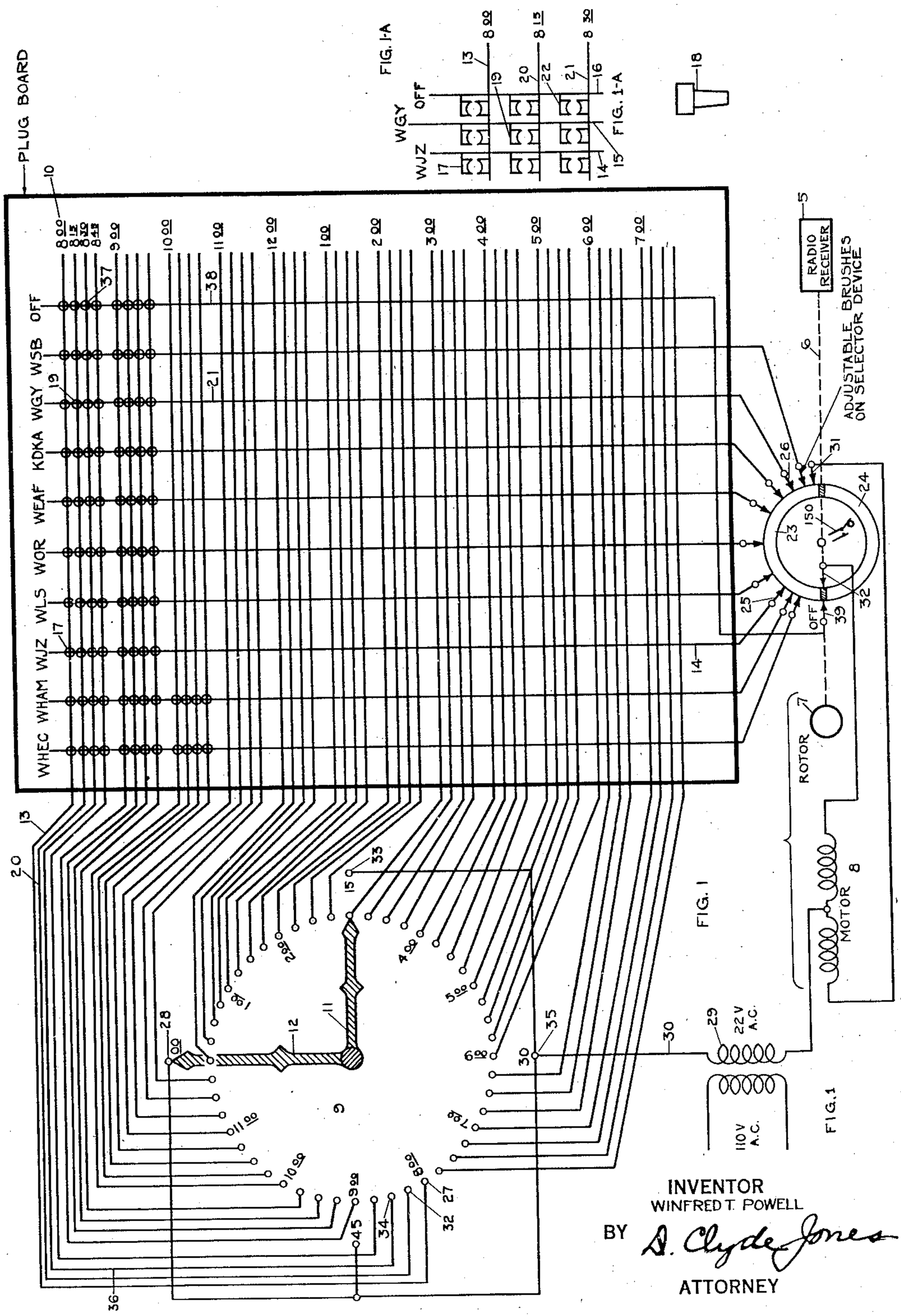
Feb. 26, 1935. W. T. POWELL 1,992,327

TIME CONTROLLED RADIO RECEIVING SYSTEM

Filed Feb. 6, 1931 3 Sheets-Sheet 1



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TIME CONTROLLED RADIO RECEIVING SYSTEM

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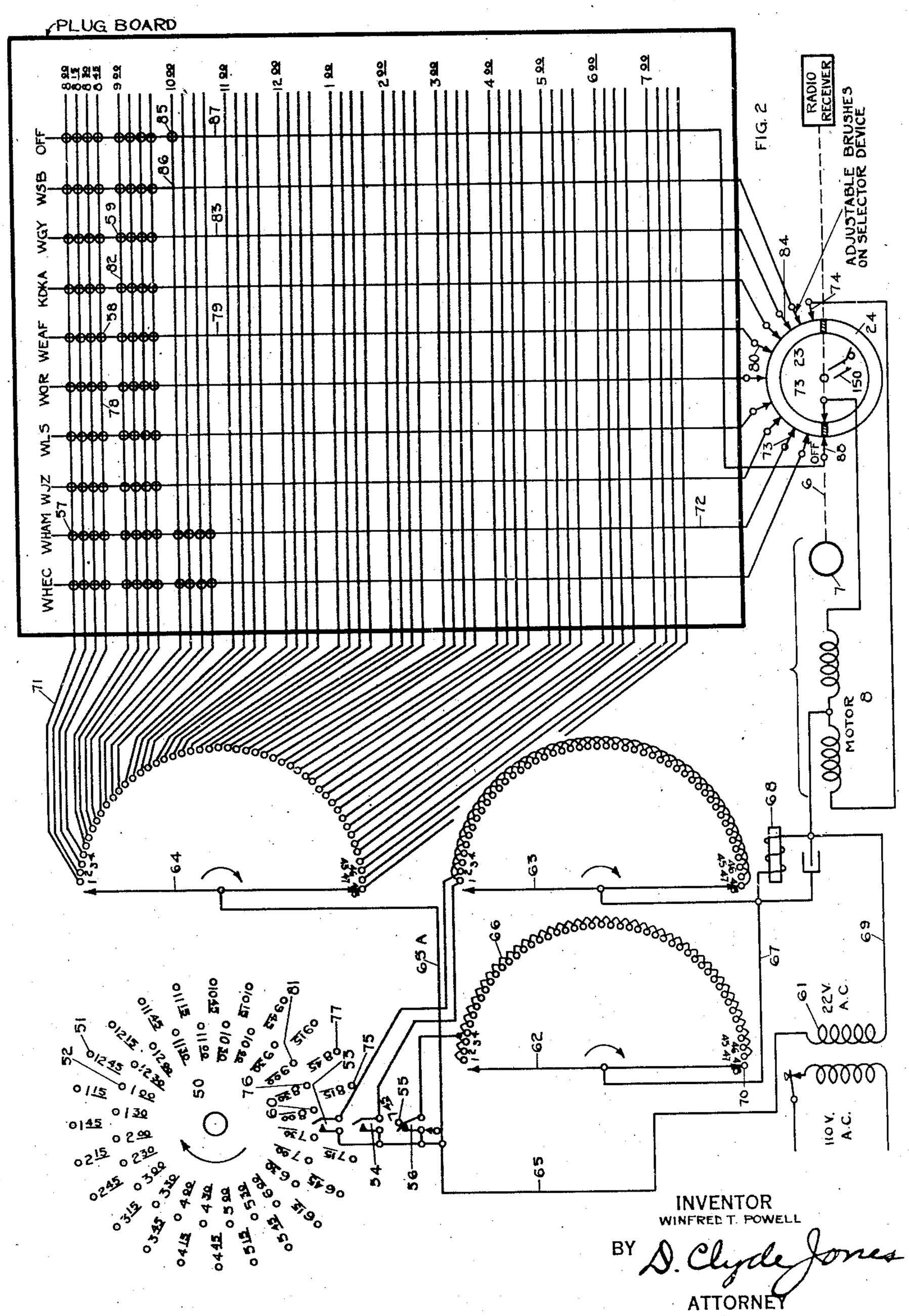

FIG. 2

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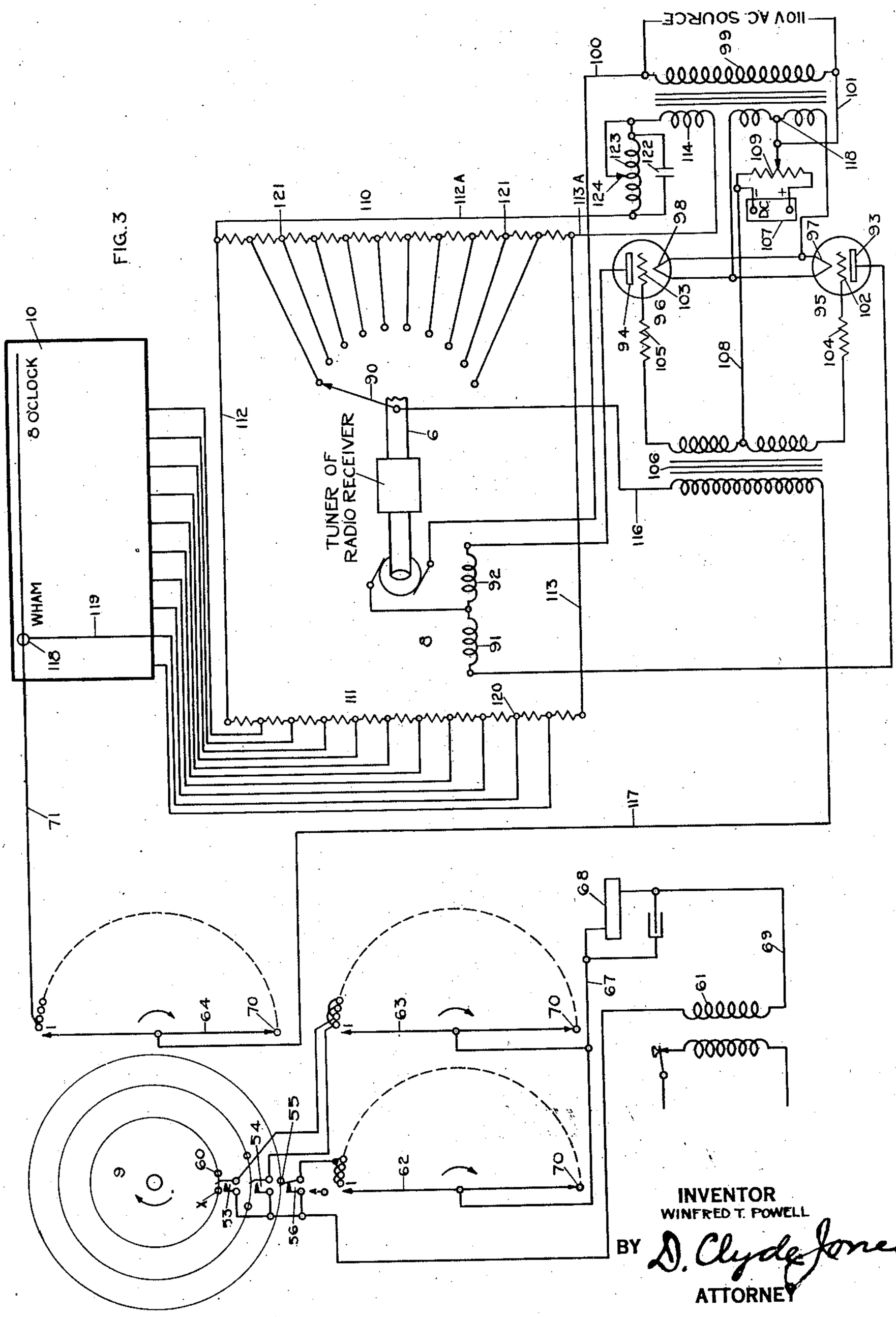
FIG. 3



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UNITED STATES PATENT OFFICE

1,992,327

TIME CONTROLLED RADIO RECEIVING SYSTEM

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Application February 6, 1931, Serial No. 513,958

8 Claims. (Cl. 250—20)

This invention relates to radio signalling systems, and more particularly to radio signalling systems in which time-actuated devices control the operation thereof.

It has been proposed to employ time-controlled switching devices for operating radio receivers in accordance with a preselected schedule or program. In such arrangements, however, the schedule selecting mechanism has necessarily been a part of or closely associated with a time-measuring device, such as a clock, so that these arrangements have not been adapted for use in remotely controlled systems whereby a desired schedule or program of stations can be selected at a point remote from the radio receiver. This has been due to the fact that in former arrangements the schedule selecting mechanism has been in a large part mechanical as distinguished from the present arrangement wherein, aside from the time-measuring device or clock, the system is in the main electrically controlled.

The main feature of the present arrangement, therefore, resides in a program-scheduled radio receiving system in which the radio receiver is selectively adjusted by a motor having circuits controlled in sequence in accordance with a predetermined time and station scheduling circuit network. A further feature of the invention resides in the use of a progressively movable switch cooperating with a time-measuring device to selectively operate station-selecting mechanism whereby the time-measuring device may be remotely place with respect to a station selecting mechanism thereby permitting greater flexibility in the system and also permitting greater simplicity in the time-measuring device or clock. An additional feature of the invention resides in the use of one or more electrostatically controlled relays or "grid-glow relays" for determining the adjustment of a radio receiver in accordance with a predetermined time and station schedule or program.

In the drawings, Fig. 1 diagrammatically represents one form of the invention wherein the portion of the drawing at the left of the heavy line rectangle represents a time-measuring device or clock arranged to close break-points at predetermined intervals in circuits utilized to control the adjustment of a radio receiver; while the portion of the drawing within said rectangle, which may be located at the radio receiver or at a point remote therefrom, represents a contact board in the form of a series of switches or circuit-closing devices whereby a circuit or circuits for adjusting the radio receiver to receive a desired station is completed at a predetermined time; and the portion of the drawing below the rectangle represents a radio receiver and a motor with its associated equipment to effect a predetermined tuning or adjustment of the radio receiver; Fig. 1A is a detail view of the contact board and one of the several plugs for use therewith; Fig. 2 is another form of the invention which is similar to the arrangement shown in Fig. 1 but differs therefrom in the use of a progressively movable switch actuated at the conclusion of predetermined time intervals to close operating circuits through the station selecting mechanism whereby the motor associated with the radio receiver is actuated for selectively tuning the same to a desired broadcasting station; Fig. 3 is a modified form of the invention which may be utilized either with the arrangements of Fig. 1 or 2 and differs therefrom in that the tuning motor of the radio receiver is actuated under the control of one or more electrostatically controlled relays or "grid-glow relays".

Referring to Fig. 1 of the drawings, 5 designates a radio receiver which may be of any well-known kind, such as the tuned radio frequency type or the superheterodyne type, wherein the tuning thereof is effected by a single control. This control may be actuated either directly or indirectly through the shaft 6 attached to the rotor 7 of a motor, generally designated 8. This motor, it will be understood, is located at the radio receiver. The system is provided with a clock 9 and a contact board 10 whereby at the proper time, the motor 8 is operated to tune the radio receiver to receive the signal of a desired broadcasting station. The clock 9 which may be located at the radio receiver or at a point remote therefrom, as best suits the installing condition, comprises any well-known clock mechanism for actuating the hour hand 11 and the minute hand 12. The hour hand 11 is arranged to engage and complete in succession an electrical circuit through contacts spaced to correspond with 15-minute intervals in the hour scale, and the minute hand 12 is arranged to engage and complete an electrical circuit in succession through any one of four contacts spaced a distance apart corresponding to a 15-minute interval in the minute scale. It will be understood that the contacts engaged by the hour hand 11 and the minute hand 12 are connected to conductors to be utilized in completing operating circuits for the motor 8 at the radio receiver.

In order that the operator may select any one

of several time and station schedules, the contact board 10 is provided in which the conductors from the clock contacts are arranged horizontally in the diagram, and each of the conductors individual to a desired station are represented by the vertical conductors extending at right angles thereto. As shown in Fig. 1A, the conductor 13 corresponding to the time 8 o'clock may be connected with any one of the station conductors 14, 15 and 16, by means of jacks such as 17, 19, 22, etc. Thus if it is desired to select a program of station WJZ at 8 o'clock, a conducting plug 18 is inserted in jack 17 to electrically connect conductors 13 and 14. It will be likewise understood that if it is desired to select a program from station WGY at 8:15, a plug similar to 18 is inserted in the jack 19 thereby connecting the conductor 20 with the stations conductor 15. Then if it is desired to turn off the radio receiver at 8:30, a plug similar to 18 is inserted into the jack 22.

From the foregoing description, it will be understood that a predetermined schedule of programs from any of several broadcasting stations at any desired time may be automatically received through the radio receiver, and when this schedule of programs has been completed, the radio receiver and its associated mechanism is disabled at a predetermined time. Although any of several well-known arrangements for controlling the motor of the radio receiver may be employed in connection with the clock mechanism and the contact board herein referred to, the arrangement diagrammatically disclosed herein will be satisfactory. This mechanism comprises a commutator in the form of two semi-circular contacts 23 and 24 actuated simultaneously with the tuning element of the radio receiver, with which contacts there engages a series of brushes, such as 24 and 26, each individual to a different station, which may be adjusted to positions corresponding to the tuning device of the radio receiver, when set to receive the program of desired stations.

After the operator has selected a predetermined schedule of programs, by inserting the plugs 18 into the proper jacks, such as 17, 19 and 22, the system needs no further control on the part of the operator. When, however, the hour hand 11 engages the contact 27 and when the minute hand 12 is in engagement with the contact 28, corresponding to the beginning of the first time interval in the schedule, the radio receiver will be turned on and automatically tuned in a manner that will now be described. As soon as the hour and minute hands engage the contacts just mentioned, a circuit is closed from the upper terminal of the secondary winding 29 of the transformer connected to the commercial alternating current source, thence over conductor 30, minute contact 28, minute hand 12, hour hand 11, contact 27, conductor 13, thence through the contacts of the jack 17, plug 18, conductor 14, brush 25, segment 23, brush 31, left hand field winding of the motor 8 and thence to the lower terminal of the transformer winding 29. Under the control of this circuit, the motor 8 actuates the shaft 6 connected to the tuning device of the radio receiver and also drives the semi-circular contacts 23 and 24 in a clockwise direction until the brush 25 is resting in the non-conducting space between the contacts 23 and 24, at which time the motor ceases to operate. It will be remembered that the brush 25 is set once and for all so that when the shaft 6 connected to the radio receiver 5, has tuned the receiver to station WJZ, this brush occupies the non-conducting space between the contacts 23 and 24.

The program from station WJZ will, therefore, be reproduced through the radio receiver until the hour hand 11 engages the contact 32 and the minute hand 12 engages the contact 33 whereupon an operating circuit is completed for the motor 8 from the transformer winding 29, conductor 30, contact 33, minute hand 12, hour hand 11, contact 32, conductor 20, contacts of jack 19 and plug 18, conductor 21, brush 26, semi-circular contact 23, brush 31, left hand winding of the motor 8 and thence to the other terminal of the transformer winding 29. Under the control of this circuit, the motor 8 rotates the shaft 6 connected to the tuning device of the radio receiver and the semi-circular contacts 23 and 24 in a clockwise direction until the brush 26 is positioned in the non-conducting space between the contacts 23 and 24. Since the brush 26 has previously been adjusted once and for all to correspond to the tuning of station WGY, when this brush reaches the position just referred to, the radio receiver is in condition to receive a program from this station.

This program will then be received under the conditions assumed until 8:30 when it is desired to turn off the radio receiver, which operation is effected when the hour hand 11 engages the contact 34 and when the minute hand 12 engages the contact 35. At this time, the operating circuit for the motor 8 is extended from the upper terminal of the transformer winding 29, conductor 30, contact 35, minute hand 12, hour hand 11, contact 34, conductor 36, jack contacts 37, plug 18, conductor 38, brush 39 now in engagement with the semi-circular contact 24, brush 32, then through the right hand winding of the motor 8, to the other terminal of the transformer winding 29. Under the control of this circuit, the motor 8 rotates the shaft 6 connected to the tuning device of the radio receiver and the contacts 23 and 24 in a counter-clockwise direction until the brush 39 occupies the non-conducting space between the contacts 23 and 24 as shown on the drawings. At this time contacts 150, included in the leads of the commercial power supply, are opened to disconnect operating current from the radio receiver and its controlling system.

Although in this description, reference has been made to selecting only two programs, it is possible to select automatically any one of the nine broadcasting stations referred to at any desired 15-minute interval during a twelve hour period. If it is desired to listen to a single station during all of this period, for example WJZ, and to have this period begin at 8 o'clock, it is simply necessary to insert the plug 18 into the jack 17 and at the conclusion of the desired period determined by the position of a plug 18 in an "off" jack, the network will automatically shut off the radio receiver.

In the form of the invention represented in Fig. 2, the time-measuring device or clock 50 differs from that shown in Fig. 1 by employing a revolving dial graduated to represent a 12-hour period divided into intervals of fifteen minutes each. This dial is provided with two series of pins 51 and 52 arranged to describe two concentrical circles. The pins 51 of the outer series are spaced to represent the 15-minute and 45-minute intervals after the hour, while the inner circle of the pins 52 is spaced to represent the hour and the 30-minute periods after the hour. In the

path of the inner circle of pins, there is mounted a set of contact springs 53 and in the path of the outer series of pins, there is provided a second set of contact springs 54. In order to synchronize a stepping switch (to be described) with the corresponding setting of the clock, means are provided to effect the synchronizing operation at a certain time in each 12-hour period. In the arrangement as shown, this synchronization occurs at 7:45 and is effected by means of the pin 55 positioned on the clock dial to correspond to this time, and in the path of this pin, there are mounted contact springs 56, the purpose of which will be further described.

The system also includes a progressively movable switch herein represented as having three sets of contacts, of which there are forty-eight sets arranged in superimposed position in the arc of the circle. Each set of contacts is arranged to be progressively engaged by a brush actuated by pawl-and-ratchet mechanism (not shown) under the control of a stepping magnet. The mechanism of this switch may be similar in construction to that disclosed in the patent to Clement, No. 1,107,153, granted Aug. 11, 1914, although any well-known type of progressively movable switch may be employed for this purpose. As will appear from this disclosure, the provision of the progressively movable switch greatly simplifies the construction of the time-measuring switch or clock, and in the event that the contact board is located at a considerable distance from the clock mechanism, the number of wires between this contact board and the clock mechanism may be greatly simplified by mounting the progressively movable switch adjacent to a contact board.

The contact board may be similar in arrangement to that disclosed in Fig. 1, although any suitable construction may be employed wherein a plurality of different circuit combinations may be selectively established.

With this explanation of the equipment employed, it is believed that this modification will best be understood by describing the method of setting up a particular schedule of programs. In the event that it is desired to set up the following schedule wherein a program from WHAM will be received at 8 o'clock, a program from WEAF at 8:45, and a program from WGY at 9 o'clock, the operator inserts the plug, such as 18, in the jack 57, another plug 18 in the jack 58, and a third plug in jack 59.

The clock mechanism is shown with the pin 55 closing the spring contacts 56 in order to synchronize the stepping switch with the clock mechanism. If the brushes 62, 63 and 64 are out of synchronism, they will be in engagement with some other contact than the last set of contacts in the series, but as represented, these brushes are in their synchronized position. Assuming, however, that they are out of synchronism when these springs 56 are closed by the pin 55 at the hour of 7:45, a circuit is then completed from the secondary winding 61 of the transformer, conductor 65, contacts 56, and thence through the contacts 66 in series, through the contact with which the brush 62 is in engagement, brush 62, conductor 67, winding of the stepping magnet 68, conductor 69 to the lower terminal of the transformer winding. Under the control of this circuit, the stepping magnet advances the brushes 62, 63 and 64 until the brush 62 is in engagement with the contact 70.

After this synchronization, the dial of the clock mechanism continues to rotate until the pin 60 in the 8 o'clock position closes the spring contacts 53, at which time a circuit is closed from the transformer winding 61, conductor 65, contact springs 53, brush 63 in its last position, winding of the stepping magnet 68, conductor 69, to the transformer winding. Under the control of this circuit, the brushes of the stepping switch are advanced until they are in engagement with the first set of switch contacts. Since it has been assumed that the radio receiver should be adjusted to bring in a program from station WHAM at this time, the mechanism is now set into operation for tuning the radio receiver to receive this program. This is effected over a circuit extending from the transformer winding 61, conductors 65 and 65*a*, brush 64 in its first position, conductor 71, jack contacts 57, plug 18, conductor 72, brush 73, adjusted for the setting of station WHAM, through the semi-circular contact 23, brush 74, left hand winding of the motor 8, conductor 69 to the other terminal of the transformer winding. Under the control of this circuit, the motor 8 rotates the shaft 6 to adjust the tuning element of the radio receiver and at the same time rotates the semi-circular contacts 23 and 24 in a clockwise direction until the brush 73 occupies the non-conducting space between these contacts, at which time the motor circuit is opened to stop its operation, with the tuning element of the radio receiver adjusted to receive the desired program.

During this time, the clock dial is rotating and at 8:15, pin 75 closes the contacts 54 completing a circuit similar to that previously described for the stepping magnet 68 which advances the brushes 62, 63 and 64 into their second position. This setting of the stepping switch is ineffective since there is no plug in any of the jacks corresponding to the 8:15 time. At 8:30, the pin 76 closes the spring contacts 53 which is effective to operate the stepping magnet which in turn advances the brushes 62, 63 and 64 into their third position where again this setting is ineffective since there is no plug in any of the jacks corresponding to the time 8:30.

At 8:45, the pin 77 closes the contacts 54 which operate the stepping magnet 68 to advance the brushes 62, 63 and 64 into their fourth position. In this position, another program is selected since a plug 18 is inserted in the jack 58 corresponding to the station WEAF and to the time 8:45. A circuit is now completed for operating the motor 8 of the station selecting mechanism which is similar to that described except that with the brush 64 in its fourth position, it includes conductors 78 and 79 and the brush 80 corresponding to the station WEAF. Under the control of this circuit, the tuning element of the radio receiver is adjusted by the shaft 6, and the semi-circular contacts 23 and 24 are also rotated in a clockwise direction until the brush 80 is positioned in the non-conducting space between these contacts, at which time the motor ceases to operate.

The program from WEAF will therefore be received until the tuning element is again adjusted at 9 o'clock when the pin 81 closes the contacts 53, and a circuit is completed through the stepping magnet 68 in the manner similar to that previously described whereupon the brushes 62, 63 and 64 are advanced into their fifth position. Since a plug 18 has been inserted in jack 59 corresponding to the time 9 o'clock and to the station WGY, an operating circuit is closed for the

motor 8 similar to those previously described except that now the circuit includes the conductors 82, 83 and the brush 84 corresponding to the station WGY. Under the control of this circuit, the motor 8 with its shaft 6 adjusts the tuning element of the radio receiver and rotates the semi-circular contacts 23 and 24 in a clockwise direction until the brush 84 is positioned in the non-conducting space between these contacts, in which position the operating circuit of the motor 8 is interrupted and the tuning element is, therefore, stopped in a position to receive a program from the station WGY.

In this arrangement also the radio receiver may be turned off at any predetermined time, for example 10 o'clock, by inserting a plug 18 into the jack 85. At that time, the brushes 62, 63 and 64 have been advanced over circuits closed by the pins on the clock dial until the brush 64 is in position to complete an operating circuit for the motor 8 through the conductors 86 and 87 and the "off" brush 88 now in contact with the semi-circular contact 24. Under the control of this circuit, the motor 8 is operated to set the shaft of the tuning element and the semi-circular contacts 23 and 24 in a counter-clockwise direction until the brush 88 occupies the non-conducting space between these contacts as represented, in which position the radio receiver is turned off by normally open off normal contacts 150 on semi-circular contacts 23 and 24.

It will be understood, of course, that various combinations of stations and times on the contact board may be set up into a schedule of programs as desired by the operator. It will further be understood that the brushes such as 73, 80, 84, etc., may be adjusted to settings corresponding to different stations than those herein indicated. In the present arrangement, the stepping switch may be associated with the contact board 10 in which case the number of conductors between the contact board and the radio receiver may be reduced in number whereby the cabling of the system is greatly simplified.

The form of the invention shown in Fig. 3 is similar to that shown in Fig. 2 except that electrostatically controlled relays or "grid-glow relays" together with a phase-shifting bridge are utilized to control the adjustment of the receiver tuning element at desired times. Since the contact board 10 and the clock 9 are the same as shown in Fig. 2, they have not been reproduced in detail. Likewise, the progressively movable switch is the same as shown in Fig. 2 and its structure has only been diagrammatically represented in part. The circuits for advancing the progressively movable switch under the control of the contacts of the clock mechanism are the same as shown in Fig. 2, but the extension of conductor 65, therein designated 65A, has been disconnected from the brush 64 of that figure and this brush is connected to a phase-shifting bridge, as will be more fully described.

Two electrostatically controlled relays or "grid-glow relays" employed in this modified system, are of the type having a cathode, anode and a control-electrode or grid surrounded by an atmosphere of mercury vapor or other gas, such as argon, all enclosed within a sealed envelope. As is well-known, an inertialess relay of this type has its cathode and anode connected in a circuit through which normally no current passes but when a suitable positive voltage is applied to the grid, the relay acts as a rectifier independently of this grid until the anode becomes negative. It is unnecessary for purposes of this description to explain the theory of this relay, but it is sufficient to state that the application of a voltage to the grid more positive than its normal condition effects the operation of the relay without the movement of mechanical parts.

This modified system also includes a motor 8 having split-field windings 91 and 92, and a rotor which serves to rotate a shaft 6 functioning to operate a tuning device of a radio receiver of any well-known type. This shaft also carries a wiper 90 which is rotated by the motor to successively engage a series of contacts for a purpose to be described. The two field-windings have their common terminals connected in series with the rotor while the other terminals of these windings are connected respectively to the anodes 93 and 94 of the electrostatically controlled relays 95 and 96. The cathodes 97 and 98 of these relays, herein represented as filaments, are connected in multiple to the terminals of the secondary winding 118 of a transformer, the primary winding 99 of which is connected to a source of alternating current. The upper terminal of the primary winding 99 is connected by the conductor 100 in series with the rotor of the motor, while the lower terminal of this winding is connected by conductor 101 to an intermediate point on the secondary winding 118. The control-electrode or grids 102 and 103 of the relays are connected through resistors 104 and 105 to the terminals of the secondary winding 106 of a step-up transformer. In order that the grids or control-electrodes may be at such voltage that they do not permit current to flow normally through the relays 95 and 96, a negative voltage is applied to these grids from a source of direct current supply 107 over a connection from the negative terminal of this source through conductor 108 to an intermediate point on the secondary winding 106, while the cathode system of the relays including the transformer secondary winding 118 is connected to the wiper of a voltage divider 109, the resistor element of which is connected across the terminals of the direct current source. By suitable adjustment of the wiper of this voltage divider, a desired difference of potential between each control-electrode and its respective cathode may be established. From the foregoing, it will be noted that the relays 95 and 96 have their respective elements arranged after the manner of a "push-pull" amplifier, although these relays do not operate primarily as amplifiers. For the purpose of controlling these relays so that current may flow therethrough to either of the windings 91 or 92 of the motor, a phase-shifting bridge is provided in which there are included two series of resistance units, one designated 110 controlled by the wiper 90 during the operation of the motor, and the other series 111 controlled by circuits completed through the contact board 10 and the brush 64 of the progressively movable switch or other suitable device actuated in accordance with time.

It will be noted that the two series of resistance units 110 and 111, have the upper terminals of both series connected by conductor 112 and the lower terminals of both series connected together by the conductor 113. Extensions of these conductors 112*a* and 113*a* are connected to the terminals of a secondary winding 114 of the transformer connected to the alternating current source by which voltage from this source is introduced into the bridge. The adjustable portion of

this bridge includes the wiper or brush 90 actuated by the shaft 6, conductor 116, primary winding of the step-up transformer 106, conductor 117, progressively movable switch brush 64 in engagement with some one of its contacts, such as the first one, conductor 71, contacts of the jacks such as 118, conductor 119 to the terminal of the resistance units included in the series 111. It will be understood that when the circuit including the conductor 117 is opened either at the brush 64 or at the contact board, the brush 90 actuated by the shaft 6, will remain in its normal position. Let it be assumed that it is desired to receive a program from station WHAM at 8 o'clock. At 7:45, the synchronizing contacts 56 are closed by the pin 55 so that a circuit is closed for the stepping magnet 68 through the brush 62 as previously described, whereby the brushes 62, 63, and 64, if not already in engagement with the last set of contacts 70, will be advanced to this position. When the clock mechanism 9 advances into the 8 o'clock position, pin 60 closes the contacts 53 whereupon the stepping magnet 68 advances the brushes 62, 63 and 64 into engagement with the first set of contacts, all of which has been previously described. Since it has been assumed that it is desired to receive a program from WHAM, at this time, the contact plug, such as 18, is inserted into the jack 118. This disturbs the electrical balance of that portion of the bridge including the primary winding of the step-up transformer 106 so that an instantaneous current flows through the primary winding of this transformer.

The bridge proper may be described as including the series of resistance units 110 and 111 having their free ends respectively connected by the conductors 112 and 113, while each series of resistance units may be considered as comprising two resistance arms the values of which are determined by a point in each series where a shunt circuit is connected thereacross. This shunt circuit includes the brush 90, conductor 116, primary winding of the step-up transformer 106, conductor 117, brush 64 in engagement with the circuit contact, such as 1, to some one of the conductors, such as 71, jack contacts, such as 118, of the contact board, conductor 119 to the point 120 in the series of resistance units 111. As long as this shunt circuit is opened either at the brush 64 or at the jack contacts of the contact board 10, the wiper 90 will remain in its normal position as shown. When, however, the brush 64 is advanced in response to the clock until it extends this circuit to conductor 71 which has its jack contact, such as 118, connected to the conductor 119, the motor will be operated. Let it be assumed that it is desired to receive a program from station WHAM at 8 o'clock and for effecting this result a plug, such as 18, is inserted in the jack 118 associated with the station WHAM. When the switch brush 64 is advanced until it is connected to the conductor 71 which corresponds to the time 8 o'clock, the mentioned shunt circuit will be connected through the conductor 119. Since the conductors 112 and 113 are connected by the conductors 112*a* and 113*a* to the terminals of the secondary winding 114 of the power transformer, the bridge is energized and consequently an instantaneous alternating current will flow through the primary winding of the transformer 106 and will, therefore, cause either the upper terminal or the lower terminal of the secondary winding of the transformer 106 to become more positive. It will be assumed that it is the upper terminal and consequently the voltage applied to the control grid 103 of the relay 96 will be more positive causing current to flow through the relay 96 which is in series with the field winding 92. This causes the motor 8 to rotate until the wiper 90 engages a contact connected to the intermediate point 121 in the series of resistance units 110, where the arms of the bridge will be balanced and current will cease through the conductor 116 whereupon the relay 96 will cease to pass current. In order to properly adjust the phase relation in the bridge, the conductor 112*a* has included therein a capacitor 122 shunted either by an inductance unit or resistance unit 123, the value of which may be adjusted by a wiper 124.

Although but a single connection is shown extended through the contact board, it will be understood by reference to Fig. 2, that a variable number of combinations to effect a selection of any desired time schedule of programs may be effected.

It will be understood that the radio receiver and its controlling system may be turned off by contacts (not shown) actuated by means such as a cam on the shaft 6, which contacts may be similar to those shown at 150 in Figs. 1 and 2.

What I claim is:

1. In a time-scheduled radio receiving system, a radio receiver having tuning means for adjusting said radio receiver to receive programs from pre-selected stations at predetermined times, a motor for adjusting said tuning means, means including a progressively movable switch for completing circuits at predetermined intervals to operate said motor whereby said tuning means is adjusted to receive programs from predetermined broadcasting stations according to schedule, clock-actuated means for advancing said switch according to time, and means for periodically synchronizing said switch with said clock-actuated means.

2. In a time-scheduled radio receiving system, a radio receiver having tuning means for adjusting the same to receive programs from desired broadcasting stations, motor mechanism for operating said tuning means, means including an electrostatically controlled relay for controlling the operation of said motor, circuits for controlling said relay, and switch contacts and clock-controlled contacts for completing said circuits at predetermined time-intervals.

3. In a time-scheduled radio receiving system, a radio receiver having tuning means for adjusting the same to receive programs from desired broadcasting stations, motor mechanism for operating said tuning means, means including a pair of electrostatically controlled relays connected in opposition for controlling the operating of said motor, circuits for controlling said relays, and switch-contacts and clock-controlled contacts for completing said circuits at predetermined time intervals.

4. In a time-scheduled radio receiving system, a radio receiver having tuning means for adjusting the same to receive programs from desired broadcasting stations, motor mechanism for operating said tuning means, means including a pair of electrostatically controlled relays connected in opposition for controlling the operation of said motor, means including an impedance bridge for actuating one or the other of said relays, and switch-contacts and clock-controlled contacts governing said bridge to effect the operation of a desired one of said relays.

5. In a time-scheduled radio receiving system, a radio receiver having tuning means for adjusting the same to receive programs from desired broadcasting stations, motor mechanism for operating said tuning means, means including a pair of electrostatically controlled relays connected in opposition for controlling the operation of said motor, a normally balanced impedance bridge for controlling the operation of said relays, means including switch contacts and clock-controlled contacts for disturbing the balance of said bridge whereby one of said relays is actuated to set in operation said motor, and means controlled by said motor for restoring the balance of said bridge.

6. In a time-scheduled radio receiving system, a radio receiver having tuning means for adjusting the same to receive programs from desired broadcasting stations, motor mechanism for operating said tuning means, means including an electrostatically controlled relay for controlling the operation of said motor, circuits for controlling said relay, and mechanism including clock controlled means for completing said circuits at predetermined time intervals.

7. In a time-scheduled radio receiving system, a radio receiver having tuning means for adjusting the same to receive programs from desired broadcasting stations, motor mechanism for operating said tuning means, means including a pair of electrostatically controlled relays connected in opposition for controlling the operation of said motor, circuits for controlling said relays, and mechanism including clock controlled means for completing said circuits at predetermined times.

8. In a time-scheduled radio receiving system, a radio receiver having tuning means for adjusting the same to receive programs from desired broadcasting stations, motor mechanism for operating said tuning means, means including a pair of electrostatically controlled relays connected in opposition for controlling the operation of said motor, means including an impedance bridge for actuating one or the other of said relays, and means including clock controlled contacts for changing the adjustment of said bridge to effect the operation of a desired one of said relays.

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