch-closer 97 rotates to a position to permit the switch 107 to open, the high-voltage current to the electromagnets is broken, in consequence of which the armature 77 is raised by the spring 88 to its normal open position, thus permitting the resetting-lever 73 to swing down and free all of the parts of the step-by-step drive-mechanism so that the latter will be again actuated in its normal step-by-step minute-by-minute movement as the switch-closer 96 closes the low-voltage switch 106 once each minute.

From the foregoing, it will be clear that only two wires, namely wires indicated at 103 and 104, are necessary for transmitting all impulses for all required actions between the master clock 95 and the various secondary clocks 10, and that there is not needed any switches or equivalent mechanism in the secondary clocks. This is extremely important inasmuch as secondary clocks are usually quite numerous in number whereas only one master clock is utilized for a large number of secondary clocks. All ordinary switches have a tendency to have one or more of their

points or contacts to foul, thus periodically resulting in one or more switches failing to properly work. At the same time, this absence of need of switches in secondary clocks is brought about while only requiring a two-wire electric-transmission system, not only resulting in the increased economy of only having to install two wires, but permitting of the installment of switch-free secondary clocks in systems which are already wired with a two-wire system without having to increase the number of wires interconnecting the master clock with the secondary clocks.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. An electric-impulse time-instrument system including: a rotatable time-shaft having a predetermined reset position; electric-impulse driving-means including step-by-step impelling-means adapted to drive said time-shaft by step-by-step movements; electric-impulse resetting-means including weight-means adapted to rotate said time-shaft to said reset position; master time-means having impulse-means adapted to selectively deliver two different types of electric impulses; electric connection-means for interconnecting said impulse-means with said driving-means and said resetting-means to deliver all of said different types of impulses to said driving-means and said resetting-means; said driving-means including brake-means for said time-shaft moved to braking position by one of said types of impulses; said impelling-means being actuable by both of said types of impulses; and said resetting-means being actuable only by the other of said types of impulses, and when so actuated, acting to free said time-shaft for rotation by said weight-means to reset position.

2. An electric-impulse time-instrument system including: a rotatable time-shaft having a predetermined reset position; electric-impulse driving-means including step-by-step impelling-means adapted to drive said time-shaft by step-by-step movements; electric-impulse resetting-means including weight-means adapted to rotate said time-shaft to said reset position; master time-means having impulse-means adapted to selectively deliver two different types of electric impulses; electric connection-means for interconnecting said impulse-means with said driving-means and said resetting-means to deliver all of said different types of impulses to said driving-means and said resetting-means; said driving-means including holding-means adapted to prevent rotation of said time-shaft between said step-by-step movements; said impelling-means being actuable by both of said types of impulses; and said resetting-means being actuable only by one of said types of impulses, and when so actuated, acting to overcome said holding-means and free said time-shaft for rotation by said weight-means to reset position.

3. An electric-impulse time-instrument system including: a rotatable time-shaft having a predetermined reset position; electric-impulse driving-means including step-by-step impelling-means adapted to drive said time-shaft by step-by-step movements; electric-impulse resetting-means adapted to rotate said time-shaft to said reset position; master time-means having impulse-means adapted to selectively deliver two different types of electric impulses; electric connection-means for interconnecting said impulse-means with said driving-means and said resetting-means to deliver all of said different types of impulses to said driving-means and said resetting-means; said driving-means including brake-means for said time-shaft moved to braking position by one of said types of impulses; said impelling-means being actuable by both of said types of impulses; and said resetting-means being actuable only by the other of said types of impulses, and when so actuated acting to free said time-shaft and rotate said time-shaft to reset position.

4. An electric-impulse time-instrument system including: a rotatable time-shaft having a predetermined reset position; electric-impulse driving-means including step-by-step impelling-means adapted to drive said time-shaft by step-by-step movements; electric-impulse resetting-means adapted to rotate said time-shaft to said reset position; master time-means having impulse-means adapted to selectively deliver two different types of electric impulses; electric connection-means including step-by-step impelling-means with said driving-means and said resetting-means to deliver all of said different types of impulses to said driving-means and said resetting-means; said driving-means including brake-means for said time-shaft urged toward braking position by both of said types of impulses; said impelling-means being actuable by both of said types of impulses; and said resetting-means being actuable only by one of said types of impulses, and when so actuated, acting to overcome said brake-means and free said time-shaft and rotate said time-shaft to reset position.

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