Jan. 23, 1934. G. F. HARTER 1,944,602

IMPULSE CLOCK

Original Filed Aug. 28, 1930

Fig. 1.

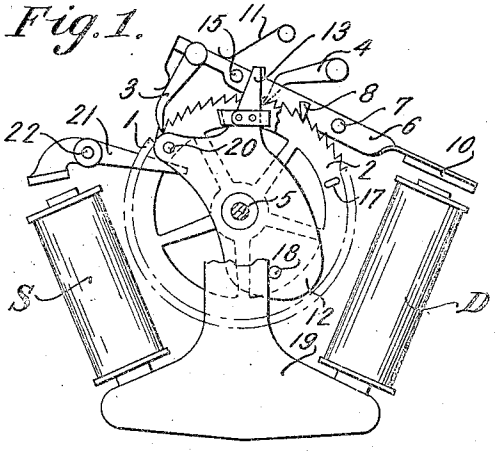



Fig. 2.

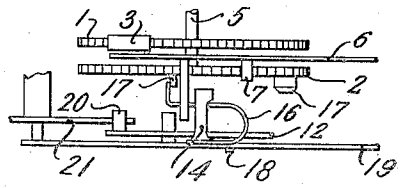



Fig. 3.

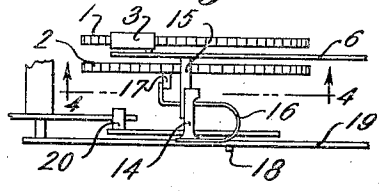



Fig. 5.

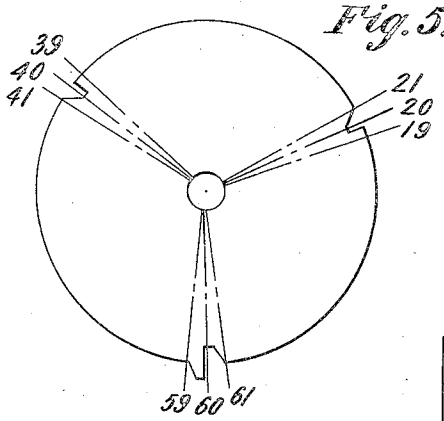



Fig. 4.

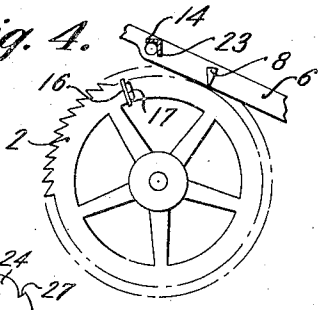
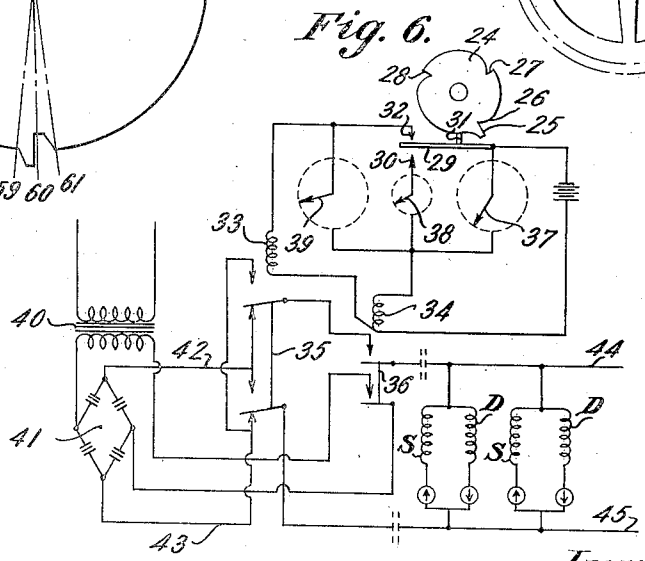



Fig. 6.




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# UNITED STATES PATENT OFFICE

1,944,602

## IMPULSE CLOCK

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Original application August 28, 1930, Serial No. 478,470. Divided and this application October 21, 1930. Serial No. 490,200

4 Claims. (Cl. 58—24)

In electric clock systems of the type in which impulses are transmitted at regular intervals (such as once per minute) to a plurality of secondary clocks which have electromagnets or other means for advancing the clock-trains one step for each impulse, it is generally known that the secondary clocks sometimes get out of step with the master clock and various schemes have been devised to correct the secondary clock at regular intervals (say once per hour). One scheme for effecting this result consists in providing a stop for physically obstructing each clock-train at regular intervals (say once per hour) if the clock is fast, with means for automatically removing the stop on the hour so that the clock-train may resume its advance after it has been retarded the required amount. In order to correct slow secondaries it has been proposed to transmit a series of fast impulses just before the end of the hour rapidly to advance the secondaries until the stops obstruct further advance, further movement of the clock-trains being permitted by automatic removal of the stops at the end of the hour.

The present application is a division of application Serial No. 478,470, filed August 28, 1930.

The object of the present invention is to improve the construction and operation of secondary clocks of the impulse type and to provide a simplified circuit for operating the secondary clocks.

For the purpose of illustrating the genus of this invention a typical embodiment is shown in the accompanying drawing in which:

Fig. 1 is a rear view of the clock mechanism, parts being broken away;

Fig. 2 is a top plan view showing the parts in normal running condition;

Fig. 3 is a similar view showing the parts in locked position;

Fig. 4 is a section on line 4—4 of Fig. 3;

Fig. 5 is a face view of a control disk in the master clock; and

Fig. 6 is a diagram of the master clock and two secondaries illustrating the novel circuit arrangement.

A secondary clock mechanism is shown for the purpose of illustration comprising two ratchet wheels 1 and 2 with associated pawls 3 and 4. The ratchet wheels 1 and 2, which are fastened together and to the shaft 5, have their teeth facing in opposite directions so that the ratchet 3 turns the wheels in a clockwise direction while the pawl 4 holds the wheels against retrograde movement while the pawl 3 is being retracted. The pawl 3 is carried on an arm 6 pivoted at 7, arm 6 being provided with a stop 8 engageable with the teeth of wheel 2 to prevent overthrow by pawl 3. The pawl 3 is retracted by a magnet D operative upon armature 10 fast to arm 6 and after the magnet is deenergized the pawl is again advanced by spring 11.

Pivotally mounted on the shaft 5 is a plate 12 having an upstanding arm 13 with a rearwardly extending stop 14 projecting forwardly in juxtaposition to a pin 15 extending rearwardly from the arm 6. A spring 16 is mounted at the base of the arm 13 to extend forwardly into the path of a pin 17 extending rearwardly from the ratchet wheel 2. The plate 12 normally tends to rotate in a clockwise direction (Fig. 1) owing to the fact that its center of gravity is to the right of the axis 5 and this tendency is limited by means of a pin 18 projecting rearwardly from the plate 12 in engagement with the frame 19 of the clock. The plate 12 is also provided with a pin 20 projecting forwardly above the armature arm 21 pivoted at 22 and actuated by the magnet S.

In the operation of the clock the pin 17 engages a spring 16 on the plate 12 at one step during each revolution of the ratchet wheel (for example the 59 minute step) thereby to swing the plate 12 in a counterclockwise direction to a position in which the stop 14 overhangs a pin 15 in immediate juxtaposition thereto so that the magnet D can not oscillate the arm 6. As shown in Fig. 4 the stop 14 may have a depending portion 23 to limit the aforesaid counterclockwise movement, thereby more positively to lock the arm 6 in fixed position. With the parts locked in this position the clock is unresponsive to further impulses through magnet D until the plate 12 is moved back to normal position. In the illustrated embodiment this is accomplished by means of magnet S which, upon receipt of an impulse from the master clock, rotates the arm 21 in a counterclockwise direction, the arm 21 engaging the pin 20 on plate 12 to move it back to the normal position shown in Figs. 1 and 2. In this return movement of the plate 12 the spring 16 snaps over the pin 17 from the position shown in Fig. 3 to a position at the right-hand side of the pin 17; and the stop 14 moves from the position shown in Fig. 3 to that shown in Figs. 1 and 2, whereupon the arm 16 is free to respond to further impulses through magnet D.

If the clock be running on time the magnet S unlocks the ratchet 3 in less than one minute after the parts move to locked position so that the ratchet responds to the succeeding minute

impulse through magnet D. For example if the parts move to locked position on the 59-minute impulse through magnet D the magnet S unlocks the ratchet prior to the 60-minute impulse. If the clock is fast the pin 17 moves the parts to locked position before the end of the hour (according to the master clock) and the clock will remain stationary until the end of the hour. During this period the pawl 3 and associated parts can not chatter back and forth because held by the stop 14. If the clock is slow it is brought to the stop position by a series of fast impulses transmitted to the magnet D by the master clock just before the end of the hour. While various systems may be employed to control the secondary clock typical examples are shown in Fig. 6 in which the magnets D and S are shown diagrammatically.

The arrangement shown in Fig. 6 comprises a controller 24 making one revolution per hour and having one cam projection 25 and three recesses 26, 27 and 28. A spring switch 29 is arranged to engage contact 30 when the lug 31 is engaged by the projection 25 and to engage the contact 32 when the lug 31 moves into either of the recesses 26, 27 or 28. As shown in Fig. 5 the controller 24 is so connected to the master clock that the projection 25 engages the lug 31 between the 59 and 60-minute positions and the lug 31 is in the recesses 26, 27 and 28 at the 60, 20 and 40-minute positions. The master clock controls two relays 33 and 34 which actuate the switches 35 and 36 respectively. The relay 34 is controlled by three contact makers 37, 38 and 39. 37 is preferably timed to close circuit once per minute and 38 is timed to close contact more frequently, say once per second. 39 is timed to close circuit just before the 59th, 19th and 39th minute impulses transmitted by 37. 40 represents a transformer for feeding a supply of alternating current to the rectifier 41, the output side of which is connected by conductors 42 and 43 to the contacts of double pole switch 35 so that current of either polarity may be transmitted to the conductors 44 and 45 leading to the secondary clocks. The two magnets S and D of each secondary clock are connected in parallel across the lines 44—45. One-way valves 46 and 47 are connected in series with the magnets S and D respectively, the valve 46 transmitting current in one direction, say from conductor 45 to conductor 44, and the other valve 47 transmitting current in the other direction, as indicated by the arrows.

The operation of the system shown in Fig. 6 is as follows: Inasmuch as switch 29 normally stands in neutral position the magnet 33 is normally deenergized so that the switch 35 normally stands in lower position, as shown, so that magnet 34, under the influence of contact maker 37, normally transmits an impulse over lines 44 and 45 in such direction as to energize magnet D once per minute. Between the 59 and 60-minute impulses the projection 25 moves switch 29 into engagement with contact 30 so that fast impulses are transmitted to the line to bring slow secondaries to the 59-minute position. Just before the 60-minute impulse the lug 31 drops into the recess 26 thereby moving the switch 29 from contact 30 to contact 32 to energize the magnet 33 and move the switch 35 to the upper position. Immediately thereafter and before the 60-minute impulse the contact maker 39 transmits an impulse through magnet 34 thereby to transmit an extra impulse to lines 44 and 45. Inasmuch as the magnet 33 is energized at the time this impulse is transmitted the polarity is reversed and the impulse therefore actuates magnet S instead of magnet D because of the one-way valves 46 and 47. From the foregoing it will be understood that the extra impulse of reversed polarity unlocks the ratchet mechanism of the secondary clocks so that they all respond to succeeding impulses of normal polarity. The extra recesses 27 and 28 are provided so that the secondary clock receives an unlocking impulse every 20 minutes, whereby if any secondary fails to respond to the unlocking impulse at the beginning of the hour it will have opportunity to resume normal operation every 20 minutes instead of having to wait a full hour.

From the foregoing it will be evident that an important aspect of the present invention comprises two circuits respectively containing impulse responsive means (D and S in the illustration) together with one-way valves oppositely connected therein for selectively passing impulses of opposite polarity in the respective circuits. In a more limited aspect those two circuits comprise branches of a single circuit, that is, two conductors or one conductor and a ground return.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. A clock system comprising a plurality of secondary clocks of the impulse type, control means for sending impulses of different polarity to said clocks, means in the secondary clocks responsive to the different impulses respectively, and valve means for selectively passing the different impulses to said means.

2. A clock system comprising a plurality of secondary clocks of the impulse type, control means for sending impulses of different polarity to said clocks, a single circuit for transmitting said impulses to the secondary clocks, means in the secondary clocks responsive to the different impulses respectively, and valve means for selectively passing the different impulses to said means.

3. A secondary clock of the impulse type comprising a branched circuit, means in one branch for normally driving the clock train, means in the other branch for resetting the clock, and valve means for selectively passing current through the branches respectively.

4. A secondary clock of the impulse type comprising a branched circuit, means in one branch for normally driving the clock train, means in the other branch for correcting the clock, and one-way valves oppositely connected in said branches respectively so that impulses in one direction operate the driving means and impulses in the opposite direction operate the correcting means.

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