

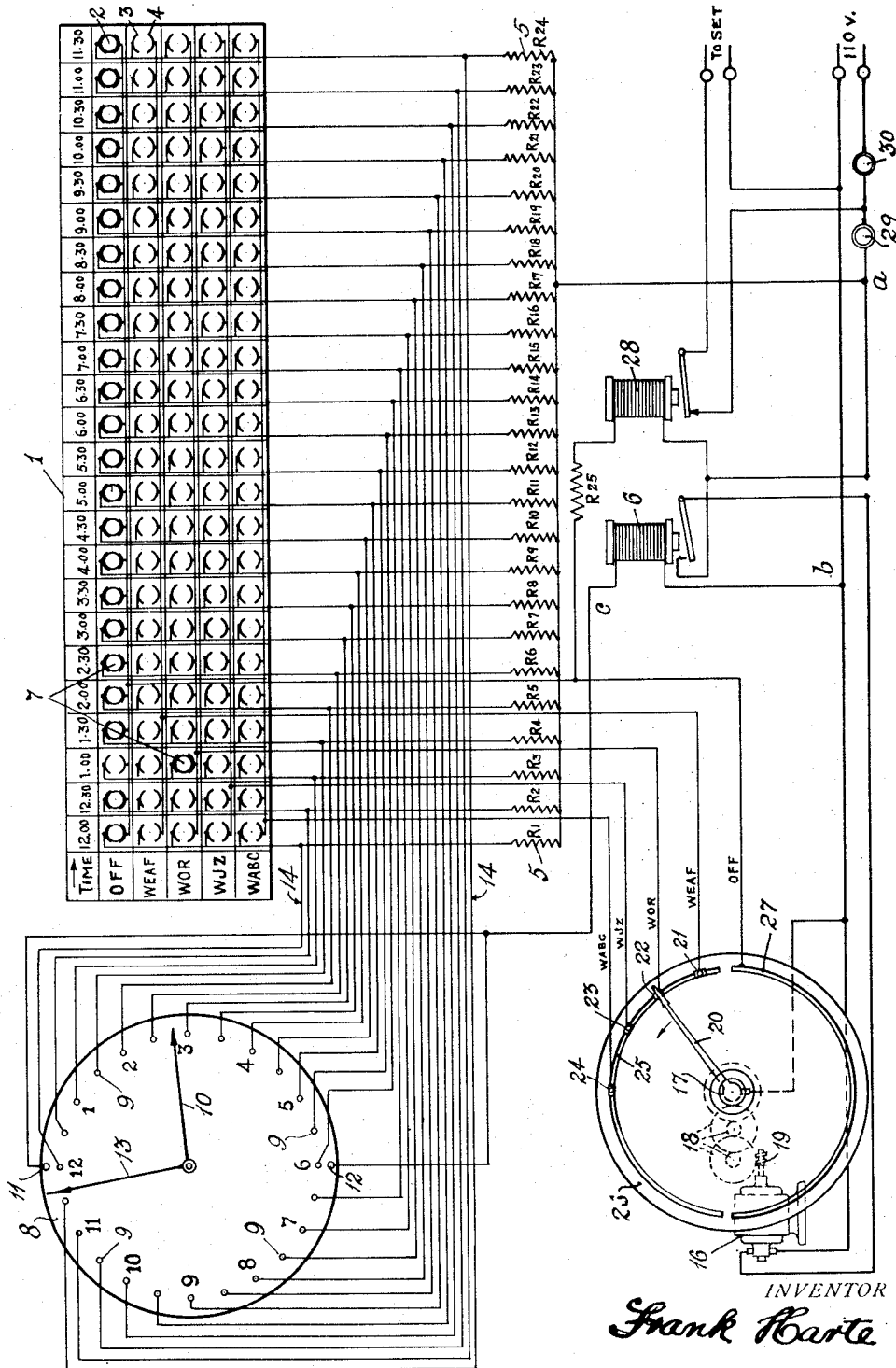
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AUTOMATIC RADIO TUNING MECHANISM

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AUTOMATIC RADIO TUNING MECHANISM

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My invention relates to time controlled mechanism and more particularly to an apparatus for automatically tuning a radio receiving set over a predetermined period of time. The apparatus, which may be either included in the construction of the receiver or manufactured separately as an attachment thereto, is designed to bring about the automatic tuning of the standard radio set to a particular broadcasting station at any particular time or to a plurality of stations in any predetermined order at periodic intervals. The invention has for its object to provide an apparatus whereby, upon the selection in advance of a program of any length of time, and the proper setting of the switchboard comprising one element of my new apparatus, the desired stations will be automatically tuned in at the proper times. My invention further contemplates, and I have provided for, the selection of either a continuous or a discontinuous program over a specific interval of time, the automatic tuning to the desired station or stations being accomplished only at such periods as have been previously designated. A still further object of my invention is the elimination of the necessity of any adjustment whatsoever during the entire period of time for which the apparatus has been designed and for which the desired program has been selected. This period may be as high as twenty-four hours, although obviously, a shorter period, for instance, twelve hours, should satisfy the most ardent "radio fan". Furthermore, my automatic tuning mechanism accomplishes not only the switching necessary to bring the set into a condition of tuning for the particular station desired at any definite hour or subdivision thereof, but also turns the radio set itself on and off for any predeterminable period of time. Other more specific objects will appear from the description hereinafter.

A particular embodiment of my invention is illustrated in the accompanying drawing in which 1 is a switchboard determining the order and frequency of switching and on which a particular one of several stations may be tuned in at any predetermined time, held tuned for any desired period, and then another station tuned in or the set completely turned off. This switchboard is provided with a number of jacks 2 arranged on the surface of the board in horizontal rows and vertical columns. The jacks are all of the double contact open circuit type, i. e., the two contacts 3 and 4 of each jack are normally in the open position. The contact 3 of each jack is connected in multiple with the corresponding contact 3 of each of the other jacks in the same vertical column, and the second contact 4 of each jack is connected, also in multiple, with the second contact 4 of each jack in the same horizontal row. Each vertical column of multiple contacts is connected separately to variable resistance elements 5 which regulate the flow of current through relay 6, operating at approximately 10 volts. The number of resistance elements 5 thus corresponds to the number of vertical columns of jacks, these resistances being indicated in the drawing as R_1 to R_{24} inclusive. The other ends of these resistance units are connected in multiple to one side of the main power line, preferably a 110 volt line, at point a .

The arrangement of jacks on the switchboard in the particular embodiment illustrated in the drawing is such that the horizontal rows of jacks correspond to the stations and the vertical columns to the units of time at which switching from one station to another, or from the "off" position to an operable position, or vice versa, is to be accomplished. The number of jacks on the switchboard is determined by the number of stations the automatic tuning mechanism has been designed to include in its operative range, the frequency of switching, i. e., tuning from one position to another, and the length of the period for which the desired program can be selected beforehand. In the apparatus herein shown and described the switchboard and associated mechanism has been designed for a selection of four broadcasting stations to which the receiving set may be automatically tuned. Switching is done once every half hour, over a twelve hour period. While a selection of four stations is no less than the demand to which the average receiving set is subjected in any particular locality, the switchboard illustrated is merely an example of what under ordinary circumstances would be considered of ample selective capacity. It is obvious that the selective capacity, as well as the frequency of switching and the length of time for which a program may be chosen in advance, for which the mechanism may be designed and constructed, is unlimited.

Since the "off" position, controlled by one of the horizontal rows of jacks, is the equivalent, in point of operation and necessary equipment, to a station, a total of one hundred and twenty jacks are required on the switchboard. Each of these jacks is designed to receive a metal plug 7 having an insulated cap which when inserted in a jack, serves to connect the two contacts thereof. For an apparatus designed for operation over a period

of twelve hours during which time switching, or change of stations, is done at intervals of a half hour in the extreme, and a selection of four stations and an "off" position, the number of plugs to be provided with each switchboard is twenty-four as will appear more clearly hereinafter.

For determining the specific times when the switching mechanism is to be actuated, and for starting the sequence of operations necessary at the periodic switching, I employ a clock 8 of the usual construction and mechanism but provided with a dial on which are distributed, at regular intervals along its periphery, contact points 9. Assuming that switching is to be done every half hour, there would be twenty-four of these contact points on the dial arranged at half hourly intervals. The hour hand 10 of the clock is rotated in the usual manner by the clock mechanism and makes successive contact with points 9. In order to obtain a more nearly instantaneous switching, two additional contact points 11 and 12 are provided at the hour and half-hour marks as determined by the minute hand 13. With these points 11 and 12, the said minute hand only, makes contact. Since the angular velocity of the hour hand is small, any slight variation on the part of the hour hand with respect to the shaft would result in a large deviation in the time of switching from the selected time. Hence the minute hand, with an angular velocity twelve times as great as that of the hour hand, is employed, with a consequent reduction in any error in time of switching.

The connection between the switchboard and clock comprises lead wires 14 from the twenty-four contacts traversed by the hour hand to the corresponding vertical column of jacks on the switchboard. The points 11 and 12, contacted by the minute hand, are connected in multiple, through relay 6, the function of which will be hereinafter more particularly described, to the 110 volt line at point b. When the apparatus is constructed without the points 11 and 12 on the clock dial (as it well may be) the electrical connection between the hands of the clock and the relay 6 may be made by means of the shaft of the clock upon which said hands are mounted.

For the mechanical operation of tuning, i. e., bringing the tuning element or elements into the position corresponding to the wave-length of the broadcasting station to the program of which it is desired to listen, I employ a 110 volt motor 16, either A. C. or D. C., depending on the source of supply. This motor is attached by any suitable mechanical coupling device such as gears, pulleys, etc., to the tuning shaft 17. A reducing train of gears 18, between said shaft and the worm 19 of the motor, may be used to obtain the reduction of speed necessary for maintaining a slow rotation of the tuning shaft 17. This tuning shaft may be made to control any number of variable tuned circuits by any of the methods familiar to those skilled in the art. The radio set, therefore, while of necessity of the so-called "one dial type", may have any number of variable tuned circuits so long as they are controlled by the turning of one shaft. Since all radio sets may be built with tuning controls continuously variable in one direction, any limitation of my new apparatus to sets having tuning controls continuously variable in one direction, is not a practical limitation. Furthermore, the automatic circuit can be so arranged, for instance, by proper gearing, as to reverse the direction of rotation of the tuning ele-

ments when said elements have been turned to their extreme positions.

Attached to the tuning shaft, and rotating therewith, is a contact arm 20 adapted to pass over and contact with, a number of switch points 21, 22, 23, and 24 arranged in a circular groove 25 upon an insulated board 26. Each switch point is adjustable in position and is connected to a horizontal row of jacks on the switchboard, and corresponds, in its position, to the tuned position of the tuning elements for the station designated by that row. Since all modern receiving apparatus is made so that the tuning positions of the elements are confined within an arc of 180°, the switch points will be within that arc. The remaining portion of the periphery of the disc or board 26 is occupied by a circular strip of metal 27 which corresponds to the "off" position and is therefore connected to the row of multiple contacts on the switchboard designating such "off" position. While in the preferred construction of my apparatus the contact member 27 is a circular strip of metal occupying the entire portion of the disc not included in the tuning arc, it is obvious that contact 27 may be a point contact similar to contacts 21 to 24.

The positions of the switch points or contacts 21 to 24 or those of any number of such contacts, depending upon the number of stations which the apparatus is designed to include in its selective capacity, are determined as follows:

A particular row of jacks on the switchboard is selected to correspond to a particular station, for instance, station WEAf. In the embodiment illustrated station WEAf occupies the position on the board having the highest wave length of the stations provided for. Station WEAf is manually tuned in and the position of the tuning elements on the particular set for the particular locality thus determined. The switchpoint 21, which is nearest in position to the maximum wavelength position of the tuning elements, is then put in a position on disc 26 such that arm 20 is in contact therewith. The positions of the other switchpoints 22, 23, 24, etc., along the periphery of the board are similarly determined. Since in standard radio practice the positions of the tuning element or elements of receiving apparatus of identical design are identical or very nearly so, the positions of the switch points on the board can be determined at the factory where the particular type of set is manufactured. It is, of course, preferable for best results, to make the determination at the exact locality and under the particular conditions of use of the receiving set.

Two relays, 6 and 28, connected as shown in the drawing, complete the apparatus. The function of the former, heretofore referred to, is to start and stop the motor. It is of the normally-open contact type. Relay 28 is of the normally-closed type and is used to turn the radio set on and off. Both relays should, for best results, operate on less than 10 volts, 10 milliamperes, so that the resistances R_1 to R_{24} may be of a high value, for instance, 10,000 ohms. The resistance R_{25} , in the line from the horizontal row of jacks on the switchboard corresponding to the "off" position, to the set operating relay 28, is similar to and of the same resistance value as the resistance elements R_1 to R_{24} .

For disconnecting the automatic mechanism hereinabove described, I provide a switch 29 in the main power line of the automatic apparatus. Thus, when no use is desired to be made of the

automatic feature, when, for instance, no particular program has been mapped out but a constant attendance on the radio set is desirable, the tuning shaft can be turned manually after throwing the switch 29. The switch 30 is the regulation switch whereby the set is turned on and off.

The operation of the apparatus is as follows:

In the normal condition of the switchboard all of the plugs occupy "off" positions. A desired program having been decided upon, to commence with the tuning in of a particular station at a particular hour, for instance, station WEAJ at 12:00 o'clock, then with switches 29 and 30 both "on", the plug in the "12:00" vertical column is removed from the "off" row and placed in the horizontal "WEAJ" row, but still in the "12:00" column. If, at 12:30 station WJZ is to be tuned in, the plug in the "12:30" column is removed from the "off" row and placed in the horizontal row designating WJZ. Thus the entire previously mapped out program of stations to be tuned in at intervals can be arranged for a period of time governed only by the designed capacity of the apparatus. If it is desired that any station remain tuned in for a longer period than the interval for which the mechanism has been constructed (in the illustrated case, one-half hour), the operator need but place the plugs in the successive vertical columns controlling the desired period of time into the successive jacks in the row designating the station desired to remain tuned in. To illustrate, continuing the exemplary program outlined above, if at one o'clock station WOR is to be tuned in, the plug in the "1:00" vertical column is placed in its jack in the "WOR" horizontal row. If WOR is to remain on till three o'clock, the several plugs in the "1:30", "2:00", and "2:30" columns are also placed in the WOR row. If the set is to be turned off from three until four o'clock, the plugs in the "3:00" and "3:30" columns are left in the "off" row. This "off" position may thus be considered the equivalent of a station position with the exception that the set is turned off during the interval in which a plug occupies the "off" position.

When the desired program has been arranged as outlined hereinabove, the automatic mechanism will function as follows: At 12 o'clock, the circuit of relay 6 will be closed from point b on one of the power lines, through the relay, through the hands of the clock (both minute and hour hand being on "12" o'clock) and the resistance R₁, to a point a on the second of the power lines. Relay 6, being in circuit will therefore operate, placing the 110 volts of the line on the motor. The motor rotates, and with it, at a greatly reduced rate due to the reduction gear train 18, the tuning shaft 17 and contact arm 20. When the contact arm, in its revolution upon the board 26, comes in contact with switch point 21, corresponding to the position of the tuning elements for the reception of the program of station WEAJ as theretofore determined and hereinabove described, a circuit from the point c on one side of relay 6 to point b on the other side of said relay and connected to the arm 20, is completed, so that the relay 6 is short-circuited, releasing the voltage from the motor which consequently stops. Station WEAJ is now tuned in. The circuit from the point c to the point b is traceable as follows: from point c, through the hands of the clock, up the vertical column "12:00" on the switchboard to the horizontal row "WEAJ", to switch point

21, contact arm 20, to point b. The contact 21 should be broad enough to allow a sufficient interval of time for the relay to release and the motor to stop without the contact arm 20 being carried past the point 21. When the relay has been short-circuited, and the power taken off the motor, the latter will stop quickly without the use of any braking mechanism due to the amount of friction developed by the rotating shaft and reducing gears.

At 12:30, the circuit for relay 6 would be completed through the hour hand on the "12:30" contact and the minute hand on the "6" (12) contact, of the clock and through R₂. Relay 6 would operate again and turn on the motor. At this time, however, contact point 23, corresponding to the position of the tuning elements for the reception of station WJZ, would be connected to the point c and relay 6 would be short-circuited and the motor stopped when the contact arm reached switch point 23, leaving WJZ tuned in. A similar sequence of operating steps would take place at 1:00 for the tuning in of station WOR. At 1:30, however, since WOR is to remain tuned in, contact arm 20 would still be on the contact point 22, corresponding to the position of the tuning elements for the reception of WOR, there would be no operation of the relay 6, it being already short-circuited, and consequently there would be no operation of the motor. At 3 o'clock, the circuit for relay 6 would be made through the clock, and R₃ and the motor would again be set in operation, the plug being in the "off"-3:00" position. This time, however, point c would be connected to the metal contact strip 27 and the motor would turn until arm 20 made contact with the contact strip 27 when it would stop, due to the short-circuiting of relay 6. At 3:30, since a plug is in the "off"-3:30" position, no change would be effected. At 4 o'clock, the switching would be resumed as indicated.

The circuit for relay 28 is also completed through contact strip 27 and the contact arm 20, so that when these two elements are in contact, i. e., in any "off" position, relay 28 is operated, breaking the line supplying power to the radio set. No power is thus consumed by the set when the automatic mechanism is in the "off" position, the set being as effectively turned off as if no automatic apparatus were attached thereto. Of course, a small amount of power is necessary to keep the relay 28 operative.

Although I have described a specific embodiment of my invention, it is to be understood that the invention is not restricted to such particular embodiment. Various modifications thereof in detail and in the arrangement of the parts may be made by those skilled in the art without departing from the invention.

I claim:

1. In combination with a radio receiving set, an apparatus of the kind described comprising a clock, a switchboard, a series of double contact open-type jacks thereon, a plurality of resistance elements, a motor, an electric circuit including power lines supplying power to said motor, a tuning shaft in said receiving set, two relays, the clock having on its dial face a plurality of contact points each connected by suitable wiring to the series of jacks arranged in columns and rows on said switchboard, a plurality of plugs for completing the circuit through said jacks, electric wiring connecting each of said contact points with one of the contacts of one of the series of jacks connected in multiple and through

- one of said resistance elements to one of the main lines supplying power to the motor actuating the tuning shaft of the receiving apparatus, a contact arm connected to said tuning shaft and rotating therewith, a board rigidly mounted about said shaft and having thereon a plurality of contact points with which said contact arm is adapted to contact, and electric wiring connecting said contact points to the second set of jack contacts connected in multiple.
2. The apparatus claimed in claim 1 having two additional contact points located at predetermined positions on the dial of the clock and connected through a relay to the second of the power lines.
3. The apparatus claimed in claim 1 having an additional contact on the rigidly mounted board corresponding to the "off" position and in electrical connection with the second series of jack contacts on the switchboard corresponding to said "off" position and, through a second relay, with the first of the power lines.
4. In combination with a radio receiving set, an apparatus of the kind described, comprising a clock, a switchboard having a series of double contact open-type jacks thereon, a plurality of resistance elements, a motor, an electric circuit including power lines supplying power to said motor, a tuning shaft in said receiving set, two relays, the clock having on its dial face a plurality of contact points each connected by suitable wiring to the series of jacks arranged in columns and rows on said switchboard, a plurality of plugs completing the circuit through said jacks, electric wiring connecting each of said contact points with one of the contacts of one of the series of jacks connected in multiple and through one of said resistance elements to one of the main lines supplying power to the motor actuating the tuning shaft of the receiving apparatus, a contact arm connected to said tuning shaft and rotating therewith, a board rigidly mounted about said shaft and having thereon a plurality of contact points with which said contact arm is adapted to contact, electric wiring connecting said contact points to the second set of jack contacts connected in multiple, two additional contact points located at predetermined positions on the dial of the clock and connected through one of said relays to the second of said main lines, and an additional contact on said rigidly mounted board corresponding to the "off" position and in electrical connection with said second series of jack contacts on the switchboard corresponding to said "off" position and, through the second of said relays, with the first mentioned power line.

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