May 11, 1937. R. OTTAWAY 2,080,330

ELECTRIC PROGRAM CLOCK

Filed Oct. 9, 1934 2 Sheets-Sheet 1

Fig. 1.

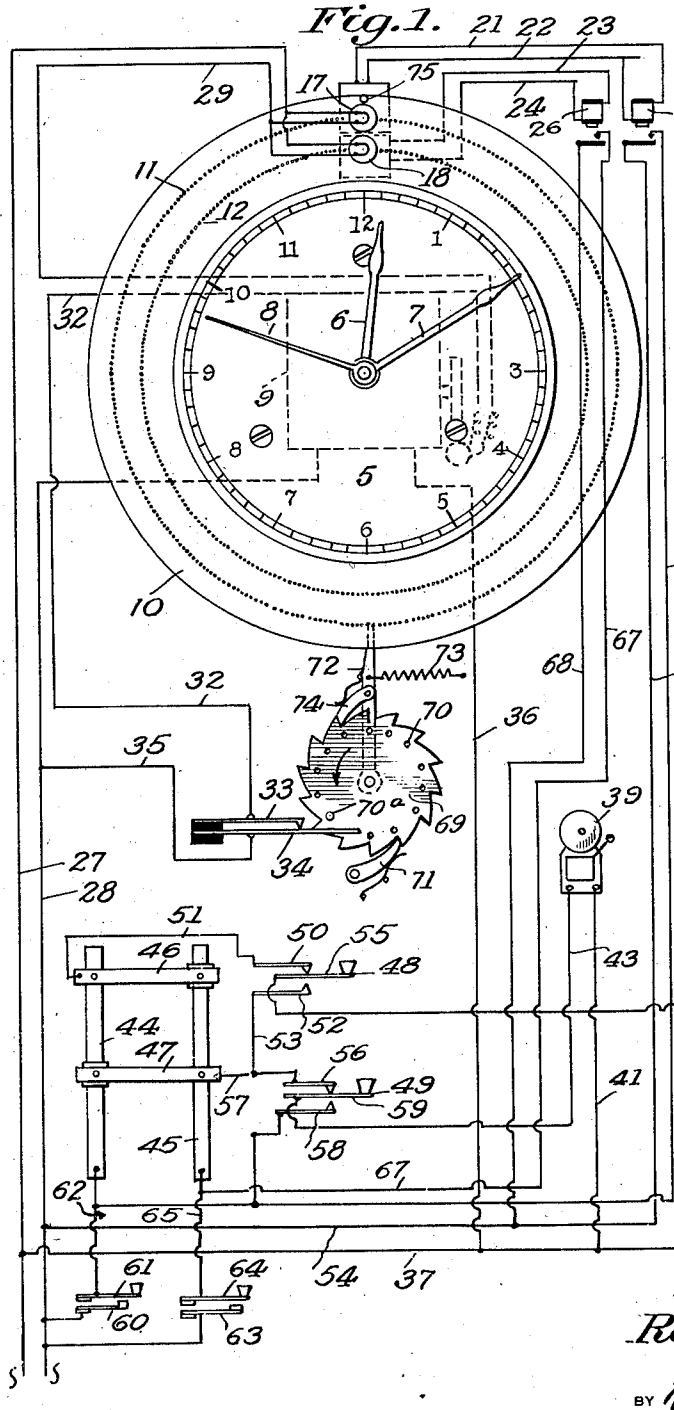
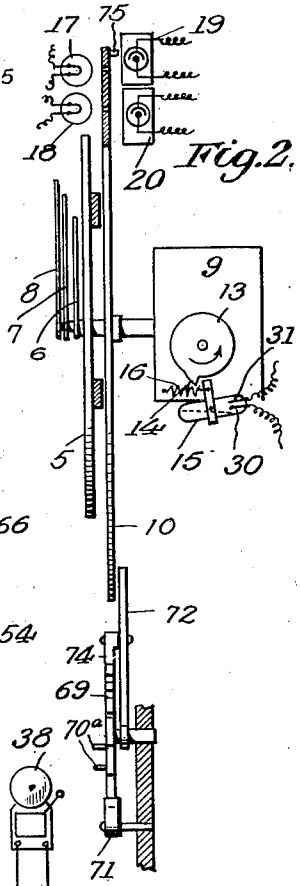


Fig. 2.



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Filed Oct. 9, 1934 2 Sheets-Sheet 2

Fig. 3.

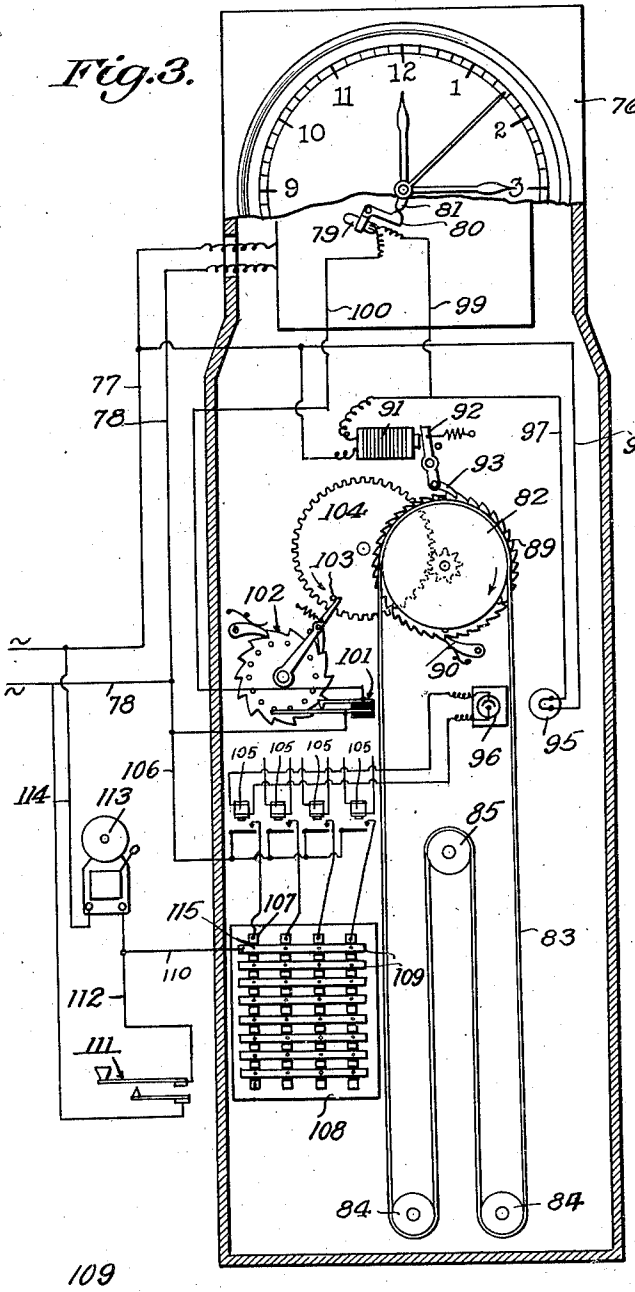
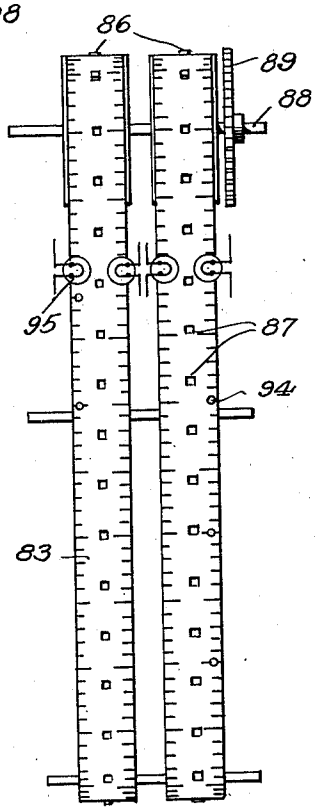



Fig. 4.



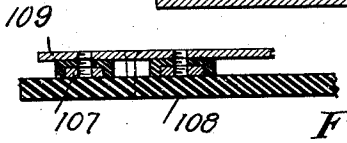




Fig. 5.

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# UNITED STATES PATENT OFFICE

2,080,330

## ELECTRIC PROGRAM CLOCK

Robert Ottaway, Milwaukee, Wis.

Application October 9, 1934, Serial No. 747,622

5 Claims. (Cl. 161—2)

The invention relates to program clocks and has for its general object the provision of a novel electrically operated device of this character for ringing bells or giving other signals such as are necessary in schools, factories and other places where signals are needed to indicate the passage or expiration of certain definite periods of time in accordance with a predetermined program.

An important object of the invention is to provide a program clock which embodies a clock driven means having selectively usable perforations and moving between a source of light and a photo-electric cell upon which light will be thrown when a perforation passes between the light and the cell at a certain predetermined time, the current generating in the cell being employed to operate relays which in turn control the energization of the bells or other signal devices.

Another object is to provide a clock of this character having associated therewith means which will operate automatically to open a master switch and render the signal bells inoperative throughout a selected number of hours, for instance during the night, and for any day or days when the signals are not needed, as for example on a Sunday while not interfering with the action on week days.

A further object is to provide a panel and switch arrangement whereby the signal bells interposed in different circuits may be transposed or switched from one circuit to another, depending upon what is considered necessary or advisable.

A further object is to provide an apparatus of this character which on account of being entirely electrically operated will eliminate the large number of individual contacts and other more or less intricate parts embodied in program clocks of the usual and well known types.

An additional object is to provide an apparatus or device for this purpose and of this character which will be comparatively simple and inexpensive to manufacture, easy to adjust for different periods of time, positive in action, efficient and durable in service, and a general improvement in the art.

To the attainment of the foregoing and other objects and advantages, the invention preferably consists in the details of construction and the arrangement and combination of parts to be hereinafter more fully described and claimed, and illustrated in the accompanying drawings in which:

Figure 1 is a somewhat diagrammatic front elevation of one form of my invention showing it constructed to control two circuits,

Figure 2 is a central vertical sectional view,

Figure 3 is a front elevation, with the diagram illustrated, showing a modified form of my clock constructed to control four circuits,

Figure 4 is an elevation of the moving tape, this view being taken at right angles to Figure 3.

Figure 5 is a sectional view of the control panel shown in that form of the invention illustrated in Figure 3.

Referring more particularly to the drawings and especially Figures 1 and 2, I have shown my device as comprising a stationary dial **5** through which extend the usual arbors carrying an hour hand **6**, a minute hand **7**, and a second hand **8** which are movable over the dial or clock face **5** and which are driven by a synchronous type of electric clock motor indicated at **9** but not shown in detail as it is unnecessary to a proper understanding of the invention. The clock face **5** has the customary hour and minute graduations, the latter being in groups of five as is the well known practice.

Rotatably mounted in concentric relation to and at the rear of the clock face **5** is a dial **10** which is formed outwardly of the dial or disk **5** with two series **11** and **12** of holes, it being intended that there be twenty-four holes between each of the successive hour indications and the intention is that all of these holes be closed, as by means of screws, with the exception of those holes which are located at the time intervals when it is desired to operate the signal bells. Driven by some convenient portion of the clock mechanism by any preferred means is a disk **13** having a cam projection **14** thereon designed to engage against and trip a conveniently mounted pivoted mercury switch **15** of any ordinary or preferred type. The rotation of the disk **13** is so timed with respect to the clock work that the disk **13** will rotate once every two and one-half minutes, thereby tripping the mercury switch and closing a circuit, to be described, controlled thereby. A spring **16** is shown as connected with the mercury switch for returning it to normal position, and breaking the circuit, after each tripping.

Located in front of the rotatable dial **10** and mounted in any preferred manner are lamp bulbs **17** and **18** so located as to project light through whichever of the holes in the series **11** and **12** are left open. Located in back of the rotatable disk **10** are photo-electric cells **19** and **20** so positioned that when open holes in the series **11** and **12** arrive at a point between the lamp bulbs **17** and **18** and the respective photo-electric cells **19** and **20** the latter will be energized for generating current which passes through conductors **21** and **22**, and **23** and **24** to relays **25** and **26** of any ordinary or preferred type.

The line wires of the current supply for the

whole apparatus are indicated at 27 and 28 and the conductor 27 is shown as connected with one terminal of both of the lamps 17 and 18, the other terminals of which are connected by a conductor 29 with one contact 30 of the mercury switch 15 which has its other contact 31 connected by a conductor 32 with one element or contact 33 of the so-called calendar controlling device to be described. Cooperating with the contact or element 33 is a contact arm 34 which is connected by a conductor 35 with the conductor 28. The conductor 28 connects with one terminal of the clock mechanism 9 which has its other terminal connected by a conductor 36 with a conductor 37 which connects with the conductor 27.

In connection with the remainder of the apparatus I provide any desired number of bells 38 and 39, or any other desired signal means. These bells are connected, respectively, by conductors 40 and 41 with the conductor 37 which leads to one line wire 27. The other terminals of the bells are connected by conductors 42 and 43 with a change-over switch mechanism here represented as comprising a pair of metal bars 44 and 45 connected by cross members 46 and 47, the former of which is insulated from the bar 45 and the latter of which is insulated from the bar 44. The change-over switch means also includes a pair of double throw switches 48 and 49 which may actually be double acting push buttons, though this is a mere mechanical detail, except that each of said switches must be susceptible of retaining either of the positions in which it is set after having been once thrown. The switch 48 comprises a contact 50 connected by a conductor 51 with the cross bar 46, and also includes a contact 52 connected by a conductor 53 with a conductor 54 which is in turn connected with the line wire 28. Operating between the contacts 50 and 52 is the movable contact 55 with which the conductor 42 is connected.

The switch 49 includes a contact 56 connected by a conductor 57 with the cross bar 47, and further includes a contact 58 connected with the conductor 53. Movable between the contacts 56 and 58 is a contact 59 with which the conductor 43 is connected.

The master control means comprises a pair of switches interposed between the respective bars 44 and 45 and the return line wire. One switch comprises a contact 60 connected with the line wire 28, and also includes a movable contact 61 connected by a conductor 62 with the bar 44. The other switch comprises a stationary contact 63 connected with the line wire 28, and further includes a movable contact 64 connected by a conductor 65 with the bar 45.

One terminal of the relay 25 is connected by a conductor 66 with the conductor 62 and has its other terminal connected to the conductor 54. One terminal of the relay 26 is connected by a conductor 67 with the conductor 65, while its other terminal is connected by a conductor 68 with the conductor 54.

As mentioned in the objects, I provide a calendar mechanism for rendering the signal system inoperative from 6:00 p. m. to 6:00 a. m. or on any day during each week. To accomplish this I provide below the rotary disk 10 a ratchet wheel 69. As there are fourteen twelve hour periods in each week there are fourteen teeth in the ratchet wheel and fourteen holes 70 into any one of which may be inserted a peg which might be a screw. Cooperating with the teeth is a spring-pressed pawl 71 for preventing retrograde movement of the ratchet. Mounted axially of the ratchet wheel is a lever arm 72 which is urged in one direction by a spring 73 and which carries a spring-pressed pawl 74 cooperating with the ratchet wheel to move it step by step. The lever arm 72 projects inwardly beyond the periphery of the rotatable disk 10 so as to be in the path of movement of a peg or pin 75 carried by the disk 10 at a point opposite the twelve o'clock indication on the clock face 5. It should be mentioned in passing that the peg located in any one of the holes 70 is intended, at certain times as will be explained, to engage against the contact arm 34 and open the circuit to the lamps 17 and 18.

The operation of this form of the invention is as follows: As pointed out above, the disk 10 has two concentric rows or series of holes of twenty-four between the successive hours, one row controlling one circuit and the other controlling the other circuit in this two circuit form of the device. All the holes 11 and 12 are closed, for instance by small screws, except those which are to admit light to the photo-electric cells 19 and 20 to effect ringing of the bells on the respective circuits at a predetermined time or times. There being twenty-four of the holes 11 and 12 between successive hour indications, one of these holes, whether open or closed, will come in line with or between the source of light and the associated photo-electric cell every two and one-half minutes. The motor 9 rotating the disk 10 and driving the hands of the clock and causing rotation of the disk 13 will cause the latter to trip the mercury switch 15 every two and a half minutes, the tripped position of the switch lasting, actually, approximately four seconds. The result of tripping the mercury switch from the position shown in Figure 2 into its opposite position will cause the mercury globule to engage and bridge the contacts 30 and 31 and when this is done current will flow through the line wire 27, both of the lamps 17 and 18, through the conductor 29, contact 30, contact 31, conductor 32, contact 33, contact 34, conductor 35, and to the line wire 28, back to the source, thereby causing energization of the lamps 17 and 18, the illumination thereof lasting about four seconds as mentioned above. If a hole in either the series 11 or 12 in line between a lamp and the associated photo-electric cell is open the light from the lamp will of course be projected through such open hole onto the photo-electric cell, resulting in energization thereof and the feeding of current through the conductors 21 and 22 to the relay 25, or through the conductors 23 and 24 to the relay 26, as the case may be, depending upon whether the open hole is in the outer or inner row. If the relay 25 is the one that is energized, and assuming that the contacts 60 and 61 are disengaged, as they are normally, current will flow from the line wire 27, conductor 37, conductor 40, all the bells 38 on that circuit, conductor 42, contact 55, contact 50, conductor 51, cross bar 46, bar 44, conductor 62, conductor 66, relay 25, conductor 54, to the line wire 28. This of course results in ringing all the bells 38 on the one circuit at the particular predetermined time. Assuming that it is one of the holes in the series 12 through which the light projects so that the relay 26 is operated, current will flow from the line wire 27, conductor 37, conductor 41, all the bells 39 on the second circuit, conductor 43, contact 59, contact 56, con-

ductor 57, cross bar 47, bar 45, conductor 67, relay 26, conductor 68, conductor 54, to the line wire 28, resulting in ringing of as many bells 39 as there may be in the second circuit.

The function of the double-throw switches 48 and 49 is to transfer the bells 38 from the first circuit to the second and the bells 39 from the second circuit to the first, or to place all in either circuit, whichever arrangement is desired. Such transfer is effected merely by throwing one or the other of the switches to its reverse position.

The above described calendar mechanism consisting of the parts 69 to 75 is for the purpose of putting the lamps 17 and 18 out of circuit from 6:00 p. m. to 6:00 a. m. or on any day during each week. As mentioned above there are fourteen twelve hour periods in each week and consequently fourteen teeth on and holes in the ratchet 69. The peg or pin 75 on the disk 10 is at the twelve o'clock indication. Clearly when this pin 75 is at the bottom of the disk 10, or at the six o'clock point it will engage the lever 72 and move it to the left whereupon the pawl 74 will move the ratchet 69 one tooth. The peg $70^a$ will then engage the elongated contact 34 and move it out of engagement with the contact 33, thereby clearly breaking the circuit above described at this point and causing deenergization of the lamps 17 and 18 so that no light will be thrown onto the selenium cells which will therefore become inactive so as not to operate the relays. The lights will remain deenergized until the peg $70^a$ has slipped off from the contact 34, which cannot occur until another twelve hours have elapsed. When this does occur the contact 38 will reengage the contact 33 and reestablish the circuit to the lamps so that the entire mechanism is restored to its normal operation.

The form of the invention disclosed in Figures 3 and 4 is based on the same general principles as the above described form and, generally speaking, the essential features of the construction are substantially the same. However, in this form the rotatable dial of the first form is replaced by a moving tape with which are associated the light producing means and the photo-electric cells. In this form there is of course provided a clock 76 having the same dial and hour, minute and second hands as before and driven by an appropriate synchronous motor fed with current through conductors 77 and 78. There is also provided a mercury switch 79 which is pivotally mounted and urged by gravity into one position and equipped with an arm 80 disposed in the path of travel of a nub or cam projection 81 on the arbor of the second hand so that when the second hand makes one complete revolution the mercury switch will be tripped, that is to say this switch will be shifted into circuit closing position every minute.

I also provide a pair of toothed reels or rollers 82 about which are trained tapes 83 extending over and under guide rollers 84 and 85. The reels 82 are provided with teeth 86 adapted to enter holes 87 in the tapes for driving purposes, that is to say so as to move the tapes step by step. These reels 82 are mounted upon a shaft 88 carrying a ratchet wheel 89 with which cooperates a spring-pressed retaining pawl 90 for preventing retrograde movement. For driving the reels and consequently the tapes I provide an electro-magnet 91 positioned adjacent an armature arm 92 which is spring pressed in one direction, which is pivoted intermediate its ends as shown and which carries a pawl 93 engaging the ratchet wheel 89. This magnet is connected in series with the feed wire 77 and the mercury switch 79 so as to be energized each time the mercury switch is tripped, thereby attracting the armature lever 92 and moving the reels one step per minute. It is intended that each of the tapes 83 be punched, as at 94 near its edges at the particular times when it is desired to have signal bells operate in accordance with a predetermined program and it is of course apparent that the location or spacing of the punched holes 94 may be easily arranged in advance. It is likewise apparent that if a program is to be changed it is a simple matter to remove one or both of the tapes and replace them with differently punched ones.

Located at one side of the tapes are light bulbs 95 and located at the opposite side are photo-electric cells 96 so that whenever a punched-out hole 94 is in alinement between a lamp 95 and a cell 96 the latter will be energized. The lamps are connected in parallel with the electro-magnet 91 by means of conductors 97 and 98 so as to flash every time the electro-magnet is energized. It is of course understood that the flashing of the lamps, though constant, has no effect on the photo-electric cells unless a hole 94 is in alinement between them. The conductor 97 leading to the lamps connects by a conductor 99 with the mercury switch and also connected with the mercury switch is a conductor 100 which leads to a switch 101 operated by a calendar device 102 which corresponds exactly with what is shown in the first form of the invention and which therefore need not be described again in detail, the purpose being the same in this instance as in the first form of the invention. However, whereas in the first form of the invention the calendar device is operated by the pin 75 on the rotatable dial 10, in this instance it is operated by a similar pin 103 on a gear 104 which is driven from the clock mechanism by means of any intermediate train of gears, not shown. In this instance the photo-electric cells 96 are connected with respective ones of a plurality of relays 105, each of which has one terminal connected by a conductor 106 with the feed wire 78. The other terminals of these relays are connected with metal bars 107 of a control panel 108. The bars 107 are bridged by a plurality of bars 109 which are insulated therefrom under normal conditions and connected with the different bars 109 are the conductors which lead to the different bell or signalling circuits—but one of such signalling circuits is indicated for the sake of clarity—in which the conductor 110 is connected with the bar 109 and with the conductor 112 which is in turn connected with one terminal of the bell 113 of which the remaining terminal is connected by a conductor 114 with the line wire or conductor 77. A normally open switch 111 is connected in each bell circuit in shunt with the relay 105 controlling that circuit and is identical in form and function with the switches 60—61 and 63—64 illustrated in connection with the construction of Figure 1. These shunt switches, in both forms of the invention, provide for manual operation of the signalling circuits, independent of the relay control, so that should occasion arise for the operation of any one at some other time than that for which the apparatus is set, it can be done by means of the said control or master switches which also provide for testing the signalling circuits from time to time to determine whether they are in order.

The control panel 108 is of somewhat peculiar construction and it should be explained that at the intersections of the bars 107 and 109 there are provided tapped holes into which may be threaded screws for completing the connection between any one of the bars 107 and any one or more of the bars 109. For instance if it is desired to have bell 113 on number one circuit, such a screw would be put in the extreme upper left hand corner intersection, or in other words at the point 115. By this means and method any bell can be changed to operate on any one of the four circuits or can be taken out of service simply by removing the screw.

From the foregoing description and a study of the drawings it will be apparent that I have thus provided a purely electrical program clock which is based on well known scientific theories which have been proved to be sound and reliable. The employment of this purely electrical means for operating the clock eliminates the multitudinous mechanical parts such as contacts and the like which are present in the ordinary mechanically driven types and as a consequence there is less to get out of order and less to adjust so that the device should be very efficient and durable in service.

While I have shown and described preferred embodiments of the invention, it should be understood that the disclosure is merely an exemplification of the principles involved as the right is reserved to make all such changes in the details of construction as will widen the field of utility and increase the adaptability of the device provided such changes constitute no departure from the spirit of the invention or the scope of the claims hereunto appended.

Having thus described the invention, I claim:

1. An electric program clock comprising, in combination with a clock mechanism, a movable member having clock mechanism actuated means for driving the same in timed relation therewith and formed with series of perforations uniformly spaced to successively pass a fixed point at a fixed rate, light producing means disposed on one side of the movable member within the area through which said perforations pass, an energizing circuit for the light producing means, light sensitive cells disposed directly opposite said light producing means but on the other side of said movable member, a periodically actuated switch controlling the light producing means and operated by the clock mechanism, signals, energizing circuits for the signals, and relays controlled by the light sensitive cells and controlling the signal circuits.

2. An electric program clock comprising, in combination with a clock mechanism, a movable member having clock mechanism actuated means for driving the same in timed relation therewith and formed with series of perforations uniformly spaced to successively pass a fixed point at a fixed rate, lamps disposed on one side of the movable member within the area through which said perforations pass, an energizing circuit for said lamps, light sensitive cells disposed directly opposite said lamps but on the other side of said movable member, a switch controlling the lamps but actuated at fixed intervals by the clock mechanism, signals, energizing circuits for the signals, relays controlled by the light sensitive cells and controlling the signal circuits, a normally closed switch controlling the lamp energizing circuit and in series with the periodically actuated switch, and switch opening means for the last said switch operatively connected with the movable member for actuation thereby at fixed intervals.

3. An electric program clock comprising, in combination with a clock mechanism, a movable member having clock mechanism actuated means for driving the same in timed relation therewith and formed with series of perforations uniformly spaced to successively pass a fixed point at a fixed rate, lamps disposed on one side of the movable member within the area through which said perforations pass, an energizing circuit for said lamps, light sensitive cells disposed directly opposite said lamps but on the other side of said movable member, a switch controlling the lamps but actuated at fixed intervals by the clock mechanism, signals, energizing circuits for the signals, relays controlled by the light sensitive cells and controlling the signal circuits, a normally closed switch controlling the lamp energizing circuit and in series with the periodically actuated switch, and switch opening means for the last said switch operatively connected with the movable member for actuation thereby at fixed intervals, the said switch comprising fixed and movable members of which the latter is yieldingly impelled into engagement with the former, and said actuating means comprising a ratchet wheel, a drive lever intermittently moved during the movement of the movable member and having a pawl engaging the ratchet wheel, and a trip pin for the movable member of the switch and selectively positionable at any one of a plurality of fixed points on the ratchet wheel.

4. An electric program clock comprising, in combination with a clock mechanism, a movable member having clock mechanism actuated means for driving the same in timed relation therewith and formed with series of perforations uniformly spaced to successively pass a fixed point at a fixed rate, light producing means disposed on one side of the movable member within the area through which said perforations pass, an energizing circuit for the light producing means, light sensitive cells disposed directly opposite said light producing means but on the other side of the said movable member, a periodically actuated switch controlling the light producing means and operated by the clock mechanism, signals, energizing circuits for the signals, relays controlled by the light sensitive cells and controlling the signal circuits, and manual switches controlling the signal circuits independently of the relays.

5. An electric program clock comprising, in combination with a clock mechanism, a movable member having clock mechanism actuated means for driving the same in timed relation therewith and formed with series of perforations uniformly spaced to successively pass a fixed point at a fixed rate, light producing means disposed on one side of the movable member within the area through which said perforations pass, an energizing circuit for the light producing means, light sensitive cells disposed directly opposite said light producing means but on the other side of said movable member, a periodically actuated switch controlling the light producing means and operated by the clock mechanism, signals, energizing circuits for the signals, relays controlled by the light sensitive cells and controlling the signal circuits, and plug members selectively positionable in the perforations to selectively shield the cells from the light producing means at such periods as it is not desired to have the former actuate the relays.

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