

Sept. 11, 1962

F. Q. RAST ET AL

3,054,038

TELEVISION PROGRAMMER

Filed Aug. 4, 1958

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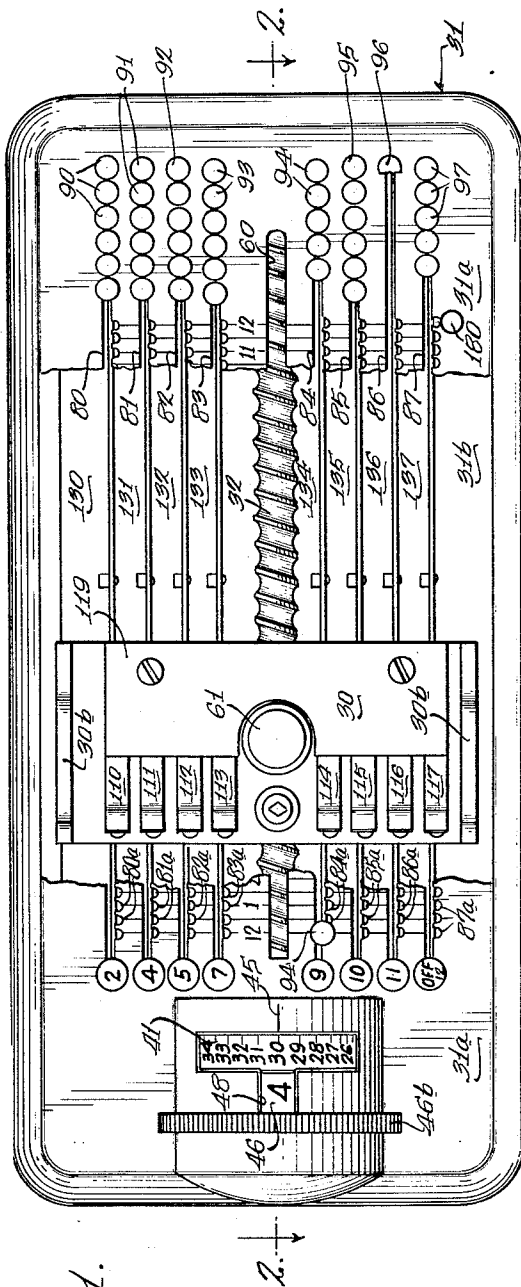
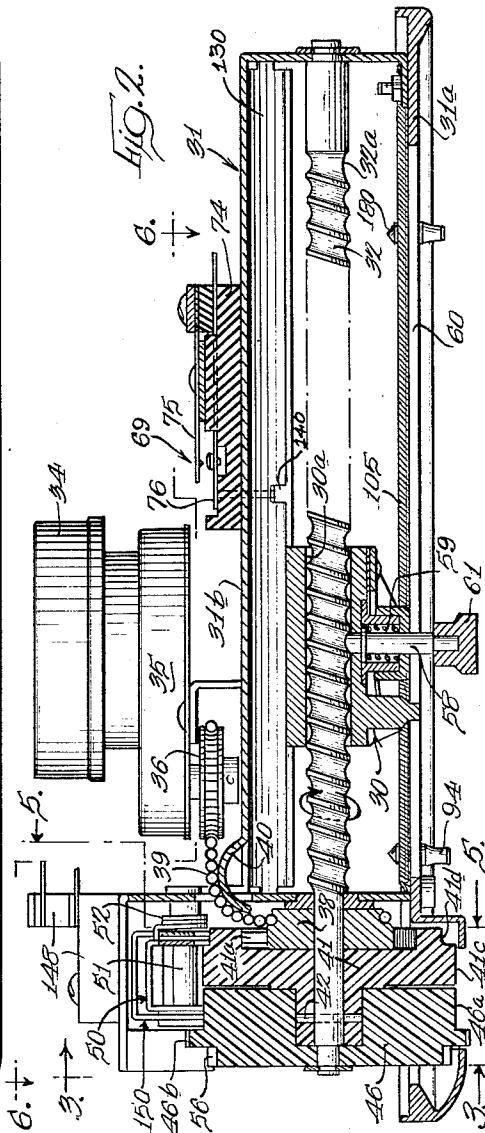


FIG. 1.

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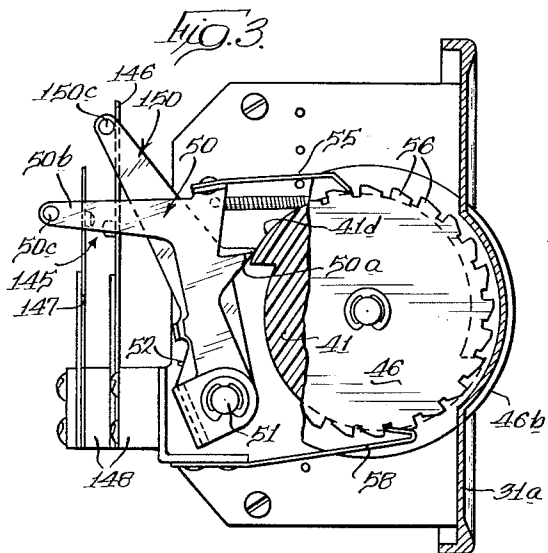
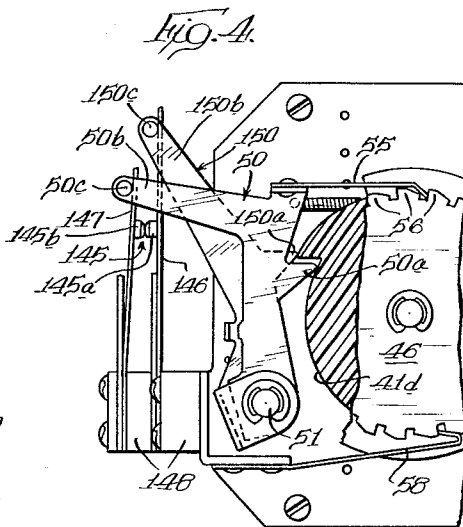
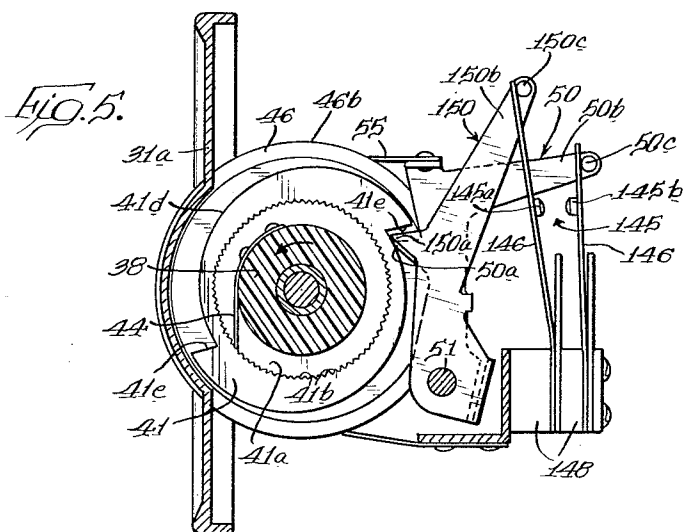
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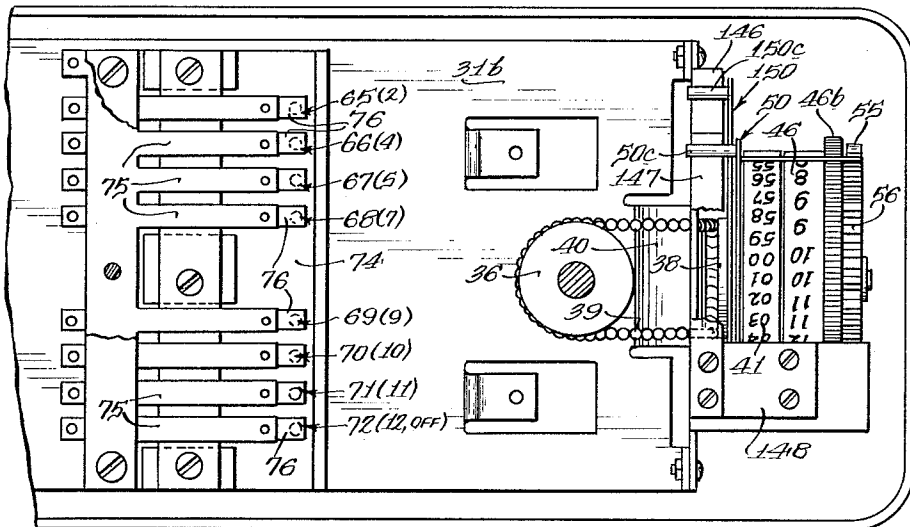
TELEVISION PROGRAMMER

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FIG. 6.



7. →

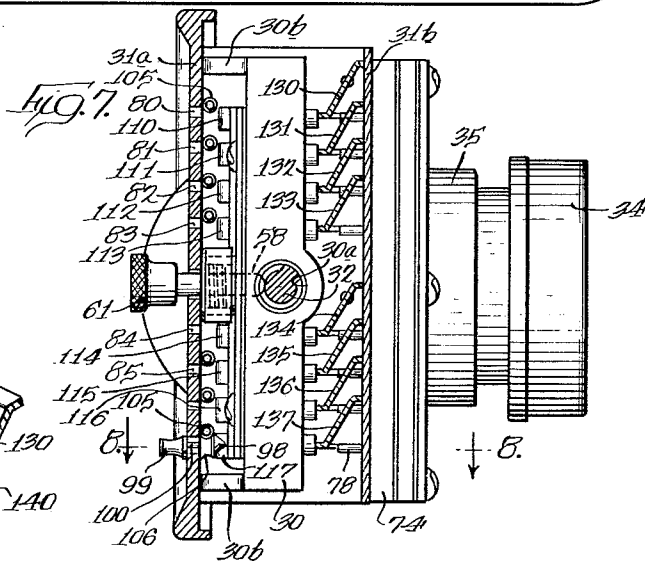


FIG. 9.

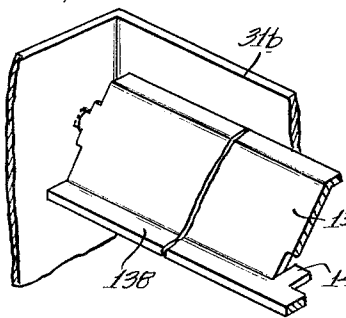
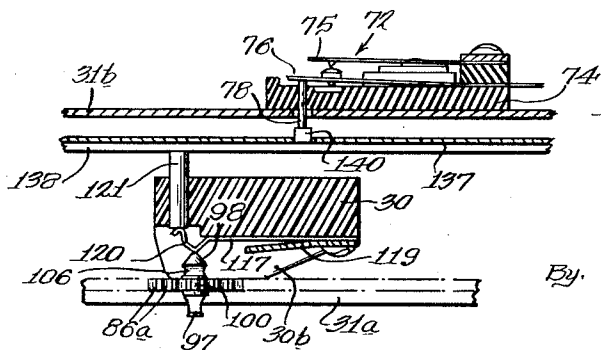


FIG. 8.



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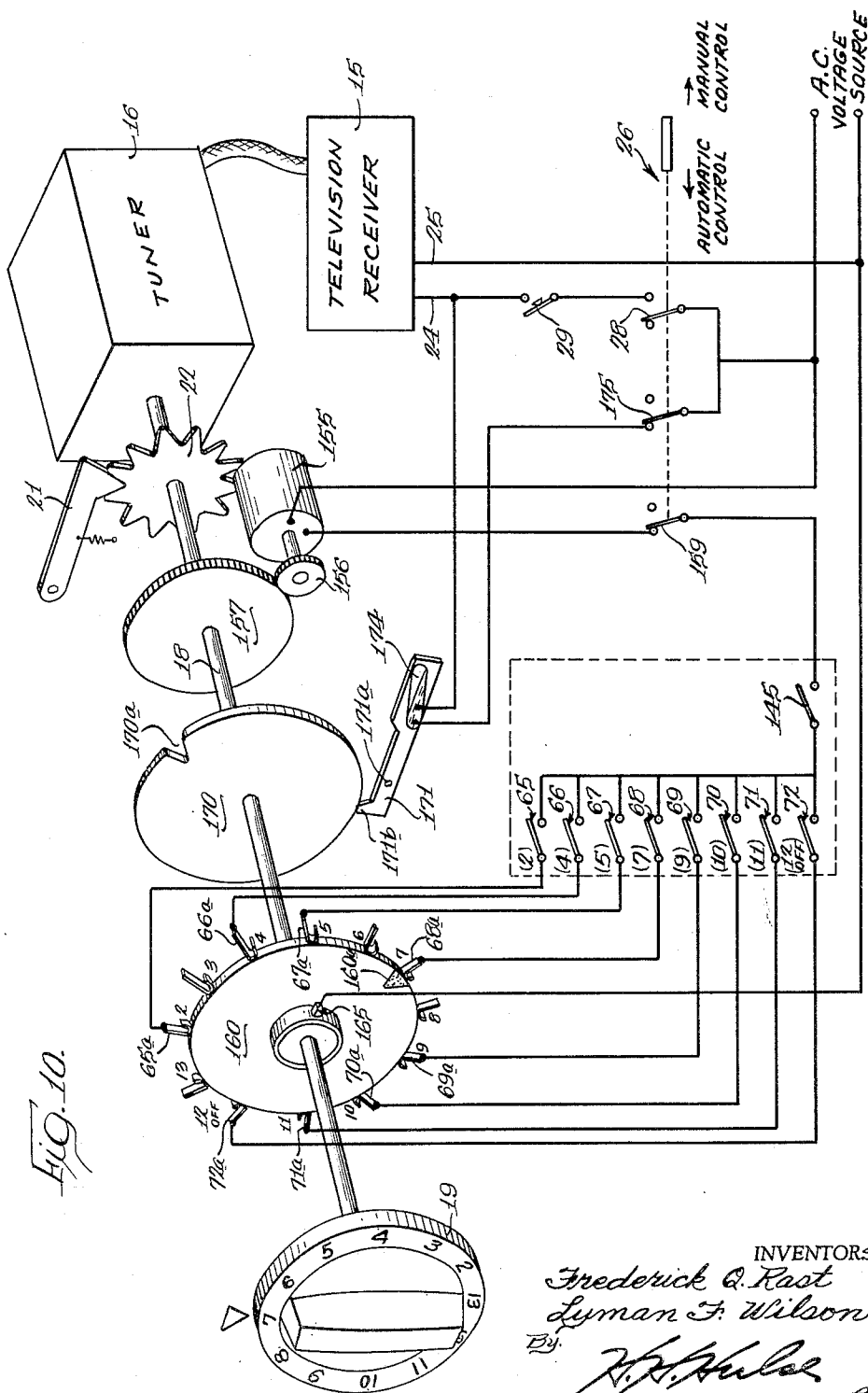
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3,054,038

TELEVISION PROGRAMMER

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Filed Aug. 4, 1958, Ser. No. 753,161
16 Claims. (Cl. 318—467)

The present invention related in general to apparatus for controlling devices, such as television receivers, over elapsed periods of time according to a preselectable, variable program.

It is the general aim of the invention to bring forth a new and advantageous programmer which sets a television receiver to any one of a plurality of channels, and turns the receiver on or off, during any desired interval over an extended period of time in accordance with a variable schedule which is preselected and preset.

An important object of the invention is to provide such a programmer which is easily set up and changed to effect any desired program of operation over a twenty-four hour period, and which is both simple in construction and reliable in use.

It is another object to provide an improved arrangement for actuating any preselected one of a plurality of switches at certain times within a cyclic period, say twenty-four hours.

A further object of the invention is to provide a movable element driven slowly at a timed rate over a relatively short path so that its position at any instant represents time together with means for assuring that the exact position of the element is correct (e.g., corresponds to minutes accuracy) when the element is roughly reset along its path to approximately the correct position (e.g., to the nearest hour setting).

Still another object of the invention is to provide especially simple means for actuating a stationary switch as a movable element passes preselectable points along its path of motion, totally avoiding the need for sliding contacts and the like.

It is an additional object to provide a programmer in which program changes are effected at preselected times determined by a movable element driven at a timed rate reaching certain positions, and especially characterized by the virtue that the program changes occur exactly at multiples of a unit time period even though the drive for the element and the position-detecting means are not constructed to have a high degree of precision and accuracy.

A further object is to provide a programmer which is characterized by simple and reliable power means for automatically moving a control member to any one of a plurality of positions corresponding to a particular one of a plurality of switches which is actuated.

It is also an object to provide a programmer which can not only set the controlled device to any one of a plurality of operating positions during preselected periods of the day, but which can also turn the controlled device on or off during preselected periods.

Other objects and advantages will become apparent as the following description proceeds, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a front elevation, partly broken away, of the timing assembly for a television programmer embodying the features of the invention;

FIG. 2 is a horizontal section taken substantially along the line 2—2 in FIG. 1 and showing particularly a mechanism for driving a movable element at a timed rate along a predetermined path;

FIG. 3 is a vertical section, taken substantially along the line 3—3 in FIG. 2;

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FIG. 4 is similar to FIG. 3, illustrating the parts in different relative positions;

FIG. 5 is a vertical section taken substantially along the line 5—5 in FIG. 2;

FIG. 6 is a fragmentary rear elevation, taken partly in section along the offset line 6—6 in FIG. 2;

FIG. 7 is a vertical section taken substantially along the line 7—7 in FIG. 6 and showing details of a cooperating movable element and means for operating stationary switches;

FIG. 8 is a fragmentary detail view, taken in section substantially along the line 8—8 in FIG. 7;

FIG. 9 is a fragmentary perspective view showing details of a rocker bar for actuating a stationary switch; and

FIG. 10 is a diagrammatic illustration of power means and electrical controls forming a part of the programmer and operable to set a movable control member to desired positions in accordance with the actuation of switches in the timing assembly.

While the invention has been shown and will be described in some detail with reference to a particular embodiment thereof, there is no intention that it thus be limited to such detail. On the contrary, it is intended here to cover all alterations, modifications, and equivalents falling within the spirit and scope of the invention as defined by the appended claims.

The exemplary programmer here illustrated is intended specifically for use in controlling the operation of a television receiver 15 (FIG. 10) which may be of the conventional type. That receiver includes as a part thereof the usual tuner 16 which conditions the receiver for reception of signals over any one of a plurality of channels. The tuner 16 may be of well known construction, and includes a control member or shaft 18 which is selectively movable to any of a plurality of angular positions. The shaft 18 may be manually set, by means of a knob 19, to any of twelve angular positions, thus conditioning the tuner to receive signals over channels 2 through 13. A spring-biased detent 21 engaging a notched disk 22 on the shaft 18 yieldably holds the latter in each of its several positions. In most areas at the present time only a limited number of the twelve television channels are in use. It has been assumed by way of example that the illustrated television receiver will receive signals over channels 2, 4, 5, 7, 9, 10 and 11.

Before proceeding with a description of the programmer, it may be observed that the television receiver 15 has a main power circuit represented by the conductors 24 and 25 (FIG. 10). Normal manual control of the receiver may be effected by moving a selector switch 26 to the manual (right) position, thereby closing contacts 28 to connect the power circuit 24, 25 to an A.C. voltage source through a conventional manually controlled on-off switch 29, usually provided as a part of the television receiver. When the selector switch 26 is shifted to the automatic position (to the left) as shown in FIG. 10, the channel setting and the energization of the television receiver 15 will be under the control of the programmer as will be more fully explained below.

Referring now to FIGS. 1 and 2, the television programmer comprises a timing assembly which includes a movable element driven along a predetermined path at a timed rate. As here shown, the movable element takes the form of a carriage block 30 disposed within a housing 31 and cooperatively engaged with a lead screw 32 rotationally driven from a synchronous motor 34 which is continuously energized from a suitable voltage source (not shown).

The drive connection from the motor 34 to the lead screw 32 includes speed reduction gearing contained within a housing 35 and having an output shaft carrying a bead sprocket 36. Drive is transmitted from the sprocket

36 to a sprocket wheel 38, disposed at right angles to the sprocket 36 and journaled on the left end of the lead screw 32, by an endless bead chain 39 trained over a guide member 40. The ratio of the drive connection from the motor 34 is preferably such that the wheel 38 is rotated at one revolution per hour.

In order to establish a one-way drive connection from the motor 34 to the lead screw 32, permitting the latter to be angularly set to a correct time position, the hub of a recessed minute wheel 41 is rigidly connected to the left end of the lead screw 32 by means of a staking pin 42. In its left face (FIG. 2) the minute wheel 41 is formed with a recess 41a having its annular wall cut to define a plurality of ratchet teeth 41b (FIG. 5). A resilient, flat spring member 44 is fixed to the periphery of the sprocket wheel 38, being engaged at its extremity in driving relation with the ratchet teeth 41b. As the sprocket wheel 38 is driven counterclockwise (FIG. 5), therefore, the spring member 44 will drive the minute wheel 41 in unison therewith. This, in turn, will drive the lead screw 32 at a precisely timed rate of one revolution per hour.

To provide a direct reading clock in combination with the timing assembly, the periphery 41c of the minute wheel 41 is divided into 60 equal arcs to which numerical indicia are applied to indicate time from one through sixty minutes. As the motor 34 thus drives the lead screw 32 at a timed rate of one revolution per hour, time to the nearest minute may be read from the front of the assembly (FIG. 1) by observing the particular one of the minute numbers which appears opposite an index mark 45. If for some reason, such as the interruption of power supplied to the synchronous motor 34, the setting of the minute wheel 41 makes its time reading incorrect, that wheel can be reset to the proper position simply by touching its periphery and rotating it forwardly (counterclockwise as viewed in FIG. 5) until the minute reading is correct. This will at the same time rotate the lead screw 32, and the spring member 44 will slip by the ratchet teeth 41b.

To provide an hour indication for the direct reading clock, an hour wheel 46 is journaled for relative rotation on the left end of the lead screw 32 and the projecting hub of the minute wheel 41. The hour wheel is divided into twenty-four arcuate areas on its periphery 46a to display time to the nearest hour by means of numerical figures moved successively into a window 48 in the housing 31. To rotationally step the hour wheel with the proper timing, a cam arm 50 is pivoted at 51 and spring biased in a clockwise direction (as viewed in FIG. 3) by a torsion spring 52 (FIG. 2). The cam arm 50 is formed with a cam follower point 50a which is thus biased to ride on a camming surface 41d at the right edge of the minute wheel 41 (FIG. 2).

As shown in FIGS. 3-5, the camming surface 41d is formed with two abrupt radial drops 41e diametrically spaced around the periphery of the minute wheel, and located such that they will ride beneath the follower point 50a when that wheel is angularly positioned to indicate 29 minutes, 30 seconds after each hour, or 30 seconds before each hour. Between each of the radial drops 41e, the camming surface 41d rises progressively in the direction of the wheel's rotation, so that as the minute wheel 41 rotates at one revolution per hour, the cam arm 50 will be progressively rocked counterclockwise (FIG. 3) until the follower point 50a drops abruptly at the points 41e (FIG. 4).

A ratchet finger 55 is carried by the cam arm 50 and cooperatively disposed with twenty-four ratchet teeth 56 formed on the edge of the hour wheel 46. As the ratchet finger 55 is thus retracted and advanced twice each hour, the hour wheel 46 will be angularly stepped in a clockwise direction (FIG. 3) twice each hour, at a total rate of two revolutions per day. For holding the hour wheel 46 in each of its angular positions, a retaining spring 58 is adapted to have a one-way engagement with the teeth 56.

Because the hour wheel is stepped twice during each hour, the numerals representing the hours 1 through 12 are duplicated on two successive peripheral portions of the hour wheel, thus assuring that the reading of the clock in hours will always be correct. It will be apparent that whenever it is necessary to correct the setting of the hour wheel 46, a knurled flange 46b, which projects through the housing 31, may be manually shifted to rotate the hour wheel forwardly (i.e., clockwise as viewed in FIG. 3).

The carriage block 30 has a central passage 30a (FIG. 2) therethrough which receives the lead screw 32, the latter being journaled at its opposite ends in the housing 31. Upper and lower projections 30b (FIG. 7) on the block 30 slidably bear against a front plate 31a of the housing 31 and prevent rotation of the block about the axis of the lead screw. For establishing an effective thread connection between the helical threads formed on the lead screw 32 and the block 30, a rounded detent 58 is slidably disposed in the block. The detent 58 projects through an elongated slot 60 formed in the front plate 31a and carries a knob 61 in order that it can be pulled outwardly against the bias of the spring 59. As the lead screw 32 turns at one revolution per hour, therefore, the detent 58 engaged with the helical thread of that screw causes the block 30 to be moved linearly at a timed rate to the right as viewed in FIGS. 1 and 2.

The front plate 31a of the housing 31 is scribed as an escutcheon plate with indicia spaced along the path of movement of the block 30 to indicate, according to the position of the block, the time reading. As shown in FIG. 1, only time to the nearest hour is marked by numerical indicia applied to alternate marks or lines spaced on the front plate 31 along the slot 60. A total of forty-eight vertical lines spaced along this plate will thus indicate, when read against the position of the block, time to the nearest half hour over a twenty-four hour period. The hour indicia begin (at the left) with the number 12, then read from 1 through 12, and repeat with the numbers 1 through 12 to provide a path of travel which indicates time over a twenty-four hour period.

When the block 32 has completed its full length of travel to the right, the detent 58 will enter from the helical thread on the lead screw 32 into a circular groove 32a (FIG. 2) formed at the right end of the lead screw. With this, the lead screw can continue to rotate without moving the block. In order to reset the block and again put it in motion, it is only necessary for the user to pull outwardly on the knob 61, slide the block to the left, and then release the knob so that the detent 58 snaps into engagement with the threads of the lead screw.

It will be seen with reference to FIGS. 1 and 2 that because the total range of travel for the block 30 is relatively short (here 4.8 inches), and the rate of travel of the block is relatively slow (here 0.20 inch per hour) in order to make the block cover that total range of travel in a relatively long total time period (twenty-four hours), it is difficult to read and determine exact time in minutes from the linear position of the block 30. It would be correspondingly difficult to set the block exactly to a linear position which reflects time in minutes when the detent 58 is engaged. In the present device, and even though the readable time indicia are spaced apart on the front plate 31a by a distance of 0.2 inch, it is only necessary when resetting the position of the block 30 to set it to the nearest position or time reading which represents time to the nearest hour.

The lead screw 32 is driven at a timed angular velocity of ω revolutions per hour, and has a pitch P inches per revolution. The carriage block 30 will thus be advanced at a rate ωP inches per hour. The spacing between successive numerical indicia is given a value of P inches and such spacing on the time scale represents $1/\omega$ hours. With such an arrangement, it is only necessary when resetting the block 32 to position it linearly along the time scale to the nearest $1/\omega$ hours, and re-engagement of the

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rounded detent with the screw thread will automatically shift the block to a position having minutes accuracy.

For example, in the present case the lead screw 32 is driven at an angular velocity ω of one revolution per hour. It has a thread pitch P of 0.2 inch. The block 32 is thus advanced at a linear velocity of ωP of 0.2 inch per hour. The hour indicia of the time scale applied to the plate 31a are spaced apart a distance P of 0.2 inch. The indicia therefore each represent $1/\omega$, or one hour, in time. And if the carriage block 30 is set to the nearest $1/\omega$ or nearest hour along the time scale, the detent 58 will, upon engagement with the threads of the lead screw, shift the block to a position that is accurate to minutes represented by the angular position of the lead screw.

As a second example, assume the lead screw to have a pitch P of 0.4 inch and its rotational velocity ω to be two revolutions per hour. Under those conditions, the indicia of the time scale would be spaced apart a distance P , i.e., 0.4 inch and would represent time to the nearest $1/\omega$ hours, i.e., to the nearest one-half hour. If the block 30 is adjusted linearly along the time scale to the nearest correct half-hour value, re-engagement of the detent 58 with the lead screw 32 will then correctively shift the block to a position accurate substantially to the nearest minute reflected by the angular position of the lead screw.

It should be noted also that whenever the minute wheel 41 is manually rotated to correct its time reading, the lead screw 32 will be rotated therewith. Thus, the block 30 will also be shifted linearly along the time scale of the escutcheon plate 31a and will accurately reflect in its linear position the minute reading of the minute wheel 41. The angular position of the lead screw 32 and the linear position of the block 30 between hour indicia will always correspond to the minutes reading of the wheel 41.

In accordance with one feature of the invention, a plurality of stationary switches, each corresponding to one of the angular positions of the tuner shaft 18, are provided, together with means for selectably actuating any one of those switches at the beginning of any half-hour period over the total cycle time of twenty-four hours. As here shown, the plurality of switches 65—72 (FIG. 6) are all simple leaf spring switches mounted to be completely stationary. Each of the switches is mounted on an insulating block 74 fixed by suitable bolts or the like to the rear panel 31b of the housing 31. Since the switches 65—72 are all identical, the detailed illustration of the particular switch 72 in FIG. 8 will suffice for all. As there shown, each of the switches comprises a first leaf spring contact 75 mounted on the block 74 and insulated from a second leaf spring contact 76. These two spring contacts are normally biased apart to electrically isolate the two, the leaf spring contact 76 normally being urged inwardly toward the insulating block 74. Slidable through the block 74 and the rear panel 31b beneath each of the leaf spring contacts 76 is an actuator pin 78. Upon shifting of the actuator pin 78, the leaf spring contact 76 will be moved outwardly from the insulating block 74 until it electrically engages and connects with the mating leaf spring contact 75.

In order to effect actuation of any one of the switches 65—72 at the end of any half-hour period during the twenty-four hour program cycle, a plurality of groups of dogs or projections are provided together with means for supporting the same at selectable points along the path which the block 30 traverses. As here shown in FIG. 1, the front plate 31a is formed with a plurality of vertically spaced slots 80—87 each of which corresponds to one of the seven positions to which the tuner shaft 18 is to be set. The slots 80—87 thus correspond, as shown by the identifying numerals at their left ends, to channels 2, 4, 5, 7, 9, 10, 11 and 12, designating that projections disposed in those slots will be effective to set the television receiver to those respective channels.

Each of the slots 80—87 extends considerably to the right of the end of the path of movement for the block

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30, and thus includes a region for holding seven groups of projections 90—97 in a stored position. The projections, as detailed most clearly in FIGS. 7 and 8, are each formed with a rounded inner nose portion 98, and an outer knob portion 99, with a midsection 100 of reduced diameter received within the corresponding slot. Thus, each of the plural projections in each of the groups 90—97 is held captive in the respective slots 80—87, but may be moved selectively to different positions lengthwise along those slots and along the path of movement of the block 30.

To hold the projections in a desired lengthwise setting along each of the slots 80—87, the lower edge of each slot is formed with a plurality of downwardly depending notches 80a—87a, respectively. As shown in FIG. 1, the notches 80a—87a are spaced lengthwise along the corresponding slots in alinement with the vertical lines representing half-hour time intervals on the linear time scale. If one of the projections 90 is, therefore, shifted to the left in the slot 80 and dropped into the notch above the numeral "1" at the left end of the slot 80, then that projection will be so disposed as to be engaged by a member carried by the block (to be described) when the block is in a position which represents time of one o'clock. In this manner, it will be seen that one of the projections may be positioned at each half-hour interval along the path of the movable block 30 so as to cooperatively engage and deflect a member which is carried by the block.

For assuring that the projections when once set to desired positions along the respective slots 80—87 will retain those positions, a plurality of flexible springs 105 are stretched across the inner surface of the front plate 31a. Those springs engage annular grooves 106 formed in the projections, and urge the latter downwardly into the bottom of the notches formed in the corresponding slots. Once a projection has been placed in a particular notch of its groove, it will be yieldably held there by the coil spring.

To effect actuation of the switches 65—72 as the movable block 30 passes projections 90—97, respectively, disposed at preselected positions along the slots 80—87, the movable block 30 is provided with a plurality of vertically spaced spring fingers 110—117. Normally, each of those spring fingers is biased outwardly from the block 30 to a position limited by a stop plate 119 (FIG. 8). Upon engagement of a follower point 120 formed on each of the fingers 110—117 with one of the aligned projections, that finger will be deflected inwardly toward the block 30 to engage and shift a corresponding slidable member or relay pin 121 carried by the block.

To translate inward deflection of each of the vertically spaced relay pins 121 into actuation of a corresponding one of the stationary switches 65—72, a plurality of rocker bars 130—137 are pivotally mounted in the rear of the housing 31. As shown best in FIG. 9, each of the rocker bars 130—137 is of elongated shape and disposed parallel to the path of movement of the block 30. Each of the rocker bars has end projections which are pivotally received in openings formed in the opposite ends of the housing 31 so that they may rock about longitudinal axes. The lower edge of each bar is thus disposed opposite a corresponding one of the relay pins 121 as the block 30 progresses over its entire path. Inward shifting of a particular pin 121 will result in its engaging the lower edge 138 of the corresponding rocker bar 130—137, thereby rocking that particular bar in a counterclockwise direction, as viewed in FIG. 7.

Such motion of the rocker bars 130—137 is caused to produce shifting of the corresponding pins 78 associated with the respective switches 65—72. For this purpose each of the rocker bars 130 is formed with an outwardly bent prong 140 alined with and disposed opposite a corresponding one of the switch pins 78. It will thus be

apparent that whenever any one of the spring fingers 110—117 (FIG. 1) passes and engages one of the projections 90—97, respectively, disposed in the corresponding one of the slots 80—87, it will engage and be deflected by that projection as an incident to the movement of the block 30. Such deflection of any one of the fingers 110—117 will result in an inward shifting of the corresponding one of the relay pins 121, and such pin will therefore rock a corresponding one of the rocker bars 130—137. This in turn will cause the lug 140 of that rocker bar to engage and shift a corresponding one of the actuator pins 78, thereby deflecting the leaf spring contact 76 of the associated switch, and closing the contacts of the corresponding one of the switches 65—72. This arrangement is particularly compact and inexpensive because it affords selective actuation of the switches 65—72 at preselected time instants represented by the settings of the projections and the timed movement of the block 30 without requiring any movable or sliding contacts. The switches themselves are mounted absolutely stationary and are of the simplest construction.

Because the total range of travel of the block 30 is relatively short and its rate of travel relatively slow to produce a twenty-four hour programming cycle, it would be difficult to construct this apparatus with sufficient precision such that a given one of the switches 65—72 could be actuated or closed exactly on the hour or half hour. The presettable projections 90—97 have fairly blunt nose portions 98, and the follower points 120 of the spring fingers 110—117 are blunt. While the projections are selectably disposed at points lengthwise along the path so as to be engaged by the corresponding spring fingers when the block is at a position representing the end of a half-hour period, the exact instant at which the corresponding one of the switches is actuated may vary by a major portion of a minute. In order that the switching of the television receiver from one channel to the other will be made to occur exactly at the end of a half-hour period, a master switch is provided together with means to assure that it will be actuated for a short interval just before the end of half-hour periods. This master switch is utilized to render the switches 65—72 effective to cause resetting of the tuner shaft 18.

As here shown in FIGS. 3, 4 and 5, a master switch 145 is formed by two contacts 145a, 145b carried by flexible spring arms 146, 147 mounted in spacing and insulating blocks 148 at the rear of the minute wheel 41. Normally the spring arms 146, 147 hold the electrical contacts separated, i.e., the master switch open (FIG. 3). However, as the minute wheel 41 reaches a position which corresponds to a time of 30 seconds before each hour or 30 seconds before each half hour, the cam arm 50 will drop on the cam surface 41d and be rocked to the counter clockwise position shown in FIG. 4, as previously explained. The cam arm 50 has an integrally formed finger 50b carrying a transverse rod 50c disposed behind the upper end of the spring arm 147. Therefore, as the cam arm 50 rocks counterclockwise to the position shown in FIG. 4, the rod 15 will engage and deflect the spring arm 147, bringing its electrical contact 145b into engagement with the mating contact 145a on the spring arm 146. The master switch 145 will thus be closed 30 seconds before the end of any half-hour period.

To effect opening of the master switch a short time thereafter, say twelve seconds later, a second cam arm 150 is pivoted at 51 and formed with a cam follower point 150a which rides on the cam surface 41b. The cam arm 150 is also biased in a counterclockwise direction (FIG. 4) by means of a torsion spring (not shown), and the follower point 150a is so located as to lag, by about twelve seconds, the location of the follower point 50a on the cam surface 41d. Thus, about twelve seconds after the follower point 50a drops on the cam portion 41e to close the master switch 145, the follower

point 150a will drop on the cam portion 41e thereby permitting the biasing spring to rock the cam arm 150 in a counterclockwise direction (FIG. 4). With this, a finger 150b integral with the cam arm 150 will move and cause a transverse rod 150c carried thereby to engage and deflect the spring arm 146 inwardly, thereby separating the electrical contacts 145a, 145b and opening the master switch 145 (FIG. 5). From the foregoing, it will be understood that the master switch 145 is closed at the end of each half-hour period, and then is reopened approximately twelve seconds later.

Referring now to FIG. 10, the power means and controls which are responsive to the switches 65—72 and 145 for positioning the tuner shaft 18 to any desired channel setting during each half hour interval of a twenty-four hour program cycle as there illustrated. An electric motor 155 is drivingly connected to the tuner shaft 18 through gears 156, 157. The motor 155 is connectable to an A.C. voltage source through a first switch contact 159 which is closed only when the selector switch 26 has been moved to the automatic (left) position. Moreover, the motor is connected to the A.C. voltage switch only when the master switch 145 is closed. Further, the motor circuit includes in series a parallel combination made up of a plurality of series combinations each of which includes one of the switches 65—72 and switching means which are controlled to be closed or conductive except when the tuner shaft 18 is in a corresponding one of its several positions corresponding to the switches 65—72.

These latter switching means are here illustrated as a commutator disk 160 made of conductive material and cooperatively associated with a plurality of stationary brushes 65a—72a corresponding to and connected in series with the respective switches 65—72. The conductive commutator disk 160 is continuously connected to one terminal of an A.C. voltage source through a brush 165, so that the wiring conductor leading from each of the brushes 65a—72a is connected to one side of the voltage source except when the disk 160 and the shaft 18 are in a particular angular position. To effect such disconnection of the brushes 65a—72a whenever the shaft 18 is in corresponding angular positions, a non-conductive segment 160a is mounted in the periphery of the disk 160 and so phased that when the tuner shaft 18 is in angular positions for reception of channels 2, 4, 5, 7, 9, 10, 11, or 12, the non-conductive segment 160a is disposed beneath the corresponding brushes 65a, 66a, 67a, 68a, 69a, 70a, 71a, or 72a. If desired, the non-conductive segment 160a may be simply a cut-out or notch in the periphery of the commutator disk 160.

In review, it will be seen that the motor 155 is adapted for connection across the A.C. voltage source by a circuit which includes a parallel combination of eight series combinations, each such series combination including one of the switches 65—72 and one of the brushes 65a—72a which will be electrically connected to the voltage source except when the tuner shaft is in a corresponding one of its angular settings. In series with the parallel combination is the master switch 145 and the selector switch 159, the latter being closed whenever automatic programming control is to take place.

As a result of this control arrangement, if the switch 68 is momentarily closed, designating that it is desired to set the tuner shaft 18 to that position which makes the television receiver 15 receive signals over channel 7, then a conductive path will be established from the A.C. voltage source to energize the motor 155 when the master switch 145 closes. That circuit will, however, be broken whenever the commutator disk 160 reaches the angular position illustrated in FIG. 10, and the non-conductive segment 160a disconnects the brush 68a from the A.C. voltage source. In this manner, closure of any of the switches 65—72 jointly with the master switch 145 will

result in the motor 155 being energized to drive the shaft 18 until it reaches an angular position corresponding to that one of the switches 65—72 which is closed.

In order to automatically turn the television receiver on or off at preselected times, the brush 72a which normally corresponds to the position of the shaft 18 for receiving signals over channel 12 is employed, it being assumed that the television receiver 15 is located in an area where television signals are not transmitted over channel 12. When it is desired that the television receiver be turned off, the switch 72 will be momentarily closed in response to the movable block 30 passing a projection 97 disposed in the slot 87 (FIGS. 1 and 2). When the master switch 145 closes, the motor 155 will be energized to drive the tuner shaft 18 to that position which corresponds to a setting for channel 12.

Means responsive to the shaft residing in this particular position are provided to de-energize the television receiver 15. As here shown, a cam disk 170 is rigidly fixed to the tuner shaft 18, and provided with a depression or notch 170a in its periphery. The cam disk cooperates with a follower finger 171, pivoted at 171a. The finger 171 is overbalanced so that its tip 171b is continuously biased against the periphery of the cam disk 170. The notch 170a is so phased angularly about the shaft 118 that it will fall opposite the tip 171b when the shaft 18 is in an angular position corresponding to channel 12, and when the non-conductive segment 160a of the commutator 160 is opposite the brush 72a. When the tuner shaft 18 has been set to that position corresponding to channel 12, therefore, the tip 170b will fall into the notch 170a, permitting the finger 171 to rotate slightly in a counterclockwise direction.

This clockwise pivoting of the finger 171 is caused to open a normally closed switch 174. The latter switch is here illustrated as a mercury switch mounted on the end of the finger 171 and having contacts normally connected by a mercury pool when the finger 171 is in its normal position. When the finger is deflected, the mercury pool shifts to the right within the switch, and therefore electrically disconnects the switch contacts. The inertia of the finger 171 and the mercury pool within the switch 174 are such that the switch 174 will not be opened if the cam disk notch 170a is moved rapidly past the fingertip 171b. As the shaft 18 is driven by the motor 155 from one channel setting to another, the television receiver will not be turned off as the notch 170a passes the tip 171b. Only if the shaft 18 comes to rest with the notch 170a opposite the finger tip 171b will the switch 174 be opened.

When the selector switch is moved to the "automatic" (left) position, its contacts 28 open to break the direct connection of the television receiver power circuit 24, 25 from the A.C. voltage source. Also, the switch 26 includes another set of contacts 175 which are moved to the closed position illustrated in FIG. 10 when the selector switch is set to the automatic position. With this, the power circuit 24, 25 is adapted for connection across the A.C. voltage source through the contacts 175, which are now closed, and the switch 174. Therefore, as long as the tuner shaft 18 is in any angular position except that corresponding to channel 12, and the switch 174 is closed, the main power circuit 24, 25 will be connected to the voltage source and the television receiver 15 turned on. However, when the tuner shaft 18 is moved to the position corresponding to channel 12, then the finger 171 will be deflected in a counterclockwise direction, the switch 174 will be opened, and the television receiver turned off.

Preferably, a projection 180 having the same function as projections 90 to 97 is permanently fixed under the last notch of the slot 87 (FIG. 1). As the block 30 reaches the end of its linear path, this projection 180 will cause closure of the switch 72, so that the shaft 18 will be set to the channel 12 position, and the switch 174 opened to turn off the television receiver 15. At the end of the twenty-four hour cycle, therefore, the receiver is always automatically turned off.

Résumé of Operation

It is believed that the operation of the television programmer will be clear from the foregoing description. However, a résumé will be helpful.

At the beginning of a day, the tuner shaft will be in that position which holds the switch 174 open and the television receiver will be turned off. The user of the television receiver will selectively move different ones of the projections 90—97 (FIG. 1) to the desired positions lengthwise in the corresponding slots 80—87. If he desires channel 2 to be received at 7:00 a.m., then one of the projections 90 will be shifted along the slot 80 and dropped into that notch which corresponds to a time setting of 7:00 a.m. In like manner, if the user desires the receiver 15 to be tuned to channel 4 at 7:30 a.m., he will slide one of the projections 91 along the slot 81 and drop it into that notch which corresponds to a time setting of 7:30 a.m. If the user desires the television receiver to be turned off at 8:00 a.m., he will slide one of the projections 97 along the slot 87 and drop it into that particular notch which corresponds to a time setting of 8:00 a.m. In like manner, any of the several channels may be programmed to be received during any half-hour period of an entire twenty-four hour cycle.

It is to be observed particularly that it is only necessary to position the projections 90—97 along the slots 80—87 at those time locations where a change in operating conditions is to occur. In other words, if it is desired to receive signals over channel 5 for a period of 3 hours, one of the projections 92 will be set in a notch of the slot 82 at that time setting corresponding to the beginning of the three-hour period. At the end of the three-hour period, one of the projections in another of the slots will be located to change the condition of the television receiver, i.e., either tune it to a different channel or turn it off.

Once the projections 90—97 have been positioned lengthwise along their corresponding slots to establish the desired program, the block 30 is adjusted lengthwise of the lead screw 32 by pulling outwardly on the knob 61 to disengage the detent 58, and then sliding the knob lengthwise along the front plate 31a. The user observes the time reading displayed by the hour and minute wheels 46 and 41, moving the block to the nearest corresponding hour position on the linear time scale of the front plate 31a. Release of the knob 61 then causes the spring 59 to urge the detent 58 back into engagement with the threads of the lead screw 32. Because of the rounded detent and the helical thread on the lead screw 32, the block will be readjusted slightly in one direction or the other as the detent engages the threads, so that the exact linear position of the block 30 will then correspond to the reading of the minute wheel 41.

The block 30 then proceeds to move to the right (FIGS. 1 and 2) relative to the lead screw 32 at a precisely timed rate. If just prior to 7:00 a.m. one of the projections 90 in the slot 80 deflects the spring arm 110 and thus shifts the associated relay pin 121 inwardly, the upper rocker bar 138 will be rocked counterclockwise (FIG. 7) and the lug 140 thereon will displace the associated pin 78 to momentarily close the switch 65. This, by virtue of the location of the projection in the 7:00 a.m. notch and the location of the spring arm 110 on the block 30, will occur a few minutes before 7:00 a.m. and the switch will remain closed until slightly after 7:00 a.m. Then, at approximately 30 seconds before 7:00 a.m., the cam arm 50 will be permitted to swing clockwise (FIG. 4) by the cam surface 41d, thus closing the master switch 145. These latter contacts will remain closed until the cam arm 150 swings clockwise (FIG. 5) to deflect the contact arm 146 and reopen the master switch.

During the short time interval that the master switch 145 is closed, an energization circuit will be completed for the motor 155. This circuit will include the conductive commutator disc 160, the brush 65a, the closed

switch 65, the master switch 145, and the closed selector switch contact 159. The motor 155 will accordingly be energized to rotate the shaft 18. When the tuner shaft reaches a setting corresponding to channel 2, the non-conductive segment 160a will fall beneath the brush 65a, thereby deenergizing the motor and stopping the tuner shaft in the desired position. The detent means 21, 22 assure that the shaft will remain in the desired position without overtravel.

It will be observed that as soon as the shaft 18 was moved from that position corresponding to channel 12, the switch 174 closed to turn the television receiver on.

If then at 7:30 a.m. the block 30 in its travel moves the spring arm 111 corresponding to the switch 66 beneath one of the projections 91 in the slot 81 so that the corresponding pin 121 is deflected to rock the bar 131, the switch 66 will be momentarily closed. This will occur a few minutes before 7:30. At about 30 seconds before 7:30 a.m., the master switch 145 will close for a period of about 12 seconds, as previously explained. Accordingly, the motor 155 will again be energized from the A.C. voltage source through the commutator disk 160, the brush 66a, the switch 66, the master switch 145, and the selector switch contacts 159. The motor 155 will, accordingly, drive the shaft 18 until it reaches that position corresponding to channel 4, whereupon the non-conductive segment 165a will fall beneath the brush 66a to de-energize the motor. Reception of signals over channel 4 will continue for as long as the shaft remains in that position.

Then, if at 8:00 a.m. the spring arm 117 carried by the block 30 in alinement with the slot 87 engages one of the projections 97 (FIG. 8), the associated pin 121 will be shifted inwardly to rock the bar 137 (FIG. 7). This will result in closure of the switch 72 a few minutes before 8:00 a.m. When the master switch contacts 145 close about 30 seconds before 8:00 a.m., as previously described, then the motor 155 will be energized to drive the shaft 18 until the non-conductive segment 169a falls beneath the brush 72a. This will de-energize the motor, leaving the shaft 18 in a position corresponding to channel 12. It will also place the notch 170a opposite the finger tip 170b, thereby opening the switch 174 and turning the television receiver 15 off.

The operation of the television receiver over a twenty-four hour period may thus be controlled according to a preselected program. At the end of any half hour, the television receiver 15 may be either turned on and switched to any one of the indicated channels, or it may be turned off. It may be left in a given setting or condition for as long as desired, and will be switched to another condition in response to the movable block 30 passing one of the projections disposed in the notches of the front plate 31a.

At the end of the day, say 12:00 midnight, when the block 30 reaches the end of its travel, the follower detent 58 will slip into the end groove 32a in the lead screw. Accordingly, the lead screw can continue to rotate, and the minute and hour wheels 46, 41 continue to correctly indicate time, while the block 30 remains stationary. The fixed projection 180 will close the switch 72, causing the tuner shaft to rotate to that position which makes the cam finger 171 open the switch 174. The television receiver will be turned off. In the morning, it is only necessary for the user to reset the projections to establish the desired program for the following day, then readjust the block 30 lengthwise of the screw 32 to the correct time setting as indicated by the hour and minute wheels 46, 41.

It will be apparent that when the synchronous motor 31 is first energized, or following a total power failure which makes the time indication of the hour and minute wheels 46, 41 erroneous, the user may correctly set the hour wheel 46 by rotating it to the correct position. He may also correctly set the minute wheel 41 by rotating it,

and this will cause corresponding rotation of the lead screw 32 and automatic corrective setting of the block 30.

From the foregoing, it will be seen that the invention provides a simple, yet reliable and conveniently operated programmer for causing a television receiver to follow any preselected program of reception over different channels and to be turned on or off at different times over an entire day. While the invention find advantageous use in connection with pre-programming of television receivers, it will be apparent to those skilled in the art that the invention will be useful in numerous other applications. In any instance where it is desired to set a movable control member, such as the shaft 18, to different ones of a plurality of positions at different preselected times, and to energize or deenergize an associated electrical device, such as the television receiver 15, the exemplary apparatus here described may be employed. It is to be understood that the invention in its broadest aspects is not to be limited specifically to the control of television receivers.

We claim as our invention:

1. A programmer comprising, in combination, a movable element, means for driving said element at a timed rate along a predetermined path, a support disposed adjacent said path and having a plurality of slots parallel to said path and each corresponding to one program condition, a plurality of groups of projections and means for supporting different ones of each group at selected points lengthwise of a corresponding one of said slots to engage said element as the latter moves thereby, a plurality of switches each corresponding to one of said slots, and means responsive to the engagement of said element with a projection in any particular slot for closing the switch which corresponds to that slot.

2. A programmer comprising, in combination, a movable block, means for driving said block at a timed rate along a predetermined path, a plurality of groups of projections, means for supporting each group of projections in a row parallel to said path and with the projections of each group selectively disposed at different points lengthwise of said path to be engaged by said element as it moves thereby, a plurality of switches each corresponding to one of said rows, means for actuating each of said switches in response to engagement of said block with any of said projections in a corresponding one of said rows, and means responsive to actuation of each of said switches.

3. A programmer comprising, in combination, a movable block, means for driving said block at a timed rate along a predetermined path, a plurality of groups of projections, means for supporting each group of projections in a row parallel to said path and with the projections of each group selectively disposed at different points lengthwise of said path, a plurality of spring-biased fingers carried by said block and each alined with the projections in one row to be deflected as the block passes each projection in that row, a plurality of switches, means for actuating each of said switches in response to deflection of a corresponding one of said fingers, and means responsive to actuation of each of said switches.

4. A programmer comprising, in combination, a movable block, means for driving said block at a timed rate along a predetermined path, a plate disposed parallel to said path and having a plurality of longitudinal slots therein, a plurality of projections and means for holding said projections at selectable points lengthwise of and extending through each slot, a plurality of spring-biased fingers movably supported in said block and respectively alined with said slots to be shifted by engagement with the projections in such slots, a plurality of pivoted rocker bars disposed parallel to the path of said block, means for rocking each rocker bar in response to shifting of a corresponding one of said fingers, a plurality of stationary switches, means for actuating each of said switches in response to rocking of a corresponding one of said bars,

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and means responsive to actuation of each of said switches.

5. A programmer comprising, in combination, a synchronous motor, a lead screw rotationally driven at a timed rate from said motor, a block, means for disengageably establishing a threaded connection between said block and screw to drive the former along the latter at a timed rate, an elongated plate having a plurality of slots parallel to the path of said block, a plurality of projections, means for holding said projections at selectable points lengthwise of and extending through said slots, a plurality of fingers movably supported on said block and respectively aligned with said slots to be shifted by engagement with the projection in such slots, a plurality of pivoted rocker bars disposed parallel to the path of said block, means for rocking each said bar in response to shifting of a corresponding one of said fingers, a plurality of stationarily mounted switches and means for actuating each in response to rocking of a corresponding one of said bars, a member movable to a plurality of positions each corresponding to one of said switches a motor drivingly connected to said member, means for completing an energization circuit for said motor in response to actuation of each of said switches, and means for breaking such circuit when the motor has driven said member to a particular position corresponding to the actuated switch.

6. A programmer comprising, in combination, a movable block, means for driving said block at a timed rate along a predetermined path, a plurality of groups of projections, means for supporting each group of projections in a row parallel to said path and with the projections of each group selectively disposed at different points lengthwise of said path, a plurality of spring-biased fingers carried by said block and each aligned with the projections in one row to be deflected as the block passes each projection in that row, a plurality of rocker bars disposed parallel to the path of said block and pivoted about their longitudinal axes, means responsive to deflections of any one of said fingers for rocking the corresponding one of said rocker bars and regardless of the position of said block, a plurality of stationary switches, means for actuating each of said switches in response to rocking of a corresponding one of said rocker bars, a member movable to a plurality of positions each corresponding to one of said switches a motor drivingly connected to said member, means for energizing said motor in response to actuation of any one of said switches, means for deenergizing said motor in response to said member reaching that position which corresponds to the particular one of said switches which is actuated, a normally closed power switch, and means for opening said power switch when said member is in a predetermined one of its positions.

7. A programmer comprising, in combination, a movable block, means for driving said block at a timed rate along a predetermined path, a plate disposed parallel to said path and having a plurality of longitudinal slots therein each corresponding to one of said tuner member positions, a plurality of projections and means for holding said projections at selectable points lengthwise of and extending through each slot, a plurality of spring-biased fingers movably supported in said block and aligned with respective ones of said slots to be shifted by engagement with the projections in such slots, a plurality of rocker bars disposed parallel to the path of said block, means for rocking each rocker bar in response to shifting of a corresponding one of said fingers, a plurality of stationary switches, means for actuating each of said switches in response to rocking of a corresponding one of said bars.

8. A programmer comprising, in combination, a synchronous motor, a minute wheel and a lead screw both rotationally driven at a timed rate from said motor, a block, a rounded detent carried by said block and removably engaged with said lead screw to establish a threaded con-

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nection between said block and screw to drive the former lengthwise of the latter at a timed rate, an elongated plate having a plurality of slots parallel to the path of said block, a plurality of projections, means for holding said projections at selectable points spaced lengthwise along said screw at locations passed by said block when said minute wheel reads half-hour values of time, said projections extending through said slots, a plurality of fingers movably supported in said block and respectively aligned with slots to be shifted by engagement with the projections in such slots, a plurality of pivoted rocker bars disposed parallel to the path of said block, means for rocking each said bar in response to shifting of a corresponding one of said fingers, and a plurality of stationary switches and means for actuating each in response to rocking of a corresponding one of said bars.

9. For use with a television receiver having a tuner member movable to a plurality of positions for receiving signals over different channels, a programmer comprising, in combination, a movable element, means for moving said element at a timed rate along a predetermined path, a plurality of switches each corresponding to one of said positions, means responsive to movement of said element past preselected ones of a plurality of points spaced a predetermined distance apart along said path for selectively actuating different ones of said switches, said points each representing a fractional hour value of time, represented by the position of said element along a linear scale, a master switch, timing means for actuating said master switch for a short period as said element passes each of said points, means responsive to coincident actuation of any one of said plurality of switches and said master switch.

10. For use with a television receiver having a tuner member movable selectively to a plurality of positions for receiving signals over different channels, a programmer comprising, in combination, a movable element, means for driving said element at a timed rate along a predetermined path, a plurality of groups of projections, means for supporting the projections of each group at selectable points spaced along said path by distances representing a predetermined fraction of an hour at the rate of travel of said element, a plurality of switches each corresponding to one of the tuner member positions, means responsive to movement of said block past projections in each of said groups for actuating respective ones of said switches, a useful device, means for partially completing an energization circuit for said device when any one of said switches is actuated, a master switch, means for actuating said master switch for a short time interval at the end of each said predetermined fraction of an hour, and means for completing said device circuit when said master switch is actuated.

11. In a programmer for moving a member to preselected ones of a plurality of positions at unit time intervals, the combination comprising a movable element, means including a synchronous motor for moving said element at a timed rate along a predetermined path, a plurality of switches each corresponding to one of said member's positions, means responsive to movement of said element past preselected ones of a plurality of points spaced a unit distance apart along said path for selectively actuating different ones of said switches, a master switch, timing means driven by said synchronous motor for actuating said master switch for a short period as said element passes each of said points, a controlled device, and means responsive to coincident actuation of one of said plurality of switches and said master switch for energizing said device.

12. In a programmer for setting a shaft to any one of a plurality of angular positions at preselected periodic times, the combination comprising a movable element, means for driving said element at a timed rate along a predetermined path, a plurality of groups of projections, means for supporting the projections of each group at se-

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lectable points spaced along said path by distances representing a unit period of time at the rate of travel of said element, a plurality of switches each corresponding to one of the angular positions of said shaft, means responsive to movement of said block past projections in each of said groups for actuating respective ones of said plurality of switches, an operating device, means for partially completing an energization circuit for said device when any one of said switches is actuated, a master switch, means for actuating said master switch for a short time interval at the end of each unit time period, means for completing said device circuit when said master switch is actuated.

13. In a programmer, the combination comprising a block movable along a predetermined path, an elongated bar disposed parallel to the path of said block and pivoted to rock about a longitudinal axis, a projection selectively positionable along said path, a movable member carried by said block and continuously disposed opposite a portion of said bar as the block moves along said path, means for shifting said movable member as said block moves past said projection to thereby rock said bar, a stationary switch, and means for actuating said switch when said bar is rocked, whereby said switch is actuated when said block passes said projection regardless of the position of the latter along said path.

14. In a programmer, the combination comprising a lead screw, means for rotating said screw at a timed rate, a block having effective threaded engagement with said screw to be advanced along the latter at a timed rate, a plurality of projections and means for supporting the same at selectable points along the path of said block, a member movably supported in said block, means engaged by said projections as said block moves thereby for shifting said member relative to said block, an elongated bar disposed parallel to said lead screw and pivoted about a longitudinal axis, said bar being positioned opposite said member as said block moves along the lead screw and to be rocked when said member is shifted, a stationary switch, and means for actuating said switch in response to rocking of said bar.

15. In a programmer, the combination comprising a lead screw having helical threads with a pitch of P

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inches, means for driving said lead screw at a timed angular velocity of ω revolutions per hour, a block movable in a direction parallel to said lead screw, a rounded detent carried by said block and yieldably urged into engagement with said screw to drive said block linearly at a rate of ωP inches per hour, an escutcheon plate adjacent the path of said block and having linear scale indicia thereon spaced apart P inches for indicating time to the nearest $1/\omega$ hour according to the relative position of said block, and means for disengaging said detent and shifting said block lengthwise along said screw, whereby re-engagement of said detent after said block has been positioned to the nearest $1/\omega$ hours along said scale will shift said block to make its exact position agree precisely with the time in minutes represented by the instantaneous angular position of said screw.

16. In a programmer, the combination comprising a lead screw having a helical thread with a pitch of P inches, a rotatable dial rigidly connected to said lead screw and scribed to display a time reading in minutes opposite an index mark, a synchronous motor, a one-way drive connection between said motor and said dial to rotate the latter at ω revolutions per hour, a block movable in a direction parallel to said lead screw, a detent carried by said block and yieldably biased into engagement with said thread so that the block is linearly driven at a rate of ωP inches per hour, an escutcheon plate adjacent the path of said block and having indicia thereon spaced apart P inches to indicate relative to an index mark on said block time to the nearest $1/\omega$ hour.

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