Sept. 12, 1939. D. BARRIE 2,172,492

CONTROL MECHANISM FOR ELECTRIC CIRCUITS

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Fig. 8.

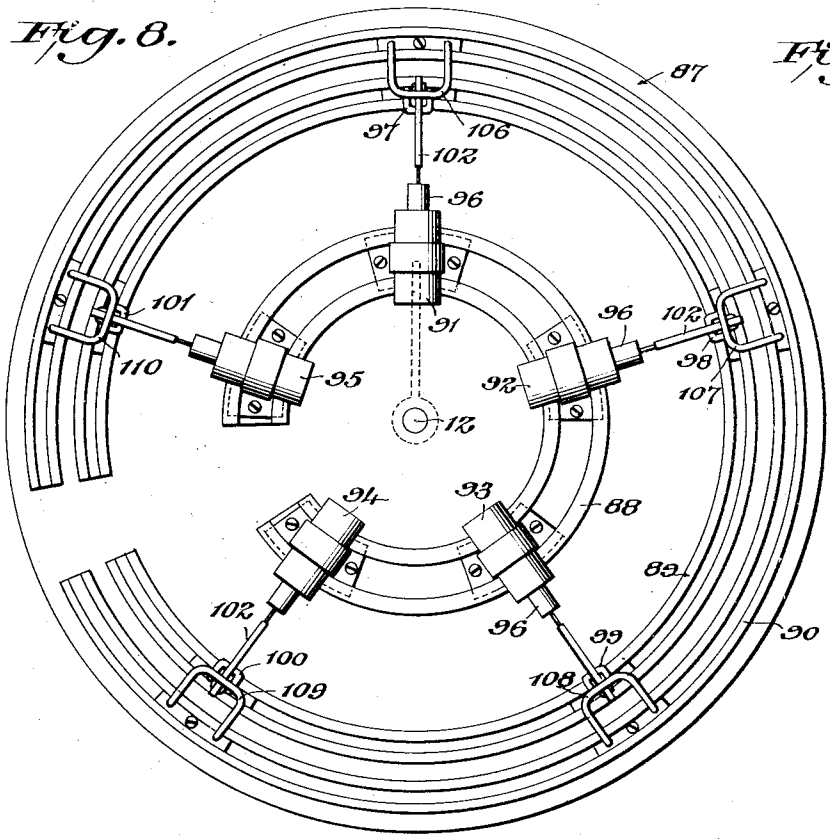
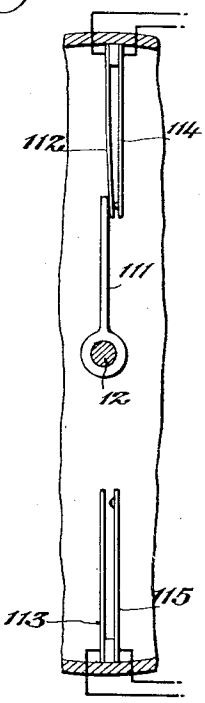


Fig. 9.



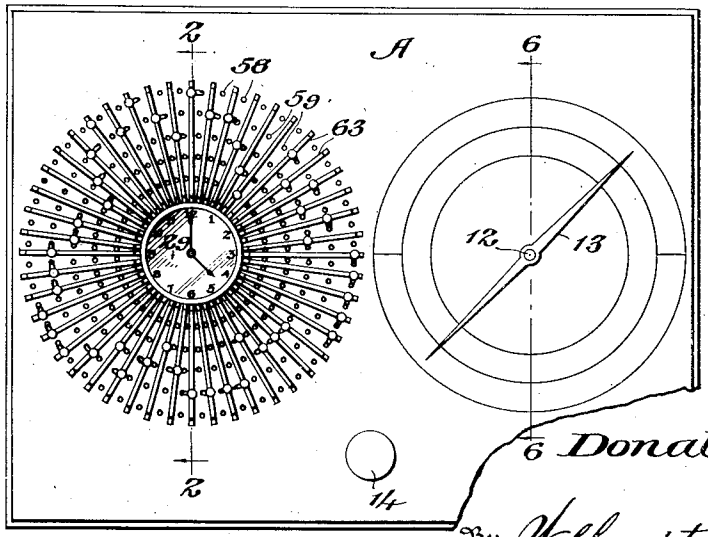


Fig. 1.

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Fig. 2.

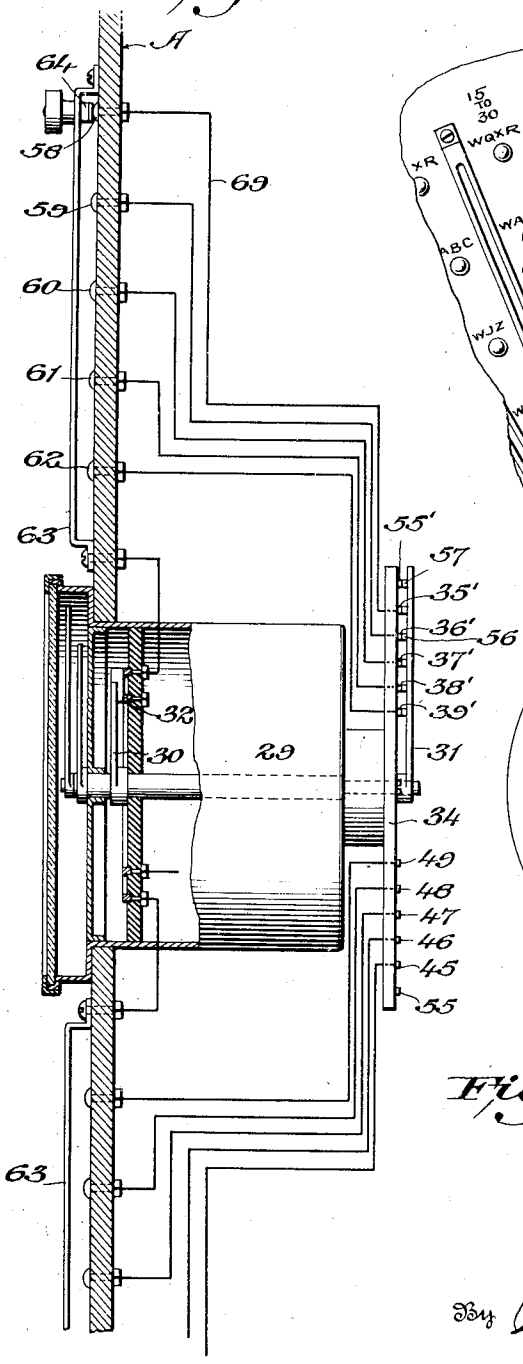


Fig. 3.

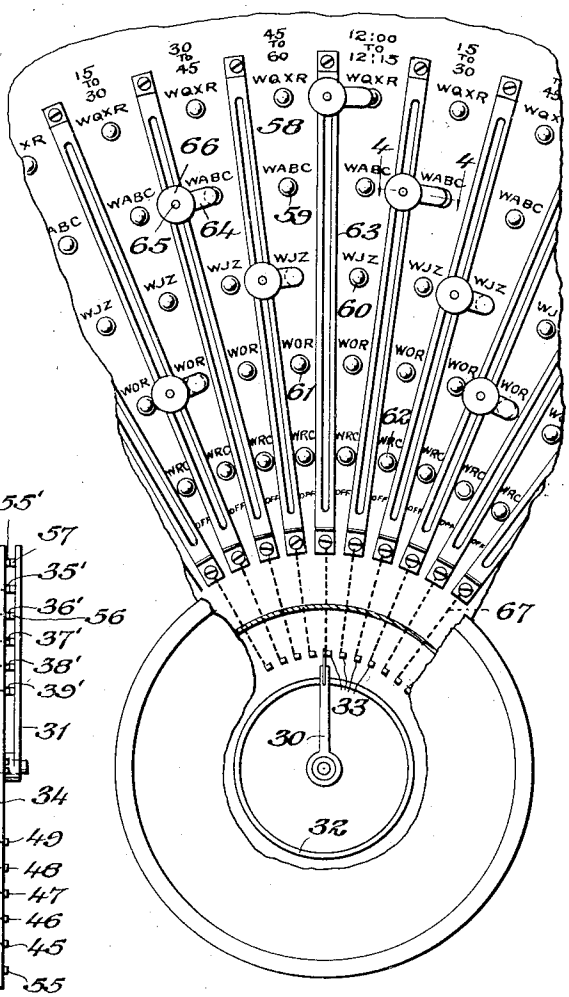
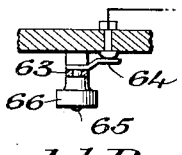


Fig. 4.



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CONTROL MECHANISM FOR ELECTRIC CIRCUITS

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Fig. 6.

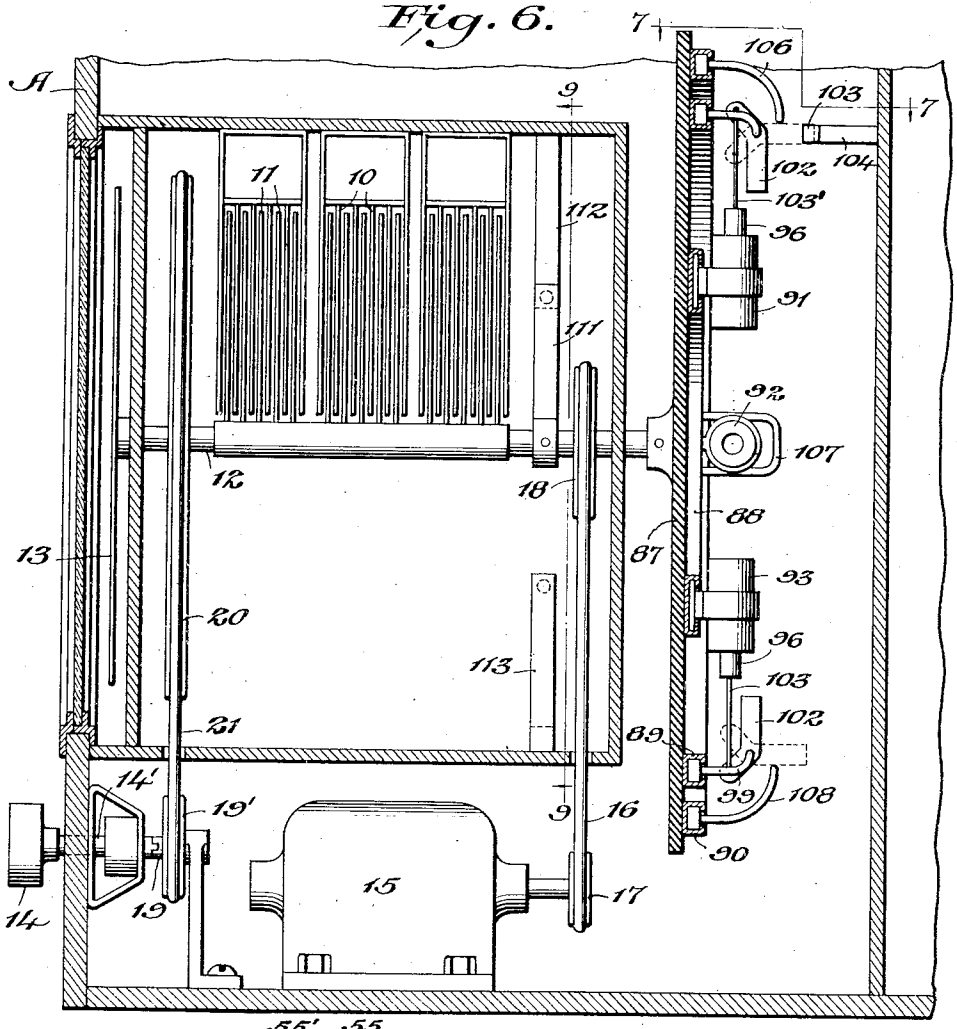


Fig. 5.

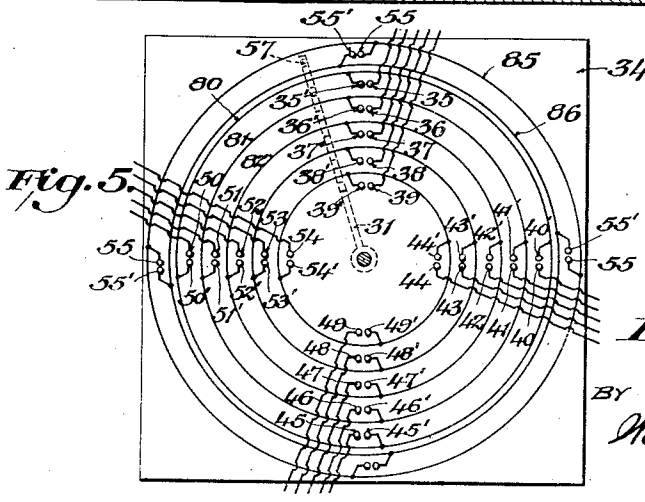
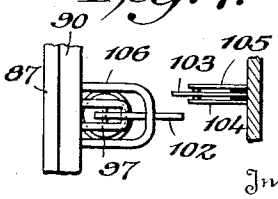


Fig. 7.



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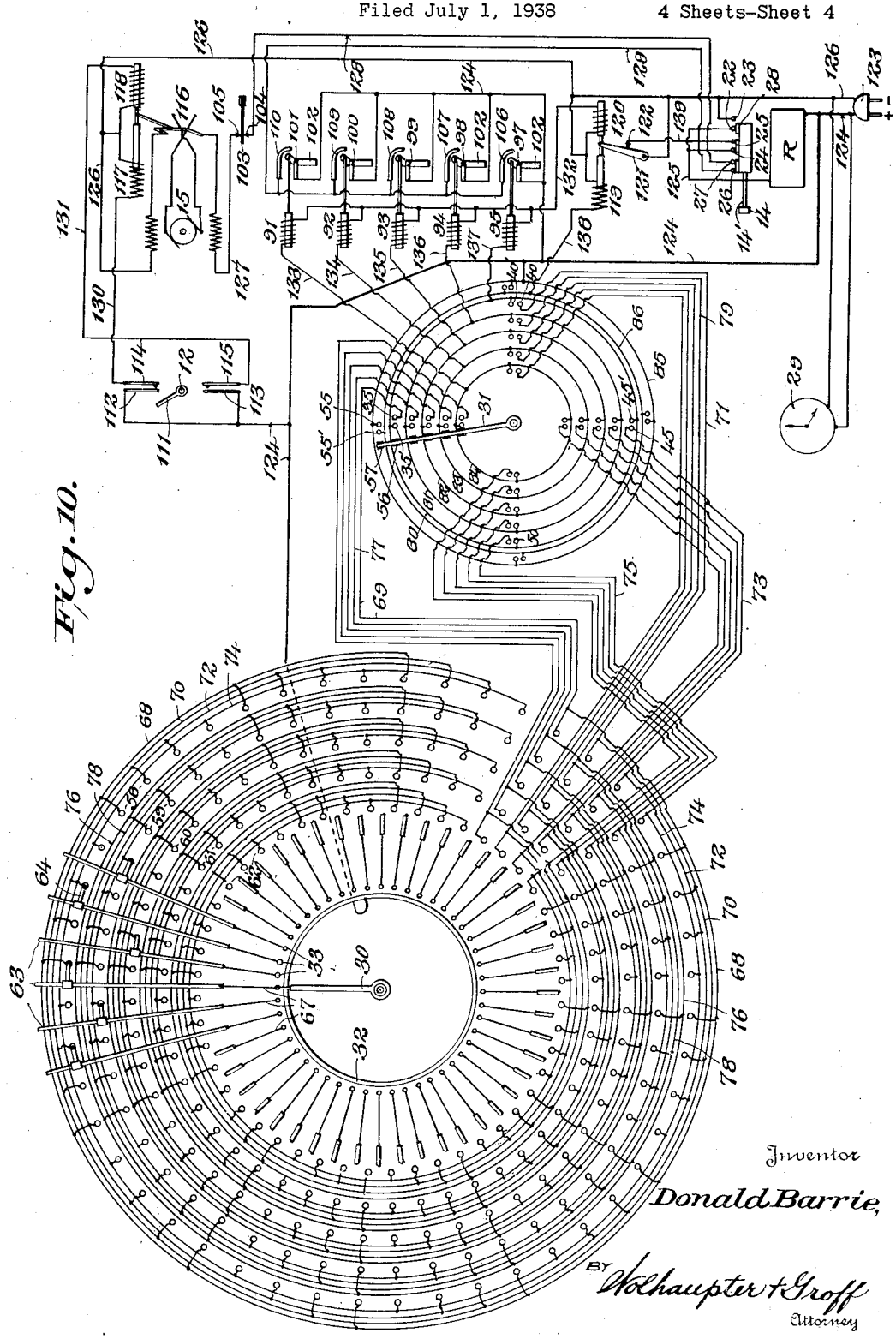


Fig. 10.

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UNITED STATES PATENT OFFICE

2,172,492

CONTROL MECHANISM FOR ELECTRIC CIRCUITS

Donald Barrie, New York, N. Y.

Application July 1, 1938, Serial No. 217,045

9 Claims. (Cl. 250—20)

This invention relates to a time-scheduled radio receiving system; that is, to a radio receiving system embodying means operable automatically to tune a receiver to different selected wave lengths at different predetermined times, and has particular reference to a time-scheduled radio receiving system of the character described and claimed in my prior application, Serial No. 159,029, filed August 14, 1937, of which this application is, in major part, a continuation. Generally speaking, the object of the invention is to provide a practical time-scheduled radio receiving system which is simple, inexpensive, highly flexible respecting the number and the selectivity of the wave lengths to which it may be tuned automatically; which is easy to manually adjust to predetermine the particular wave length to which the receiver will be tuned at any predetermined time, and which is thoroughly reliable and efficient in operation.

With the foregoing and various other objects in view, which will become more fully apparent as the nature of the invention is better understood, the same consists in the novel features of construction, combination and arrangement of parts, and in the novel mode of operation, as will be hereinafter more fully described, illustrated in the accompanying drawings and defined in the appended claims.

In the accompanying drawings, wherein like characters of reference denote corresponding parts in the different views:

Figure 1 is a front elevation of a radio receiver equipped with a control means in accordance with the invention.

Figure 2 is a section on the line 2—2 of Fig. 1.

Figure 3 is an enlarged front elevation of a portion of the receiver.

Figure 4 is a detail section on the line 4—4 of Fig. 3.

Figure 5 is a front elevation on a contact panel of the control means.

Figure 6 is a section on the line 6—6 of Fig. 1.

Figure 7 is a detail section on the line 7—7 of Fig. 6.

Figure 8 is a rear elevation of an element of the control means which is rotatable with the tuning condensers of the radio receiver and which carries adjustable actuators for a switch of the control means.

Figure 9 is a section on the line 9—9 of Fig. 6; and

Figure 10 is a diagram of the control means.

Referring to the drawings in detail, A designates a cabinet which may be of any suitable construction and design and which is understood to contain the various electrical elements and connections comprising a radio receiver, said elements and connections for the most part not being illustrated because they may be of any known type and because, in themselves, they are inconsequential so far as the present invention is concerned. On the other hand, the present invention is very particularly concerned with that element of the receiver which is adjustable to tune the receiver to different wave lengths; that is, for the reception of the broadcasts of different broadcasting stations. Such element may have different forms, but, usually, it has the form of a variable condenser, or a plurality of variable condensers, the movable plates of which are mounted on a single shaft for unitary rotative adjustment relative to cooperating stator plates. Accordingly, a variable condenser is illustrated in Fig. 6 of the drawings as comprising the adjustable element for tuning the receiver to different wave lengths, said condenser comprising, as usual, stator plates 10 and cooperating movable plates 11 mounted on a rotatable shaft 12 for rotative adjustment with said shaft relative to said stator plates. The shaft 12 is, of course, mounted in suitable supports within the cabinet A and, as usual, may be equipped at its forward end with a pointer 13 for cooperation with a station indicating dial or chart visible at the front of the cabinet A. Moreover, a knob 14 is provided as usual for manual rotative adjustment of the shaft 12 and the condenser blades carried thereby, and, in accordance with the present invention, a reversible electric motor 15 is suitably mounted within the cabinet A and is suitably connected with said shaft 12 for power rotative adjustment of said shaft and of the condenser blades carried thereby.

According to the specific embodiment of the invention illustrated in the present instance, the driving connection between the motor 15 and the shaft 12 is comprised by a belt 16 extending over pulleys 17 and 18 on the motor shaft and the condenser shaft 12, respectively. Also, according to the specific embodiment of the invention illustrated in the present instance, the knob 14 not only is rotatable to rotatively adjust the shaft 12, but is mounted for push-pull operation to actuate switch means for determining whether the shaft 12 shall be manually or power driven. To this end, the knob 14 is carried by a shaft 14' which is mounted for inward and outward movement as well as for rotation, and behind and in alinement with said shaft 14' is suitably mounted

a rotatable stub shaft 19. On the stub shaft 19 is a pulley 19' and extending over this pulley and over a pulley 20 on the shaft 12 is a belt 21. Moreover, on the shafts 14' and 19 are suitable clutch means which are engageable to connect said shafts for unitary rotation by pushing on the knob 14 and thereby sliding the shaft 14' inwardly, and which are disengageable to disconnect said shafts by pulling on said knob and thereby sliding said shaft 14' outwardly. Thus, when the knob 14 is pushed inwardly it is operatively connected with the shaft 12 and is effective, by rotation, to rotatably adjust said shaft. On the other hand, when said knob 14 is pulled it is disconnected from the shaft 12 and the latter then is rotatively adjustable only by the motor 15.

The switch means actuated by pushing and pulling of the knob 14 may be of any suitable design and is illustrated in the diagrammatic view, Fig. 10, as comprising a first pair of fixed contacts 22 and 23, a second pair of fixed contacts 24 and 25, a third pair of fixed contacts 26 and 27, and cooperating contacts 28 carried by the shaft 14' and arranged so that when said shaft is pushed inwardly the switch comprising the contacts 22 and 23 is closed and the switches comprising the contacts 24, 25 and 26, 27 are opened, and when said shaft is pulled outwardly the first mentioned switch is opened and the latter mentioned switches are closed.

As will later appear, it is not necessary to combine the switch actuating means and the means for manually adjusting the shaft 12, in a single device. On the contrary, said switch actuating means and said manual adjusting means may be entirely separate and distinct from each other, but an arrangement such as shown and described is preferred because of its simplicity and compactness and because the knob 14 is disconnected from the shaft 12 and therefore is not rotated therewith when said shaft is driven by the motor 15.

In further accordance with the invention, a clock, designated generally as 29, and preferably but not necessarily of the electric type, is suitably mounted in or upon the cabinet A and suitably drives a pair of switch arms 30 and 31, the first in harmony with its hour hand or arbor and the second in harmony with its minute hand or arbor.

The switch arm 30 cooperates with a circular conductor 32 and also with a circular series of spaced apart contacts 33, said switch arm, or a suitable contact thereon, being in constant engagement with the conductor 32 and successively engaging the contacts 33 as it rotates in harmony with the hour hand or arbor of the clock 29. There may be any desired number of the contacts 33 depending upon the duration of broadcast periods, but since the usual broadcast period has a duration of fifteen minutes, there preferably are forty-eight of said contacts 33, one for each of the fifteen minute periods represented by travel of the switch arm 30 through three hundred and sixty degrees, or, in other words one for each of the fifteen minute periods represented by travel of the hour hand or arbor of the clock through a complete revolution. The said contacts 33 may be mounted in any suitable manner and are spaced equal distances apart. Thus, they are related, respectively, to the said forty-eight fifteen minute periods which elapse during travel of the arm 30 through a complete circle, and they are positioned so that they are successively engaged by said arm 30, or by a contact carried thereby, at the beginning of said fifteen minute periods. Moreover, each contact 33, in conjunction with the circular conductor 32 and the arm 30 comprises an electric switch. Accordingly, said switches are successively closed, and openel, by rotation of the arm 30, at times corresponding to the beginning of the successive fifteen minute periods which elapse during rotation of said arm 30.

The other switch arm, 31, cooperates with four sets of contacts on a suitable fixed panel 34, said sets of contacts being spaced ninety degrees apart in accordance with the angular movement of said arm 31 which occurs during the elapse of each fifteen minute period. Moreover, said sets of contacts are arranged so that the arm 31 cooperates with the same substantially at the beginning of each fifteen minute period. Thus, it is apparent that, as the clock 29 operates, the switch arm 31 cooperates with a first set of its related contacts while the switch arm 30 is cooperating with the first of a group of four of the contacts 33; that said switch arm 31 operates with the next set of its related contacts while the switch arm 30 is cooperating with the second of the said group of four contacts 33; and that said switch arm 31 cooperates with the third and the fourth sets of its related contacts while the switch arm 30 is cooperating with the third and the fourth contacts, respectively, of the said group of four of the contacts 33. Further, it is apparent that, as the clock continues to operate and the switch arm 31 completes its rotation and again cooperates with the first of its related sets of contacts, the switch arm 30 will cooperate with the first of a second group of four of the contacts 33 and so on indefinitely.

While the means comprising the present invention may be designed to control automatic tuning of the radio receiver to any desired number of wave lengths within practical limits, said means has arbitrarily been illustrated in the present instance as designed for tuning the receiver to five different wave lengths. In this connection, it is pointed out that each of the four sets of contacts on the panel 34 is composed of companion, spaced pairs of contacts and that there are as many of said pairs in each set as the number of wave lengths with respect to which automatic tuning is to be controlled. Accordingly, there are, in the present instance, in each of said sets of contacts, five separate pairs of contacts, those of the first set being designed as 35, 36, 37, 38 and 39, and 35', 36', 37', 38' and 39', respectively; those of the second set as 40, 41, 42, 43 and 44 and 40', 41', 42', 43' and 44', respectively; those of the third set as 45, 46, 47, 48 and 49 and 45', 46', 47', 48' and 49', respectively; and those of the fourth set as 50, 51, 52, 53 and 54 and 50', 51', 52', 53' and 54', respectively. In addition, each of said sets of contacts has related thereto an additional pair of spaced contacts 55, 55' disposed slightly in advance of its related set of contacts as regards the direction of rotation of the switch arm 31.

The switch arm 31 carries a set of contacts 56 to respectively bridge the five different pairs of contacts in each of the four sets of contacts on the panel 34 as said switch arm moves into alinement with said sets of contacts. Also, said switch arm 31 carries an additional contact 57 to bridge each of the four pairs of contacts 55, 55' just prior to simultaneous, or substantially simultaneous, bridging of the five different pairs of contacts of each set by the series of contacts 56.

Either directly on the front of the cabinet A, or on a suitable panel or broadcast station indicating dial, are as many concentric, circular series of contacts as the number of wave lengths or broadcast stations with respect to which the receiver is to be automatically controlled. In this connection, since the present mechanism is designed to control automatic tuning in respect to five different wave lengths or broadcast stations, there are five of said circular series of contacts, designated as **58**, **59**, **60**, **61** and **62**, respectively, each series related to a different wave length or broadcast station. Moreover, in each of said series there are forty-eight contacts spaced equal distances apart so as to correspond to the forty-eight fifteen minute periods which elapse during twelve hours, or, in other words, during travel of the switch arm **30** through a complete revolution.

The contacts of the series **58**, **59**, **60**, **61** and **62** are arranged in forty-eight radial rows, and related to each row is a radially disposed electrical conductor **63** carrying, for manual adjustment therealong, a contact finger **64** which, by adjustment along said conductor, may be engaged with any one of the contacts in the related radial row.

There are, of course, forty-eight of the conductors **63**, one for each of the related forty-eight radial rows of contacts, and on each of said conductors there is only a single contact finger which may be of any preferred construction and which may be mounted on its conductor **63** in any preferred manner for adjustment therealong. In this connection, the conductors **63** are illustrated in the present instance as comprising narrow, slotted plates having extending through the slots thereof threaded studs **65** which carry, beneath said plates, the contact fingers **64** and, above said plates, thumb nuts **66**. Accordingly, by loosening any given nut **65** the related contact finger may be slid along the related conductor, and by tightening the nut the contact finger may be locked in its adjusted position. However, it will be understood that the construction illustrated in this respect merely is representative of various other different structures which may be used in lieu of said illustrated structure.

Each contact **33** is related to one of the conductors **63** and is electrically connected therewith as indicated at **67**. Accordingly, whenever, the switch arm **30** bridges the circular conductor **32** and any one of the contacts **33**, an electrical connection is established from said circular conductor **32**, through the switch arm **30** to the contact **33** engaged by the switch arm, through the related electrical connection **67** to the related conductor **63** and from said conductor **63** through the contact finger **64** carried thereby to the contact with which said contact finger **64** is engaged.

Since there are forty-eight of the contacts **33** spaced apart and positioned so that they are successively engaged by the switch arm **30** at times corresponding to the beginning of successive fifteen minute periods on the face of a clock, and since said contacts **33** are comprised by groups of four of said contacts corresponding to the four fifteen minute periods represented by a complete rotation of the contact arm **31** during a period of one hour, it follows that, since there are forty-eight of the conductors **63**, one related to each contact **33**, and forty-eight contacts in each of the circular series **58**, **59**, **60**, **61** and **62**, said conductors **63** and the related radial rows of contacts with which the contact fingers **64** cooperate, also are comprised by groups of four corresponding to the four fifteen minute periods represented by a complete rotation of the contact arm **31**.

For the sake of simplifying this description it will be assumed that the first contact of each circular series **58**, **59**, **60**, **61** and **62** is related to the conductor **63** and the contact **33** corresponding to the vertical or twelve o'clock position of the switch arm **30**. Such being the case, it follows that the second contact of each of said series is related to the conductor **63** and the contact **33** corresponding to the 12:15 o'clock position of the switch arm **30**; that the third contact of each of said series is related to the conductor **63** and the contact **33** corresponding to the 12:30 o'clock position of the switch arm **30** and so on throughout the whole of said series of contacts **58**, **59**, **60**, **61** and **62** and the conductors **63**. This means, of course, that the first of each group of four contacts in each of the series **58**, **59**, **60**, **61** and **62** is related to the first set of contacts on the panel **34**; that the second of each group of four contacts in each of said series is related to the second set of contacts on the panel **34** and so on for each of the remaining two contacts of the series **58**, **59**, **60**, **61** and **62** in each group of four of said contacts.

The first contacts of the twelve groups of four of the first series of contacts **58** all are connected together by a conductor **68** and this conductor is connected by a conductor **69** with the contact **35** of the first set of contacts on the panel **34**; the second contacts of the twelve groups of four of the first series of contacts **58** all are connected together by a conductor **70** and this conductor is connected by a conductor **71** with the contact **40** of the second set of contacts on the panel **34**; the third contacts of the twelve groups of four of the first series of contacts **58** all are connected together by a conductor **72** and this conductor is connected by a conductor **73** with the contact **45** of the third set of contacts on the panel **34**; and the fourth contacts of the twelve groups of four of the first series of contacts **58** all are connected together by a conductor **74** and this conductor is connected by a conductor **75** with the contact **50** of the fourth set of contacts on the panel **34**.

The same connecting scheme as just set forth holds true with respect to each of the other series of the contacts **59**, **60**, **61** and **62** and the contacts on the panel **34**. That is to say, the first contacts of the twelve groups of four of the second series of contacts **59** are connected together by a conductor **76** and this conductor is connected by a conductor **77** with the contact **36** of the first set on the panel **34**; the second contacts of the twelve groups of four of the second series of contacts **59** all are connected together by a conductor **78** and this conductor is connected by a conductor **79** with the contact **41** of the second set of contacts on the panel **34** and so on, not only in respect to the two remaining contacts in each group of four in the second series of contacts **59**, but in respect to the contacts of each group of four in the three remaining series **60**, **61** and **62**. In other words, the first contacts of the groups of four in the series **58**, **59**, **60**, **61** and **62** are connected with the contacts **35**, **36**, **37**, **38** and **39**, respectively of the first set of contacts on the panel **34**; the second contacts of the groups of four in the series **58**, **59**, **60**, **61** and **62** are connected with the contacts **40**, **41**, **42**, **43** and **44**, respectively of the second set of contacts on the panel **34**;

the third contacts of the groups of four in the series 58, 59, 60, 61 and 62 are connected with the contacts 45, 46, 47, 48 and 49, respectively, of the third set of contacts on the panel 34; and the fourth contacts of the groups of four in the series 58, 59, 60, 61 and 62 are connected with the contacts 50, 51, 52, 53 and 54, respectively, of the fourth set of contacts on the panel 34.

A conductor 80 connects together the contacts 35', 40', 45' and 50'; a conductor 81 connects together the contacts 36', 41', 46' and 51'; a conductor 82 connects together the contacts 37', 42', 47' and 52'; a conductor 83 connects together the contacts 38', 43', 48' and 53'; a conductor 84 connects together the contacts 39', 44', 49' and 54'; a conductor 85 connects together the contacts 55; and a conductor 86 connects together the contacts 55'.

Referring now particularly to Figs. 6 and 8 of the drawings, it will be observed that a disk 87, preferably of insulating material, is fixed on the tuning unit shaft 12 and carries on one face thereof, in the present instance its rear face, an inner circular track 88 and a pair of outer circular tracks 89 and 90, and that said tracks are concentric with each other and with respect to the axis of rotation of said disk.

Mounted in any suitable manner on the track 88 for circumferential adjustment relative to the disk 87 are five solenoids 91, 92, 93, 94 and 95, one for each of the five circular series of contacts 58, 59, 60, 61 and 62, which are radially, or substantially radially, disposed and which may be fastened in any positions of adjustment along the track 88 in any suitable manner. Each of said solenoids includes a core 96, and, moreover, said solenoids are of the type in which their cores 96 normally are projected outwardly, either by suitable spring means or in any other suitable manner, and are retracted when said solenoids are electrically energized.

Related to the solenoids 91, 92, 93, 94 and 95 are five switch actuator supports 97, 98, 99, 100 and 101, respectively, which are mounted in any suitable manner on the track 89 for circumferential adjustment relative to the disk 87 and which, as in the case of said solenoids, may be fastened in any positions of adjustment along said track 89 in any desired manner. On each of said switch actuator supports is mounted a switch actuator in the form of an arm 102 which is pivoted intermediate its ends to its support and which, at one end, is connected to its related solenoid core by a suitable connecting link 103' and at its other end is free. In the normal, projected positions of the solenoid cores, the free end portions of the arms 102 are disposed parallel, or substantially parallel, to the disk 87, as shown by full lines in Figure 6, and in the retracted position of any given solenoid core, the free end portion of the related arm 102 is disposed at right angles, or substantially at right angles, to the plane of the disk 87, in the present instance projecting rearwardly with respect to said disk as illustrated by dotted lines in Figure 6 of the drawings. When the arms 102 are in their normal positions illustrated by full lines in Figure 6, they do not perform any function as a consequence of rotation of the disk 87, inasmuch as they are disposed forwardly of a spring contact finger 103 with which they are designed to cooperate. When, however, any given arm 102 is swung to a position at right angles to the disk 87, its free end then is disposed so that, as a consequence of rotation of the disk 87, it will strike one side or the other of the spring contact finger 103, depending upon the direction of rotation of the disk 87.

The spring contact finger 103 may be mounted in any suitable manner and has cooperating therewith a pair of spring contact fingers 104 and 105 which also may be mounted in any suitable manner and which, are disposed, respectively, at opposite sides of the finger 103. Normally the three contact fingers 103, 104 and 105 are in circuit closing relationship, but when the contact finger 103 is engaged by the free end portion of any of the arms 102 and is moved laterally by said arm, it is separated from one or the other of the contact fingers 104, 105, depending upon the direction of rotation of the disk 87, and the circuit through the finger from which it is separated thereby is opened.

The solenoid 91 and the related arm 102 are initially adjusted and fastened circumferentially with respect to the disk 87 so that when the tuning unit is in a correct position of rotative adjustment to cause the receiver to tune with the wave length or broadcasting station related to the series of contacts 58, the said arm 102, assuming its right angular relationship to the disk 87, is in a position to engage the finger 103. The other solenoids and their related arms 102 are similarly initially adjusted and fastened. That is to say, the solenoid 92 and its arm 102 are adjusted and fastened so that the arm 102 is in a position to engage the finger 103 when the tuning unit is in a correct position of rotative adjustment to cause the receiver to tune with the wave length or broadcasting station related to the series of contacts 59, and so on with respect to each of the three remaining solenoids 93, 94 and 95 related, respectively, to the remaining three series of contacts 60, 61 and 62 which, in turn, are related, respectively, to three other different wave lengths or broadcasting stations.

Related to the switch actuator supports 97, 98, 99, 100 and 101 are five contacts 106, 107, 108, 109 and 110, respectively, which are mounted on the track 90 for circumferential adjustment in harmony with said switch actuator supports and which are designed to be engaged by their related arms 102 when said arms are swung to positions at right angles to the disk 87.

Referring further to Figures 6 and 9 of the drawings, it will be observed that the tuning unit shaft 12 has fixed thereon an arm 111 and that, disposed in the path of rotation of this arm and one hundred and eighty degrees apart, are two spring contact fingers 112 and 113 having companion contact fingers 114 and 115, respectively, from which they are normally separated. Accordingly, the circuits controlled by said fingers 112, 114 and 113, 115 normally are open, but when, by rotation of the shaft 12, the arm 111 strikes either of the fingers 112 or 113, said finger is flexed into engagement with its companion finger and the related circuit is closed.

Referring, now, to the diagrammatic view, Figure 10, it will be observed that the present mechanism includes a reversing switch 116 for controlling reversing of the motor 15; that two solenoids 117, 118 are provided for reversing said switch 116, and that two additional solenoids 119, 120 are provided for actuating a movable switch element 121 into and from engagement with a companion switch element or contact 122. It will further be observed that from one side, the positive side in the present instance, of a suitable source of current, indicated as a wall plug

123, a conductor 124 leads to the receiver, designated generally as R, to the five switch acutator supports 97, 98, 99, 100 and 101, to the conductor 85 connecting together the contacts 55, to each of the contact fingers 112, 113, and also to the conductor ring 32. Further, it will be observed that from the receiver R a conductor 125 leads to the two switch contacts 22 and 24; and that, from the other side of the source of current, a conductor 126 leads to the switch contact 23, to one end of the winding of each of the solenoids 119 and 120, to one end of the winding of each of the solenoids 117 and 118, and also to the field winding of the motor 15.

Interposed in the field winding of the motor 15 is the reversing switch 116, and from said field winding a conductor 127 leads to the spring contact finger 105. From the companion spring contact finger 104 a conductor 128 leads to the switch contact 27, and from the companion switch contact 26 a conductor 129 leads to the five contact elements 106, 107, 108, 109, 110.

Connecting the contact finger 114 with the other end of the winding of the solenoid 117 is a conductor 130, and connecting the contact finger 115 with the other end of the winding of the solenoid 118 is a conductor 131.

A conductor 132 connects together one end of the winding of each of the solenoids 91, 92, 93, 94, and 95 and the other end of the winding of the solenoid 120. On the other hand, the other ends of the windings of the solenoids 91, 92, 93, 94 and 95 are connected by conductors 133, 134, 135, 136 and 137 to the conductors 84, 83, 82, 81 and 80, respectively, and the other end of the winding of the solenoid 119 is connected by a conductor 138 with the conductor 86. Finally, a conductor 139 connects the contacts 25 and 122.

From the foregoing it will be apparent that, upon pushing the knob 14 inwardly to couple its shaft 14' with the shaft 19 to enable manual tuning adjustments of the tuning unit, the switch comprising the contacts 22, 23 will be closed and the switches comprising the contacts 24, 25 and 26, 27 will be opened. Accordingly, the receiver circuit will be closed through the conductors 124, 125, the switch comprising the contacts 22, 23 and the conductor 126, and, therefore, the receiver may be manually adjusted and operated in the ordinary, well known manner, all parts comprising the present mechanism being inoperative because of opening of the switches comprising the contacts 24, 25 and 26, 27. On the other hand, by pulling the knob 14 outwardly, its shaft 14' is uncoupled from the shaft 19 and, consequently, from the tuning unit and, at the same time, the switch comprising the contacts 22, 23 is opened and the switches comprising the contacts 24, 25 and 26, 27 are closed. Tuning of the receiver to different wave lengths at predetermined times then is under the automatic control of the present mechanism. For example, let it be assumed that the time is approaching twelve o'clock and that, any time prior to twelve o'clock, it had been decided that the program desired to be heard from twelve o'clock until 12:15 o'clock is the program broadcast by the station to which the series of contacts 58 is related. Under such conditions, the contact finger 64 on the first conductor 63, that is, the conductor 63 corresponding to the twelve-o'clock position of the hands of a clock, is, any time prior to twelve o'clock, adjusted along said first conductor to a position in which it engages the related contact of the series of contacts 58. Then, as the time approaches twelve o'clock and the contacts 55, 55' are bridged by the contact 57 of the switch arm 31 moving in harmony with the minute hand of the clock, an initial operation, due to the contacts 55, 55' being disposed slightly in advance of the remaining contacts of the first set on the panel 34, occurs as follows: A circuit is closed from the conductor 124 through the conductors 85 and 86 now electrically connected together by bridging of the contacts 55, 55' by the contact 57 of the switch arm 31, to the conductor 138, and through the solenoid 119 to the conductor 126, and thereby the switch arm 121 is swung to open the switch comprised by said switch arm and the contact 122. This "turns off" the receiver R because said switch 121, 122 is included in the receiver circuit when the knob 14 is in its "pulled" position, as indicated in Figure 10.

The receiver remains "turned off" for a brief period of time until the contact arm 31 reaches the position in which its contacts 56 bridge the remaining contacts 35, 35', etc. of the first set of contacts on the panel 34. When this occurs, a circuit is closed through the conductor 124, the conductor ring 32, the contact arm 30, the contact 33 related to the first conductor 63, the related conductor 67, the said first conductor 63, the contact finger 64, the contact of the series 53 with which the finger 64 is engaged, the conductors 68, 69, the contacts 35, 35' bridged by the related contact 56 on the switch arm 31, the conductor 80, the conductor 137, the solenoid 95, the conductor 132, the solenoid 120 and the conductor 126. Thereby, the switch 121, 122 is closed closing the receiver circuit, but the receiver does not receive immediately due to the time required for its tubes to "heat up". The solenoid 95 was, of course, energized simultaneously with energization of the solenoid 120, and this resulted in swinging of the related switch actuator arm 102 to a position at right angles to the disk 87, at the same time closing the switch comprised by the support 97 and the contact 106. Accordingly, another circuit was closed from the conductor 124 through the switch 97, 102, 106, the conductor 129, the bridged contacts 26, 27, the conductor 128, the spring contacts 104, 103, 105 and the conductor 127 to the motor 15, including the reversing switch 116, and from the motor through the conductor 126. Accordingly, the motor began to rotate in one direction or the other, depending upon the position of the reversing switch 116 when the motor circuit was closed, thereby rotating the tuning unit and the disk 87 and the solenoids and switch actuator arms carried by said disk.

The motor circuit obviously remains closed as long as the contacts 35, 35' are bridged and the switch 103, 104, 105 remains closed. In this connection it also is obvious, assuming bridging of contacts 35, 35' and a closed status of the switch 103, 104, 105, that the motor will oscillate through an angle of 180° due to engagement of the arm 111 alternately with the spring contact fingers 112, 113 and causing them to engage their related contact fingers 114, 115, thereby causing the solenoids 117, 118 to be energized alternately with consequent actuation of the motor reversing switch 116. Accordingly, as long as the motor circuit is closed the motor oscillates, "hunting" the correct tuning position for the tuning unit as determined by engagement with the contact finger 103 of whichever of the arms 102 happens to be positioned to engage said contact finger. In this connection it is apparent that, since the

solenoids on the disk 87 are individually related to the series of contacts 58, 59, 60, 61 and 62 representing different wave lengths or broadcasting stations, and that, since a circuit cannot be closed through more than one of the contacts of all of said series at any given time, not more than one of the solenoids 91, 92, 93, 94 or 95 may be energized at any given time and, consequently, only one of the arms 102 may be projected at any given time. Also, it will be recalled that the solenoids 91, 92, 93, 94 and 95 and their related arms 102 initially are adjusted so that whenever any given solenoid is energized and its arm 102 is projected and is engaged with the contact finger 103, the tuning unit is correctly tuned to the wave length or broadcasting station to which that particular solenoid is related. Therefore, according to the example heretofore given, the motor will rotate in one diretcion or the other, and, if necessary, reverse its direction of rotation, until the projected arm 102 related to the solenoid 95 engages one side or the other of the contact finger 103 and opens the switch 103, 104, 105. This will open the motor circuit and adjustment of the tuning unit will be halted with the tuning unit in correct tuning position for the wave length or broadcasting station to which the solenoid 95 is related. With opening of the motor circuit the energy stored in the contact finger 103 will be sufficient to slightly rotate the motor in a direction opposite the direction in which it was rotating and the switch 103, 104, 105 will close, again closing the motor circuit. Accordingly, there will continue what may be termed a "bouncing" of the arm 102 against the spring finger 103 as long as the contacts 35, 35' remain bridged, but as soon as the circuit is opened at the contacts 35, 35', the motor and the tuning unit come to rest, with the tuning unit properly tuned to the wave length or broadcasting station to which the series of contacts 58 are related.

Only a very brief period of time is required for the tuning adjustment to be effected, and during this time the receiver is silent due to the same having been "turned off" shortly prior to initiation of the tuning operation and due to the time required for it to "heat up" following its "turning on" simultaneously with initiation of the tuning operation. Consequently, undesirable noises which might be produced if the receiver were operative during the tuning operation, are avoided.

Following the tuning operation described, the receiver operates over the fifteen minute period which elapses during travel of the contact arm 30 to the second contact 33 and during travel of the contact arm 31 to the second set of contacts on the panel 34. Here the operation just recounted is repeated, assuming the contact finger 64 of the second conductor 63 is engaged with the related contact in the series of contacts 58, for the second contact in the series of contacts 58 has the same relationship to the contacts 40, 40' of the second set of contacts on the panel 34 as the first contact of said series of contacts 58 has to the contacts 35, 35' of the first set of contacts on said panel 34, the contacts 35' and 40' being connected to the same solenoid.

Had the contact finger 64 of the first conductor 63 been engaged, for example, with the first contact in the series 59, the operation recounted would have been the same except, obviously, that the solenoid 94 would have been energized and the tuning unit would have been adjusted according to the position of said solenoid 94 on the disk 87, that is, to tune with the wave length or broadcasting station represented by the series of contacts 59.

By the time the contact arm 31 has moved through a complete revolution or cycle, the contact arm 30 has successively engaged four of the contacts 33. Accordingly, a new cycle of operation begins with movement of the contact arm 30 into engagement with the fifth contact 33. The reason for connecting together the contacts of the series 58, 59, 60, 61 and 62 in the manner heretofore described therefore will be apparent. It will further be apparent that by "setting" the contact fingers 64 of the successive conductors 63 each on the related contact of a selected series of the contacts 58, 59, 60, 61 and 62, the mechanism will operate automatically at fifteen minute intervals to tune the receiver to the definte broadcast program desired during each fifteen minute period.

If, during any given fifteen minute period it should be desired that the receiver remain silent, the contact finger on the conductor 63 in control of that fifteen minute period simply is adjusted to a position in which it does not engage any related contact.

As will be apparent, merely by increasing or decreasing the number of contacts 33, 63, etc. and the number of sets of contacts on the panel 34, and by correspondingly changing the connections between the various related contacts, the mechanism may be adapted to operate at other than fifteen minute intervals. Moreover, it is apparent that the number of wave lengths or broadcasting stations with respect to which the mechanism is automatically controlled, is arbitrary and is determined by the number of the series of contacts 58, 59, etc., the number of pairs of contacts in each set on the panel 34 and the number of solenoids 91, 92, etc., and their related parts which may be provided.

Without further description it is thought that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will, of course, be understood that changes in the form, proportion and minor details of construction may be resorted to, without departing from the spirit of the invention and scope of the appended claims.

I claim:

1. In a time-scheduled radio receiving system, a radio receiver including means adjustable to tune the same to different wave lengths, a reversible motor and cooperating means included in the circuit thereof for reversibly adjusting said tuning means, clock-operated means for causing closing the circuit of said motor at predetermined times, said motor circuit including a normally closed switch and a plurality of individually and selectively electrically operable actuators for said switch, adjustable in harmony with said tuning means and having normal positions in which they are ineffective to actuate said switch and operative positions to which they are operated when energized and in which they are effective to open said switch responsive to adjustment of the tuning means in either direction to different positions determined by the positions of said actuators relative to said tuning means, and manually adjustable means cooperating with said clock operated means to exclude all but one of said actuators from the motor circuit at any given time and to select the actuator that is included in the motor circuit at any given time.

2. In a time-scheduled radio receiving system, a radio receiver including a tuning unit rotatably adjustable to tune the receiver to different wave lengths, a reversible motor and cooperating means in the circuit thereof for reversibly rotatably adjusting said tuning unit, a normally closed switch in the motor circuit having a fixed position, a plurality of actuators for opening said switch, said actuators being collectively reversibly rotatable with said tuning unit and being angularly spaced apart, and having normal positions in which they are ineffective to open said switch responsive to their rotation, electrical devices individual to said actuators for operating them to positions in which they are effective to open said switch responsive to their rotation with the tuning unit in either direction, said devices being operable when energized to close the motor circuit, and cooperating manually adjustable and clock-operated means effective to select one of said devices and to close a circuit therethrough at a predetermined time.

3. In a time-scheduled radio receiving system, a radio receiver including a tuning unit rotatably adjustable to tune the receiver to different wave lengths, a reversible motor and cooperating means in the circuit thereof for reversibly rotatably adjusting said tuning unit, a normally closed switch in the motor circuit having a fixed position, a plurality of actuators for opening said switch, said actuators being collectively reversibly rotatable with said tuning unit and being angularly spaced apart, and having normal positions in which they are ineffective to open said switch responsive to their rotation, electrical devices individual to said actuators for operating them to positions in which they are effective to open said switch responsive to their rotation with the tuning unit in either direction, and cooperating manually adjustable and clock operated switch means effective at different predetermined times to select one of said devices and close a circuit therethrough, said devices and actuators being angularly adjustable relative to the tuning means.

4. A time-scheduled radio receiving system as set forth in claim 3, in which a switch for reversing said motor is included in the motor circuit, in which electro-magnetic means are provided for actuating said switch, and in which switch means controlled by operation of the motor control operation of said electro-magnetic means.

5. A time-scheduled radio receiving system as set forth in claim 3 including a rotatable and push-pull element effective by push-pull operation to connect and disconnect the same to and from the tuning unit, said element, when connected with the tuning unit, being manually rotatable to rotatably adjust the same, and switch means operable by push-pull actuation of said element to include the time-scheduled control means for the receiver in circuit with the receiver when said element is disconnected from the tuning unit, and to disconnect the time-scheduled control means from the receiver circuit when said element is connected with the tuning unit.

6. A time-scheduled radio receiving system as set forth in claim 2 in which the switch actuators constitute the movable elements of switches for closing the motor circuit.

7. In a time-scheduled radio receiving system, a radio receiver including a tuning unit rotatably adjustable to tune the receiver to different wave lengths, a motor for rotating said tuning unit, a disk rotatable with said tuning unit, a normally closed switch in the circuit of said motor having a fixed position, a plurality of actuators for opening said switch, said actuators being carried by said disk and being angularly adjustable with respect thereto, said actuators having normal positions in which they are ineffective, responsive to rotation of said disk, to open said switch, and having operative positions in which they are effective, responsive to rotation of said disk, to open said switch, a normally deenergized solenoid individual to each of said actuators operable, when energized, to move its related actuator to its operative position, a plurality of normally open switches in the motor circuit any one of which, when closed, closes the motor circuit, said normally open switches being individual to said actuators, said actuators, when moved to their operative positions, being effective to close the motor circuit, and cooperating manually adjustable and clock-operated switches effective to select different of said solenoids at different predetermined times and to close a circuit therethrough.

8. A time-scheduled radio receiving system as set forth in claim 7 including means for opening the circuit of the receiver just prior to closing of the circuit through the selected solenoid and to close the receiver circuit shortly after closing of the circuit through the selected solenoid.

9. In a time-scheduled radio receiving system, a radio receiver including a tuning unit rotatably adjustable to tune the receiver to different wave lengths, a motor for rotatably adjusting said tuning unit, a normally closed switch in the circuit of said motor, a plurality of electrically operable normally open switches in the circuit of said motor any one of which, when closed, is effective to close the motor circuit, said normally closed switch having a fixed position, said normally open switches being collectively rotatable in harmony with the tuning unit and angularly spaced with respect thereto and being ineffective, when open, to open said normally closed switch, but being effective, when closed, to open said normally closed switch responsive to rotation of said tuning unit, and cooperating manually adjustable and clock-operated means for individually and selectively closing the circuits of said normally open switches at predetermined times.

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