P. MANSEL.

ELECTRIC CLOCK.

APPLICATION FILED AUG. 15, 1918.

1,417,620.

Patented May 30, 1922.

3 SHEETS—SHEET 1.

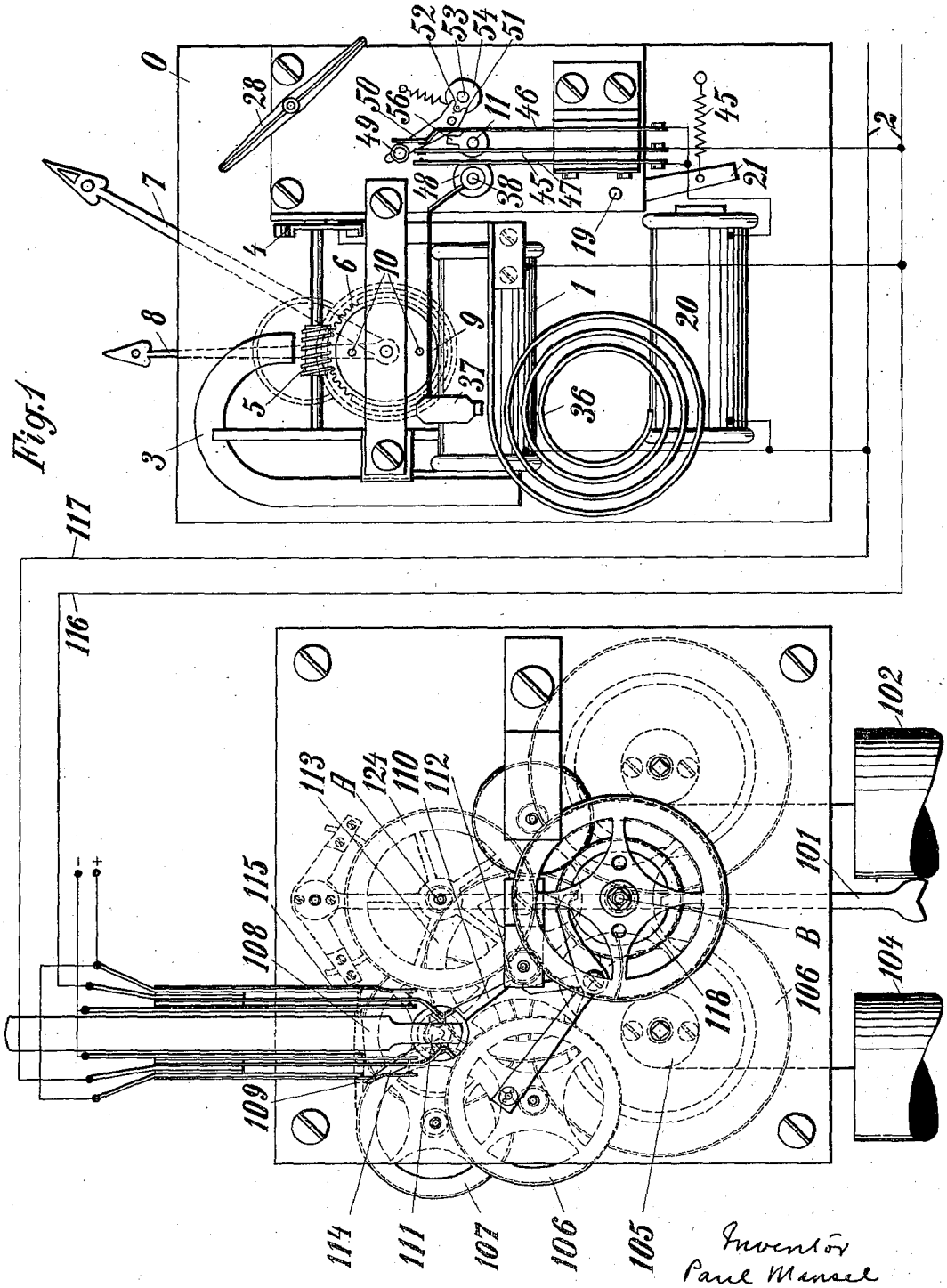

Fig. 1

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3 SHEETS—SHEET 2.

Fig. 2

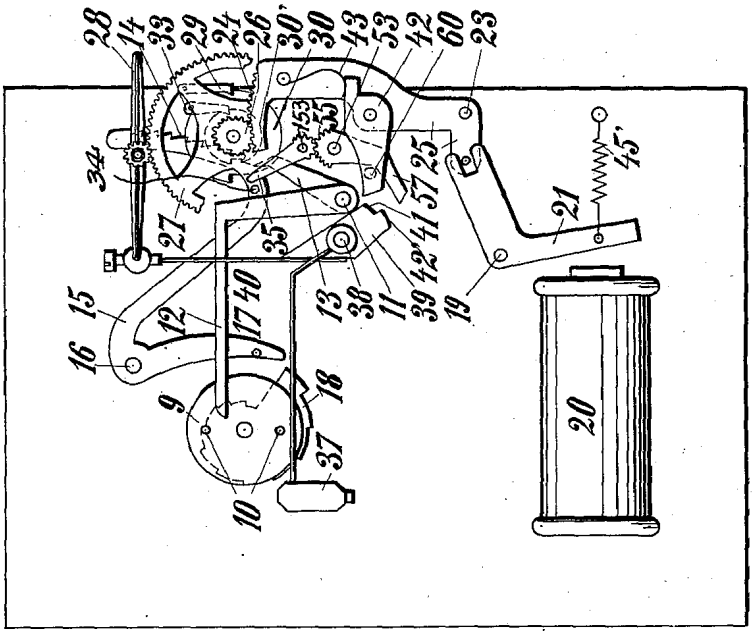
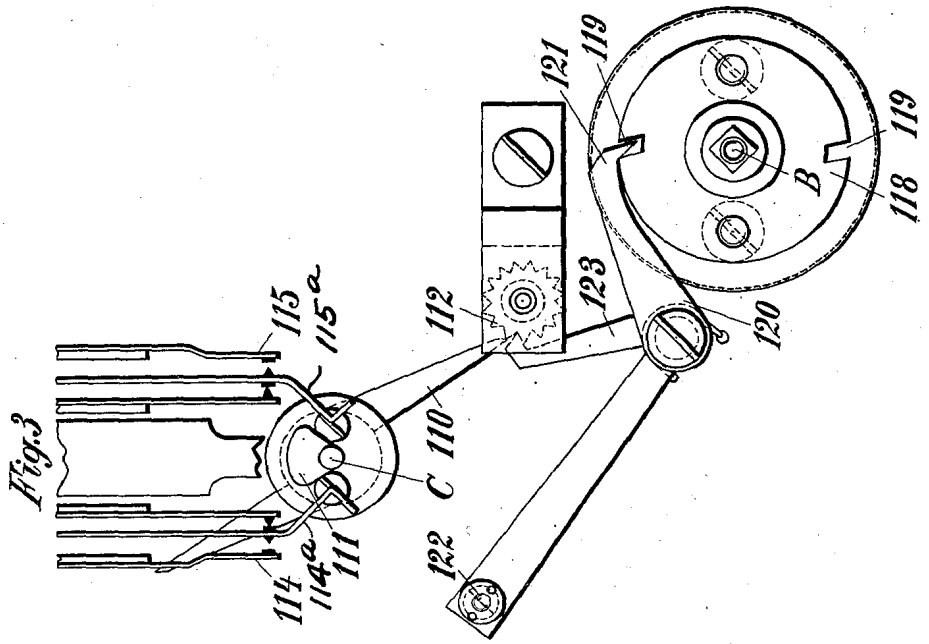


Fig. 3



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3 SHEETS—SHEET 3.

Fig. 2a

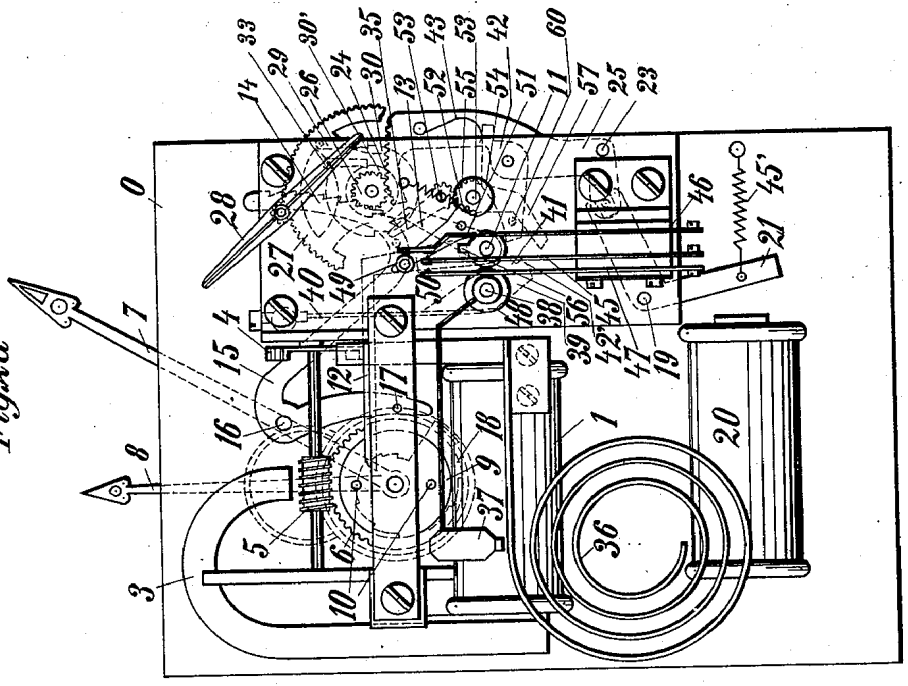
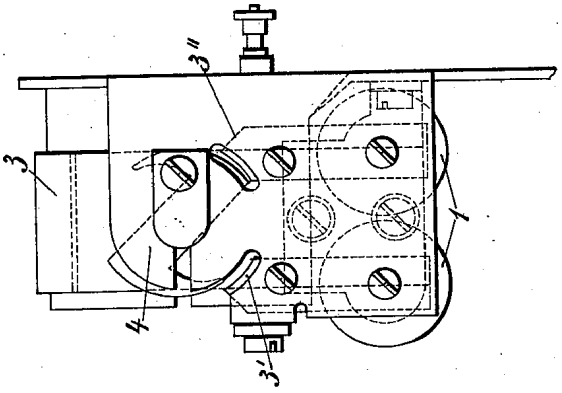


Fig. 2b



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UNITED STATES PATENT OFFICE.

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ELECTRIC CLOCK.

1,417,620. Specification of Letters Patent. Patented May 30, 1922.

Application filed August 15, 1918. Serial No. 250,096.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, PAUL MANSEL, residing at Charlottenburg, near Berlin, Germany, have invented certain new and useful Improvements in Electric Clocks, (for which I have filed application in Germany May 12, 1917, Patent No. 323,233,) of which the following is a specification.

My invention relates to clocks and more especially to secondary clocks with a strike train, the particular object of this invention being to provide mechanisms of this kind which are less cumbersome and more reliable than those hitherto known.

In secondary clocks provided with a strike train this latter is actuated in general by the train of the secondary clock causing the strike works to be wound up. In some cases the strike train which may be provided in the master clock, is used to feed the secondary strike train.

Clocks of the kind mentioned in the first instance are impaired by the great stress under which the sensitive works of the secondary clock are placed, while those of the last mentioned kind require special connections for feeding the secondary clock strike train.

According to my invention these drawbacks are obviated in the following way: I keep the contact of the master clock which is designed to actuate the secondary clocks, closed during the time of striking and at the same time I cause the circuit of a strike train magnet, which is connected in parallel with the coil of the secondary clock train, to be closed so that the magnet is now fed through the net work provided for driving the secondary clocks. The strike train mechanism itself controls in a well known manner the interrupting and closing of the same circuit a number of times corresponding to the number of strokes.

In the drawings affixed to this specification and forming part thereof the preferred forms of a master clock and the strike train of a secondary clock are shown connected with each other, and in which—

Figure 1 represents on the left a part of the master clock train and on the right a part of a secondary clock train.

Figure 2 represents in detail certain portions of the striking train, omitted in Figure 1 for clearness.

Figure 2^a represents a detail view of the secondary clock train magnet seen from the right hand side in Figure 1.

Figure 2^b represents a view of the secondary clock train similar to that shown in Figure 1, but with the trains, shown in Figure 2, indicated in dotted lines.

Figure 3 represents in detail and in larger scale the strike control movement of the master clock shown in Figure 1.

Referring to the drawings B is the minute wheel arbor of the master clock and 118 a wheel fixed on said arbor and provided with notches 119 (see Figure 3), a lever 120 being applied against the circumference of said wheel provided with a pawl 121 adapted to enter said notches. The number of notches provided in wheel 118 depends upon whether the clock shall strike only full hours or also half hours and quarters of an hour. In the first mentioned case a single notch will suffice; half hours will require two notches and quarters four of them. The lever 110 fastened to a cam disk 111 fixed upon an axle C and actuated by a spring, is brought in contact, while it is being rotated, with the teeth of a toothed wheel 112 driven from the minute wheel arbor, the arbor of said wheel 112 driving the wheel 124. The toothed wheel 112 retards the movements of rotation of lever 110 in such a manner that the latter performs one-half revolution every minute for closing the contact for the actuation of the secondary clock train, said contact being effected at 114, 115 through cam disk 111, which alternately lifts contact springs 114^a and 115^a.

Assuming wheel 118 to be provided with a single notch 119 only, then pawl 121 will glide on the circumference of wheel 118 until the end of each hour, and only once in an hour will it enter the notch 119, such as is shown in Figure 3. At such moment the other end of lever 120 carrying a pin 122 will cross the path of lever 110 thus causing this latter, when it is released by wheel 112, to abut against said pin 122 and to remain in this position until the pawl 121 has left the notch 119, thus causing the pin 122 to effect a movement of rotation which carries it out of the path of lever 110. During the time when lever 110 is in contact with pin 122 the cam 111 will close either contact 114 or contact 115 as referred to before, the time of closing being predetermined by the form of the

notch 119 and the pawl 121 so as to suffice also for the greatest number of strokes. As wheel 118 rotates only very slowly, an exact setting of the time of closing would require a very careful adjusting. In order to avoid this a third lever arm 123 is provided, this arm engaging the toothed wheel 112 in such a way that whenever said arm is in contact with the point of the tooth, the pawl 121 is out of engagement with the notch 119 and the wheel is not locked. Whenever one of the contacts 114, 115 is closed a contact in the secondary clock is carried in a well known manner into a position of closing, this contact serving for closing the strike train magnet circuit, thus causing this latter to be excited and the striking to be started, the number of strokes being controlled in a well known manner by the strike train mechanism itself.

The secondary clock shown in the drawings receives the current impulses for rotating the hands 7, 8 and for feeding the strike train magnet through wire 2. To this end the cores of the electro-magnet coils 1 are attached to the permanent magnet 3 (Figures 2^a, 2^b).

A secondary clock of this character is more fully described and shown in my co-pending application, Serial No. 146,939, filed on February 6th, 1917. Therefore, only those portions of the mechanism thereof are illustrated and described in the present case as are necessary to understand the invention involved here. In the magnetic circuit of the pole pieces 3′ of this magnet an **S**-shaped armature 4 is rotatably located, said armature being caused by each current impulse transmitted through the line wire to move on in the same direction and causing in its turn, by means of a worm 5 and gear wheel 6, the hands 7 and 8 to travel around. Near the end of each hour a longer current impulse is transmitted to the electromagnet 1, said impulse not only causing the hands to move, but also supplying the current required for the operation of the strike train. The strike train itself is actuated by means of series of excitations, corresponding to the number of strokes of a strike train magnet 20 connected in parallel to the clock magnet 1, the current supply of magnet 20 being started by the clock work and controlled by the strike train itself. The current impulse transmitted at the end of each hour should last long enough to allow the strike train to strike full twelve hours. For the half hours the usual impulse transmitted every minute and serving to keep the clock going will suffice. A current impulse of greater duration may be transmitted to the clock also every half hour.

The arbor of the minute hand 7 carries a disk 9 provided with two diametrically opposite pins 10 (Figures 2, 2^a), these pins being adapted to cooperate with a bell crank lever 12 (the releasing lever) fixed on an axle 11 in such a manner that the said lever is lifted before the end of each half and full hour and will slip off exactly at the end of the half or full hours. The pins 10 are arranged at different distances from the arbor of the minute hand so as to lift the releasing lever at the end of each full hour more than at the end of each half hour. On the lever axle 11 there is further fastened a pawl 13 gearing with the teeth 14 of a rack 15 adapted to swing on axle 16. When lever 12 is lifted at the end of an hour, pawl 13 is withdrawn from the teeth of the rack, thus allowing this latter to swing on its pivot in a downward direction until a pin 17 fastened to it meets the periphery of a step disk 18 fastened to the arbor, operating the hour hand 8. At the end of each half hour the rack drops only for one tooth as the following larger tooth meets the pawl 13, which in this case is not withdrawn sufficiently to allow the passage of the larger teeth following the first short tooth of the rack.

As soon as lever 12 has slipped off pin 10, which will be the case at the end of each full or half hour, the strike train is set going. The pawl 13 now engages the tooth 14 whose distance from the first tooth, according to the position of the step disk 18, corresponds to the length of the row of teeth which equals the number of strokes required to indicate the respective hour. Therefore, if the rack is moved upwards during the act of striking and if an individual stroke corresponds to each tooth of the rack, then the number of strokes is dependent upon the step disk and from the position of the hands.

The rack is caused to move upwards by the strike train magnet 20, attracting its armature 21 pivoted on an axle 19 and being influenced by a spring 45′, thus causing a bell crank lever 25 movable on an axle 23 and carrying a toothed segment 24 to move (Figures 2, 2^a). The toothed segment is in gear with a pinion 26 braked in both directions by means of a fly 28 coupled with it by gear wheel 27, which carries a pawl 29. This pawl is adapted to take along a notched disk 30, when the gear wheel 27 is rotating in clockwise direction. Disk 30′ moving with the disk 30, carries two pins 31 arranged diametrically opposite each other and catching alternately in the teeth 14 of the rack 15 so as to cause the rack to move upwards by one tooth whenever the armature 21 is attracted. When the armature falls off, disk 30 will keep its position due to the disengaging couplings 29 and 30 and a pawl 33 fixed to the casing and engaging ratchet teeth of disk 30′. The rack is held in its position by the pawl 13 until it is lifted another tooth by one of the pins 31, when

the armature 21 is attracted once more. In accordance with the action of the contact device influencing the circuit of magnet 20 the upwards movement of the rack will continue until it has reached its uppermost position, where a pin 34 arranged on the rack will cut off the supply of current to magnet 20 by means of a lever, as will be described more fully hereinafter.

While the rack moves upwards, the strike train is actuated. The striker 37 striking the gong spring 36, is fixed on a rotatable axle 38 carrying a block 39 influenced by a spring 40 so as to have a tendency to remain in its position of rest and not to come in contact with the gong spring or similar sound producer after having once struck it. Block 39 is provided with an indenture 41; a pawl 42 pivotally attached to the toothed segment lever 25 and pressed by a spring 43 against a pin 42′ engages in said indenture 41 as soon as the armature 21 is attracted, thus causing striker 37 to be lifted each time the armature is being attracted. In order to allow striker 37 to slip off suddenly the relative movements of pawl 42 and block 39 are chosen in such a manner that after the striker has been lifted through the necessary distance, the pawl will leave the indenture 41, thus allowing the striker to slip off freely. At the same time pawl 42 comes to rest on the projection 42′. As soon as magnet 20 becomes deenergized the armature is released and under the action of spring 45′ pawl 42 then returns into the position shown in figure 2ª.

The current supply to magnet 20 is controlled by a number of contact springs 45, 46, 47, (Figure 1.) Spring 45 is connected to one pole of the line 2, while springs 46, 47 are connected to the other pole over the magnet winding. Spring 46 is influenced by the releasing lever 12, ratchet pawl 42 and rack 15, spring 47 by the striker 37.

The connections for actuating the strike train are as follows: So long as the strike train is at rest, contact spring 47 lies against a flattened portion provided on the insulating block 48 fixed to the striker axle 38, contacts 47, 45 being opened. Spring 46 is kept away from spring 45 by an insulating block 49 arranged on a lever 50 provided at its free end with a fork 51 embracing a pin 52, said pin being arranged on a disk 54 fixed on an axle 53. This axle is coupled by means of gear 55 with another axle 153 carrying the lever 35 adapted to be turned by a pin 34 arranged on rack 15 whenever the rack has reached its uppermost position. In accordance with this arrangement, whenever the strike train is at rest, the contacts 46, 45 is open and the strike train magnet 20 does not receive any current.

Towards the end of each half and full hour one of the pins 10 meets the releasing lever 12 which is lifted more or less according to which pin is in engagement with it. By the rotation of the releasing lever the lever 13 is removed from the rack, which latter drops under the influence of its weight. The rack drops on the stepwheel at the end of each full hour, while for half hours it drops only until its short tooth has passed the pawl 13, when the first of the following larger teeth engages the pawl, which in this case is not thrown sufficiently far to admit the passage of the larger teeth. When the rack drops pin 34 provided on the same, leaves the lever 35, by means of which and of gear 55, pin 52, lever 50 and insulating piece 49 it has kept the contact spring 46 apart from the spring 45. By means of its tension spring 46 would at present close its contact, but is prevented from so doing by an insulating piece 56, which on lifting releasing lever 12 is rotated against spring 46 with its projection. Exactly at the end of a half or a full hour, releasing lever 12 slips off the pin 10, with which it is in engagement. Insulating piece 56 leaves with its projection spring 46 and the contact between springs 45 and 46 is closed. The magnet 20 is now supplied with current so as to attract its armature 21. The attraction of the armature is retarded on account of its engagement with the fan 28 by means of toothed segment 25, pinion 26, and gear 27.

The rotation of the toothed segment 25 causes the rotation of the block 39 by means of the pawl 42, so that the striker is lifted. When the striker reaches its uppermost position, block 39 and pawl 42 come out of engagement so that the striker may perform its downward stroke freely, without being retarded by the fan.

While the striker is lifted the insulating piece 48 fixed on its axle is pressed against contact spring 47, so that the contact between the spring 47, 45 is closed. This is necessary because the pawl 42 gliding in projection 42′, has, immediately before the striker has reached its uppermost position, pressed downwards, by aid of a pin 60, a lever 57 fixed to axle 53, thus turning insulating block 49 and opening contacts 46, 45. This opening of the contacts is done for the purpose of causing striker 37 to effect the opening of the circuit which will take place at the contact 47, 45.

When the armature 21 has been moved against the action of fly 28 slowly into its position of rest by spring 45′, the toothed segment 24 being ready to lift the rack once more and pawl 42 having slipped off the projection 42′ of block 39, so as to be about to enter notch 41, pin 60 also releases lever 47 and lever 50 with its insulating block 49, thus allowing contacts 46, 45 to close and magnet 20 to be supplied with current. In this way the interruption of the

current energizing magnet 20 depends upon the end of the upwards stroke of the striker and the closure of the contact 45, 47 when the armature moves in its position of rest. As the armature has a retarded motion, the striker has reached already its position of rest before the armature reaches its rest position. On account of the fact, that the striker falls freely while the armature is retarded, the stroke of the striker will be performed with full strength and the motion of the armature to its position of rest is noiseless, so that the sound of the gong is not disturbed by troublesome noises.

As soon as the contact between 46, 45 is closed, armature 20 is energized again and a new stroke is performed and this is repeated until the rack has reached its uppermost position. At each lifting of the striker the rack is lifted one tooth. To this end the larger gear 27, which is rotated when the armature is attracted, is provided with a pawl 29 which upon the attraction of the armature rotates two disks 30, 30'. One of two pins 32, provided on the disk 30', engages a tooth of the rack and lifts this latter for one tooth. In the raised position the rack is held by the pawl 13, when the gear is moving in the opposite direction. When the armature returns into its position of rest, the disks 30, 30' are not rotated, as they are prevented from so doing by a pawl 33 pivotally attached to the casing. After the rack has reached its uppermost position further strokes are prevented by pin 34, by means of which the insulating piece 49 is pressed against contact spring 46 to hold it open, until the releasing lever is lifted again and removes the pawl 13, so that the rack drops again.

In order to be able to indicate the half hours by aid of a single stroke, the following arrangement is provided: The first tooth 58 of the rack is somwhat smaller than the rest and the releasing pin 10 for the half hours is arranged at a smaller distance from the centre of the releasing disk 9, so as to cause the pawl 13 of releasing lever 12 to release only tooth 58, but to be caught again by the normal size tooth 59 next following. In this manner only a single stroke is produced.

The strike train of the clock instead of being fed from the clock supply line, may as well be fed from a battery or from a heavy current supply.

The clock train according to the present invention may also be connected, by aid of the step disk, with the receiver of an electric or other remote control device. By setting the sender connected to the said device the step disk may be set also at will, so as to produce any desired number of strokes. The releasing proper must be effected in this case after the step disk has been set, either by the movement of the receiver when setting the step disk or by a special movement.

I claim:

1. In an electric clock system in combination, a master clock and a secondary clock electrically connected with each other, means comprising a contact for driving said secondary clock from said master clock, a strike train forming part of said secondary clock and means for automatically keeping said contact closed so as to feed said strike train with current while it is operating.

2. In an electric clock system in combination, a master clock and a secondary clock electrically connected with each other, means comprising a contact for driving said secondary clock from said master clock, a strike train forming part of said secondary clock, a rotatable cam for temporarily closing said contact, and means for preventing said cam from rotating in accordance with the time required for the striking.

3. In an electric clock system in combination, a master clock and a secondary clock electrically connected with each other, means comprising a contact for driving said secondary clock from said master clock, a strike train forming part of said secondary clock, a rotatable cam for temporarily closing said contact, and means connected with the minute hand arbor of the master clock for preventing said cam from rotating in accordance with the time required for the striking.

4. In an electric clock system in combination, a master clock and a secondary clock electrically connected with each other, means comprising a contact for driving said secondary clock from said master clock, a strike train forming part of said secondary clock, a rotatable cam for temporarily closing said contact, a notched disk fixed on the minute hand arbor of said master-clock and an oscillating lever adapted, under the influence of said notched disk, to temporarily prevent said cam from rotating in accordance with the time required for the striking.

In testimony whereof I affix my signature.

PAUL MANSEL.