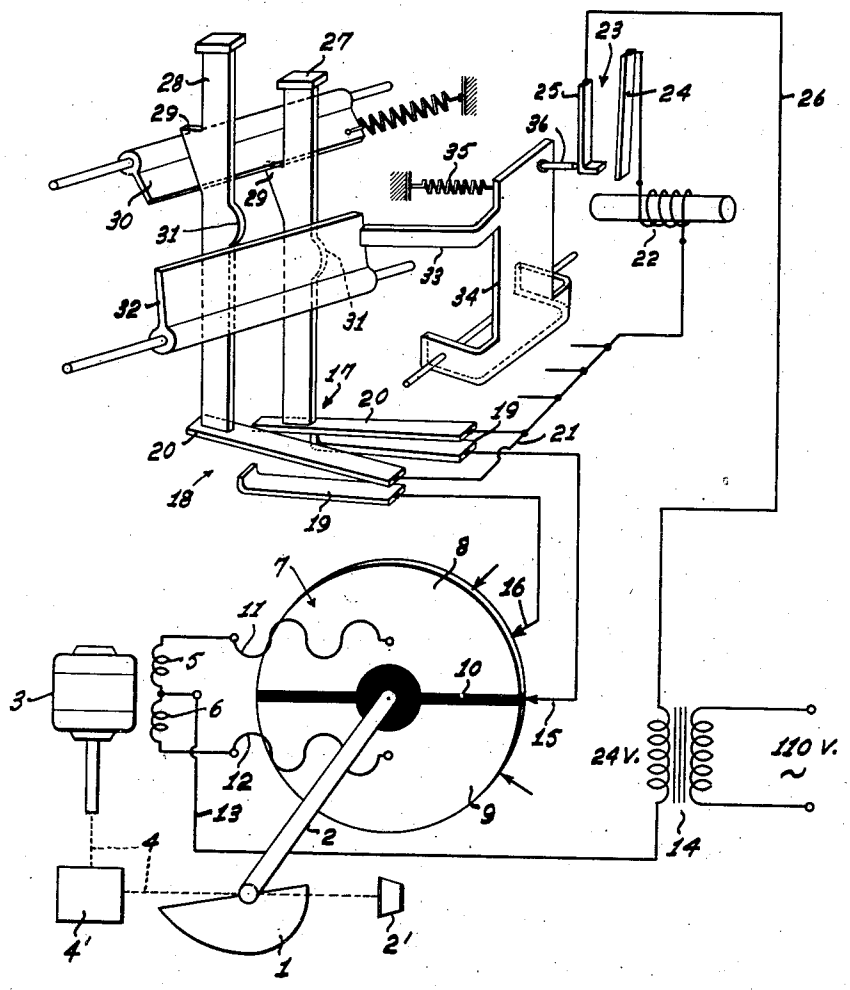
Nov. 9, 1948. W. E. NEWMAN 2,453,251

MOTOR-OPERATED PUSHBUTTON TUNER

Filed Feb. 17, 1944 3 Sheets-Sheet 1

Fig. 1.



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MOTOR-OPERATED PUSHBUTTON TUNER

Filed Feb. 17, 1944 3 Sheets-Sheet 2

Fig. 1a.

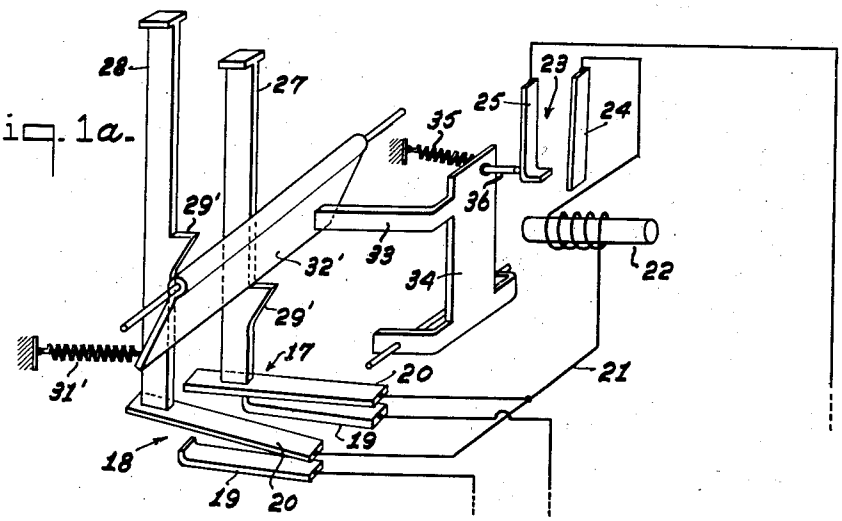
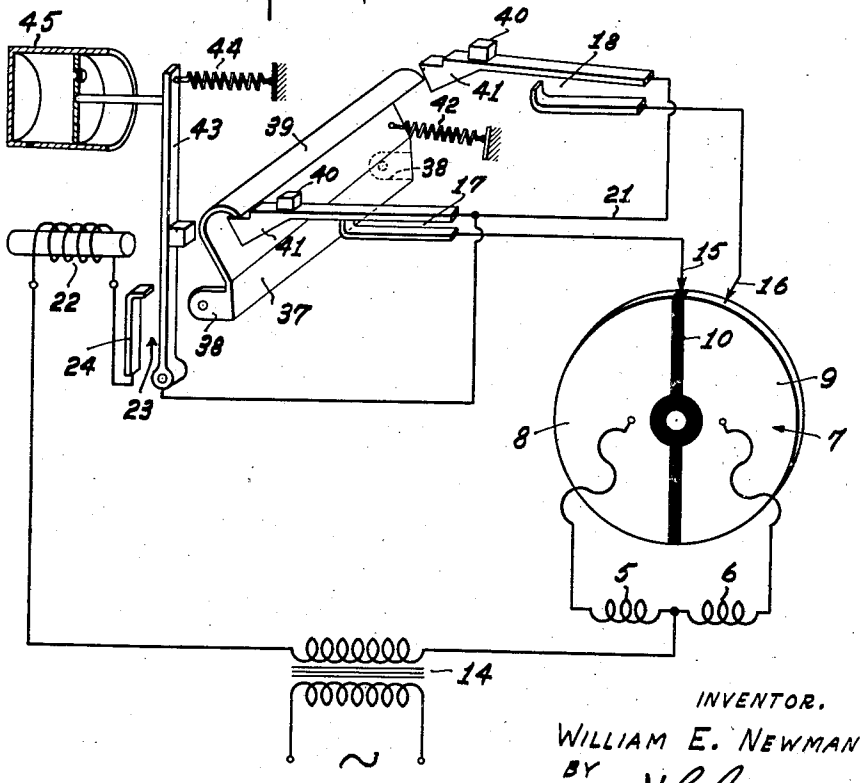


Fig. 2.



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MOTOR-OPERATED PUSHBUTTON TUNER

Filed Feb. 17, 1944 3 Sheets-Sheet 3

Fig. 3.

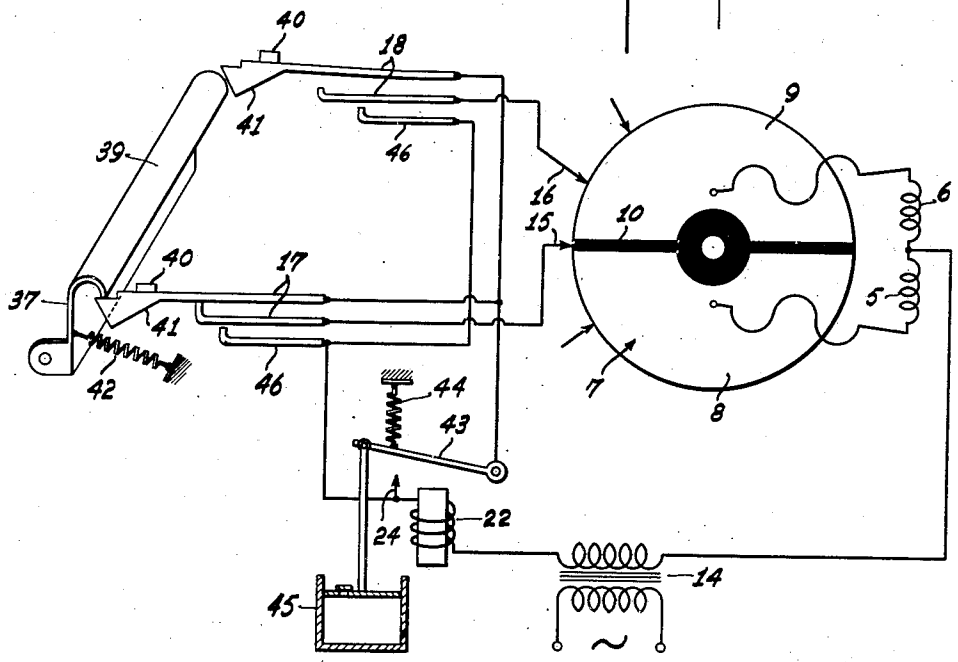
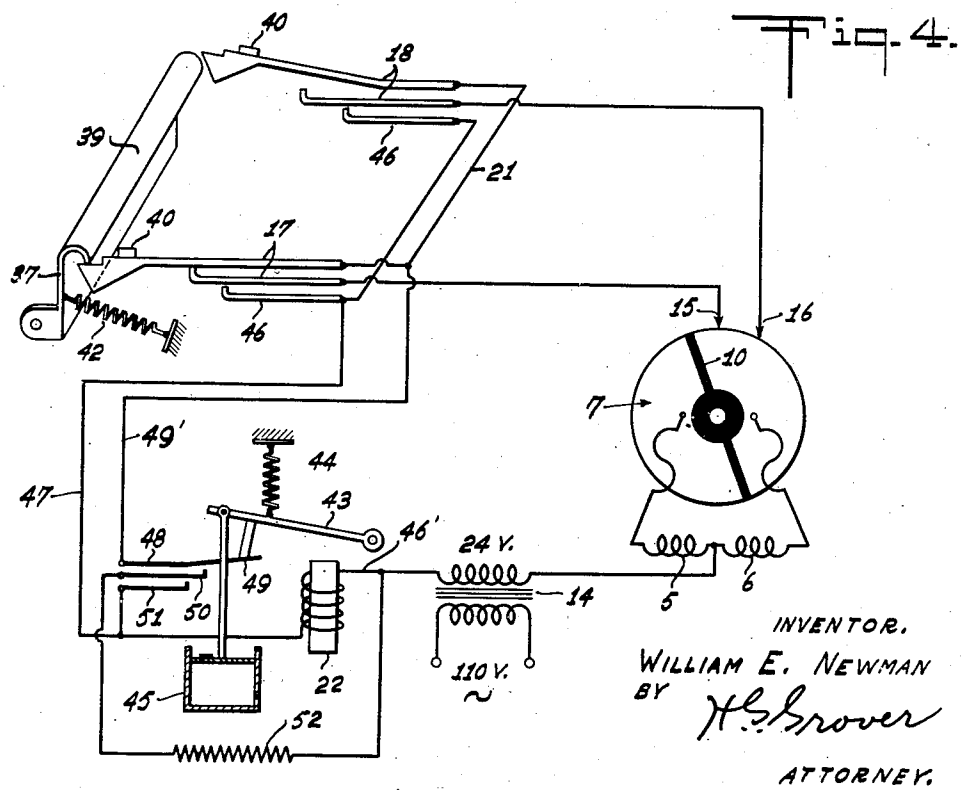


Fig. 4.



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Patented Nov. 9, 1948

2,453,251

UNITED STATES PATENT OFFICE

2,453,251

MOTOR-OPERATED PUSH-BUTTON TUNER

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Application February 17, 1944, Serial No. 522,753

14 Claims. (Cl. 318—466)

1

My present invention relates to automatic tuners, such as may be employed in radio receivers, and more particularly to mechanism which will permit of manual adjustment of the tuning element following an automatic tuning operation without intermediate actuation of conditioning means for changing from automatic to manual control.

Push-button, time-controlled pre-selection, and other automatically-tuned radio receivers are designed so that only a limited number of predetermined stations are capable of being tuned in automatically. In order that other stations may be tuned in, it is necessary to employ manual tuning. Also, particularly in the automatic control of radio receivers operating in the short wave bands where the signal channels are closely adjacent to one another, it is often necessary or desirable, after a station is tuned in automatically, e. g., by a motor, to resort to manual adjustment in order to obtain more exact tuning. Unless an "automatic-manual" switch or the like is first thrown to "manual" position or necessary provisions, such as are provided by this invention, are made to allow for such manual control, it will be found that very slight movement of the manual control member will again set the motor into operation, thereby interfering with the manual adjustment.

In motor-tuned radio receivers of the type mentioned, it is customary to interpose a manually-controlled clutch mechanism between the motor drive and the tuning device, or else to provide an auxiliary push-button or other manually-controlled switch arranged to open the motor circuit or otherwise disable the motor for the purpose of conditioning the receiver for manual tuning. In accordance with the present invention, however, the "automatic-manual" conditioning devices of the prior art are dispensed with and in lieu thereof, in the illustrated, motor-tuned embodiment of my invention, there is provided in the motor circuit a normally-open switch which is momentarily closed upon actuation of any one of the station-selecting push-buttons or other station-selecting means and is kept closed by a relay or like means which remains energized so long as the motor is operative for adjusting the receiver to the desired station, but which then opens the motor circuit until automatic operation is again initiated. Consequently, subsequent manual adjustment of the tuner will not initiate operation of the motor and will not be affected by the motor-driving means.

It is, therefore, one of the objects of the invention to provide improved automatic tuning mechanism which will permit of manual adjustment of the tuning element independently of the automatic tuning mechanism and without requiring manual actuation of any means for conditioning the mechanism for manual tuning control.

2

It is a further object of the invention to provide an automatic, motor-operated, push-button tuner which is provided with means under the control of the several push-buttons, effective during the automatic tuning operation to permit uninterrupted operation of the motor and to break the motor circuit after completion of an automatic tuning operation in such a way as to permit manual tuning without interference from the motor.

The novel features characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and mode of operation together with further objects and advantages thereof, will best be understood by reference to the following description taken in connection with the accompanying drawing in which:

Fig. 1 discloses in schematic fashion an embodiment of the invention; Fig. 1*a* shows a modification of the system shown in Fig. 1; and Figs. 2 to 4 show further embodiments of the invention.

Referring to Fig. 1, the receiver tuning device is shown at **1** in the form of a variable condenser, the shaft **2** of which is driven from a motor **3** by suitable means not shown, but represented by the dotted line connection **4** which may include a gear reduction train represented by block **4'**. A control knob **2'** suitably coupled to the condenser shaft **2** permits of manual tuning of the receiver. The motor is of the reversible type, being provided with field windings **5** and **6**. Affixed to and movable with the tuning condenser shaft is a motor reversing and station selector commutator disc **7** of known construction, constituted by conductive segments **8** and **9** separated or split by a narrow strip of insulation **10**. The segments **8** and **9** are electrically connected respectively by way of conductors **11** and **12** to the free terminals of the field windings **5** and **6**, and the common terminal of said windings is connected by way of conductor **13** to one side of a suitable source of low voltage alternating current represented by the transformer **14**.

Disposed around the selector disc **7** and in contact with the periphery thereof are a plurality of adjustable brush contacts, only two of which are shown at **15** and **16**, each corresponding to a predetermined one of the broadcasting stations

which are desired to be tuned in automatically. The brush contacts 15, 16, have associated with them normally open switches 17, 18 respectively, the stationary contacts 19 and 19' of which are electrically connected to their respective brush contacts, while the cooperating movable contacts 20 are connected to the conductor 21 leading to one terminal of the winding of an electromagnet or solenoid relay 22. Interposed between the other terminal of the solenoid winding and the other side of power supply source 14 is a normally open auxiliary switch 23, the stationary contact 24 of which is connected to the solenoid winding and the movable contact 25 to the power source by way of conductor 26.

Cooperatively related with the switches 17, 18, etc. in any suitable manner are the respective push-button plungers 27, 28, etc. As illustrated the plungers are supported on the movable switch contacts 20 which are biased upwardly to open-circuit position by their inherent resilience. Each push-button plunger or rod is provided with a pawl 29 which is adapted to cooperate with a pivoted latch bar 30 which operates in a well-known manner to hold an actuated push-button in operative position and to permit the release of a previously-operated push-button. Each push-button plunger is further provided with a cam member 31 which is adapted to cooperate with a pivoted rocker bar 32. In the path of motion of the rocker bar there is disposed an arm 33 formed integral or otherwise with a pivoted armature 34 under control of the electromagnet 22. At the free end of the armature there is carried a pin 36 or other suitable device in alignment with the movable contact 25 of switch 23. Normally, the armature is biased by a spring 35 to one position shown in the drawing, so that ordinarily switch 23 remains open-circuited.

The system above described operates in the following manner: upon actuation of a push-button, such as 27 for example, the contacts of switch 17 will be closed and will be kept closed by action of the latch bar on the push-button plunger. During the movement of the plunger to operative position, the rocker bar 32 will be rocked by action of the cam 31 to actuate the armature 34 to the right as viewed in Fig. 1, whereupon pin 36 will cause switch 23 to close thereby completing the motor circuit as follows, it being assumed that the brush contact 15 which corresponds to the actuated push-button 27 was initially at some point on the selector disc other than in contact with insulating strip 10; one side of source 14, conductor 13, one or the other of the field windings 5, 6, conductors 11, 12 and segments 8, 9, the contact 15, closed switch 17, conductor 21, relay 22, closed switch 23, conductor 26 and back to the other side of the energizing source. The motor will then begin to drive the tuning device in a direction determined by the particular field winding that happens to be in circuit and will continue to operate until the selector disc is moved to the position shown where its insulating strip 10 contacts with brush 15. During the operation of the motor, electromagnet 22 will also be energized thereby attracting its armature 34 to effect closure of switch 23.

The tuning device now having been moved to a predetermined position of adjustment, the motor circuit is broken at the brush contact 15 and also at the switch 23 since armature 34 is released by the deenergized electromagnet 22, and since the movement of push-button plunger 27 to its innermost, latched position carries the cam member 31

past the rocker bar 32 thereby permitting armature 34 to be retracted from the position in which it closes switch 23. If it is now desired to effect manual tuning, adjustment of tuning shaft 2 by manual control members 2' will not cause the motor circuit to be completed, by reason of the fact that although electrical contact is made between brush contact 15 and one or the other of the selector disc segments 8, 9, the circuit will still be open at switch 23. It will be clear, however, that in the absence of switch 23, the slightest movement of the tuning device by the manual control member will cause operation of the motor since its circuit will be completed at the selector disc, it being noted that switch 17 is in the closed position due to the previously-actuated push-button 27 which remains latched until released.

The arrangement described above may be simplified somewhat by the utilization of a single member to perform the two functions independently performed by the latch bar 30 and the rocker bar 32. This is shown in Fig. 1*a* wherein the single member is constituted by a pivoted rocker bar 32' similarly disposed as the rocker bar 32 of Fig. 1, between the bank of push-button plungers 27, 28, etc., and the armature 34.

Upon actuation of a push-button the rocker bar is adapted to be rocked in a clockwise direction, against the action of a spring 31', by means of a pawl 29' which during substantially the entire travel of the push-button performs the function of the cam 31 in Fig. 1. At substantially the limit of the push-button travel, the pawl will have moved sufficiently below the rocker bar to permit the latter to be returned to its normal or inactive position under the influence of spring 31', in which position the rocker bar is adapted to coact with the pawl which now performs the function of the pawl 29 in Fig. 1 to latch the actuated push-button in its operative position. In other respects the arrangement disclosed in Fig. 1*a* is the same as that of Fig. 1 and will operate in a similar manner.

A further modification of the invention is disclosed in Fig. 2 wherein the same or corresponding parts as in the previous figures are designated by the same reference characters. In this embodiment there is provided a pivoted latch bar 37 which performs the two functions of the rocker bar 32' of Fig. 1*a*. The latch bar may have the configuration shown, pivoted at 38, 38 at the bottom and provided at the top with a rounded portion 39 which is turned back on itself to provide a ledge for locking the push-buttons in operative position. The movable contacts of switches 17 and 18 in this case carry at their free ends operating members or push-buttons 40, each of which is provided with a cam member 41.

Normally, the latch bar assumes the position shown due to the action of spring 42. In this position the cam member 41 of the several push-buttons, except the one that had been previously actuated, will be disposed above the rounded portion of the latch bar, as shown for the upper push-button. Upon actuation of a push-button, its cam member 41 will coact with rounded portion 39 to force the latch bar to rock to the left against the action of spring 42, permitting thereby the release of a previously-actuated push-button, and at the conclusion of its stroke the push-button will be latched in the position shown for the lower push-button.

Disposed adjacent the latch bar is a pivoted armature 43 of an electromagnet 22' which corresponds to the electromagnet 22 of Fig. 1, said

armature 43 and stationary contact 24 constituting switch 23 which corresponds to the switch 23 of Fig. 1. Normally the armature is urged to the right against the latch bar by means of a spring 44. A dash-pot or equivalent time delay device 45 is associated with the armature to retard its return movement to normal position by spring 44.

In operation, actuation of a push-button will cause closure of switch contacts 17 or 18 during the initial movement of the push-button, and during continued movement will cam the latch bar to the left against the action of spring 42, causing thereby a corresponding movement of armature 43 to contacting relation with stationary contact 24. As a result, the motor circuit will be completed as described in connection with Fig. 1 and the motor will operate until the selector disc gap 10 breaks the circuit. The instant the disc gap opens the circuit electromagnet 22 will be deenergized to release its armature which, however, will still remain in contact with fixed contact 24 due to the time delay action of dash-pot 45. Spring 44, however, will pull the armature far enough to the right so that it will not be attracted to the electromagnet when the motor circuit is again closed due to over-travel. The time delay action of the dash-pot will, therefore, allow the motor to hunt a few times before the final opening of contacts 24, 43 of switch 23.

The embodiment disclosed in Fig. 3 is substantially the same as that of Fig. 2, the difference being that the circuit of electromagnet 22 is closed by an extra contact 46 associated with each of the push-button contacts 17, 18, etc. This has the advantage that the several push-buttons do not have to be located near the electromagnet. The arrangement of Fig. 3 functions as follows: when a push-button is pushed down the switch contacts 17 or 18 will close during the initial movement thereby only partially completing the motor circuit from the selector disc 7 to the armature 43. However, during the final movement of the push-button, and before assuming its latched position, the push-button contacts and the auxiliary contact 46 will momentarily be closed to energize electromagnet 22. In the illustrated arrangement this may be accomplished by pushing the button 40 slightly beyond the latched position thereby bringing the lower contact of switch 17 or 18 into engagement with contact 46. As a consequence, assuming that switch 17 has been actuated, armature 43 will be pulled over to contact with 24 thus to complete the motor circuit as follows: one side of power source 14, electromagnet 22, contact 24, armature 43, closed contacts of switch 17, brush contact 15, commutator segment 8 or 9, the corresponding field winding 5 or 6, and back to the other side of the power source. The motor then operates to adjust the tuning device to the position determined by the brush contact associated with the actuated push-button, at which position the selector disc breaks the circuit and the motor is stopped. Meanwhile, the push-button 40 is retained in latched position with switch contacts 17 closed but out of engagement with contact 46. As in Fig. 2 the dash-pot 45 provides the slow release of armature 43 to permit the motor to hunt a few times before the final opening of switch contacts 24, 43.

In order that hunting by the motor may be accomplished at reduced voltage, and therefore at a lower speed than when the motor is first energized, before its circuit is broken at the selector disc, the system of Fig. 3 may be modified as

shown in Fig. 4. The winding of solenoid or electromagnet 22 is connected at one end to the source 14 by a conductor 46' and at the other end to contact 46 by a conductor 47, as in Fig. 3. Cooperatively related with the armature 43 is a three-contact switch 48 having one contact 49 connected by a conductor 49' to the bus wire 21 connecting the upper contacts of the push-button switches 17, 18, etc., a second contact 50 connected to conductor 46 through a voltage-dropping resistor 52, and a third contact 51 connected directly to conductor 47.

In operation, when a push-button 40 is pressed down beyond the position where it latches, the lower contact 17 and contact 46 close the circuit through electromagnet 22 and energize it. This pulls the armature 43 down and closes the contacts 49, 50 and 51 against the action of spring 44. The pressure on the push-button may now be released, thereby breaking the circuit between lower contact 17 and contact 46. The two contacts 17, however, remain closed because of the latch bar 37 holding the push-button latched in place. The motor now is supplied with the full voltage until the commutator disc 7 momentarily opens the motor circuit, causing the electromagnet to be deenergized and therefore the release of armature 43. The dash-pot 45 is so designed that there is enough lash to permit the opening of the contacts 50 and 51 the moment the electromagnet is deenergized; however, the dash-pot holds contacts 49 and 50 closed for a predetermined time so that the resistor 52 is included in circuit, and the motor will hunt at a reduced voltage before finally coming to rest. After the motor has stopped, the dash-pot permits the opening of contacts 49 and 50 so that manual adjustment may be made without reenergizing the motor.

While I have shown and described certain preferred embodiments for carrying my invention into effect, it will be apparent to one skilled in the art that my invention is by no means limited to the particular organizations herein disclosed, but that many modifications may be made without departing from the scope of my invention as set forth in the appended claims. For example, it will be evident that my invention is not limited to use with push-button operation but may readily be applied to time-controlled, automatic program preselectors employing a motor drive. In such apparatus this invention will be advantageous in enabling manual tuning adjustment without affecting or being affected by the automatic tuning mechanism.

What I claim is:

1. The combination with a tuning element, of manually-operable means for actuating the element to desired tuning position, automatic, motor-operated means of the type including a single split commutator and a plurality of angularly adjustable brushes disposed in permanent contacting relation on the periphery of said commutator, for moving the tuning element to any one of a number of different pre-selected positions, said latter position being determined by the angular positions of the contact brushes, and of the improvement which consists in a second switching means connected in circuit with the motor and with the contact brushes for preventing the automatic tuning means from being thrown into operation upon actuation of the tuning element by said manually-operable means.

2. The combination with a tuning element, of manually-operable means for actuating the ele-

ment to desired tuning positions, automatic, motor-operated means of the type including a single split commutator connected with the tuning element for movement therewith and having a plurality of angularly adjustable brushes disposed in permanent contacting relation on the periphery of said commutator, for moving the tuning element to any one of a number of different preselected positions, said latter position being determined by the angular positions of the contact brushes, and of the improvement which consists in a solenoid relay and switch connected in circuit with the motor and with the contact brushes for insuring operation of the motor until the preselected tuning position is attained and preventing the automatic tuning means from being thrown into operation upon actuation of the tuning element by said manually-operable means.

3. The combination with a tuning element, of means for manually actuating the element to desired tuning positions, automatic, motor-operated means for automatically moving the tuning element to any one of a number of different preselected positions, said motor-operated means comprising a single split commutator, means for causing the commutator to move with the tuning element, a plurality of angularly adjustable contact brushes disposed in permanent contacting relation on the periphery of the commutator in accordance with the preselected tuning positions, and devices for alternatively completing circuits through the respective contact brushes and the motor to adjust the tuning element, and of the improvement which consists in a switch in circuit with a plurality of the contact brushes, a relay for holding the switch closed whenever current flows to any of such plurality of contact brushes, and means for closing the last-mentioned switch upon operation of any of the devices to complete a circuit to any of the contact brushes constructed to enable the last-mentioned switch to be opened under control of the relay and thereby to prevent the motor from being thrown into operation upon actuation of the tuning element by the manually-operated means.

4. The combination with a tuning element, of means for manually actuating the element to desired tuning positions, automatic, motor-operated means for automatically moving the tuning element to any one of a number of different preselected positions, said motor-operated means comprising a single split commutator, means for causing the commutator to move with the tuning element, a plurality of angularly adjustable contact brushes disposed in permanent contacting relation on the periphery of the commutator in accordance with the preselected tuning positions, and push-button plungers for alternatively completing circuits through the respective contact brushes and the motor to adjust the tuning element, and of the improvement which consists in a switch in circuit with a plurality of the contact brushes, a relay for holding the switch closed whenever current flows to any of such plurality of contact brushes, means for closing the switch upon operation of any of the plungers to complete a circuit through one of the contact brushes constructed to enable the last-mentioned switch to be opened under control of the relay while the push-button plunger remains in actuated position and to prevent the motor circuit from being again closed until another of said push-button plungers is actuated to complete a circuit through another of said plurality of contact brushes.

5. In a radio tuning control system, a tuning device to be adjusted, means including a motor for actuating said device to predetermined adjusted positions, a plurality of selectively-operable push-buttons each corresponding to one of said positions, a normally open switch associated with each push-button which is adapted upon operation to close its switch, an additional normally open switch, the motor requiring for its operation the closure of any one of the push-button switches and also said additional switch, an electromagnet having an armature, said push-button switches, said additional switch and the electromagnet being serially included in circuit with the motor, and a member adapted upon operation of any one of the push-buttons to momentarily close said additional switch whereupon the electromagnet and motor are energized, said armature being adapted upon energization of the electromagnet to hold said additional switch in closed position until the motor circuit is broken upon actuation of the tuning device to the adjusted position corresponding to the actuated push-button.

6. A radio tuning control system as defined in claim 5, wherein the member for momentarily closing the additional switch is constituted by a pivoted rocker bar which is cammed to operative position in response to actuation of any one of the push-buttons.

7. A radio tuning control system as defined in claim 5, wherein the armature constitutes the movable contact of the additional switch and the member for momentarily closing the additional switch is constituted by a pivoted rocker bar which is cammed to operative position in response to actuation of any one of the push-buttons, and wherein a time delay device is associated with the armature switch contact to retard its return to normal inoperative position.

8. The combination of a tuning element, of automatic tuning means comprising motor mechanism and a plurality of electric circuits for causing the motor mechanism to move the tuning element to different, preselected positions respectively, push-button plungers for alternatively closing said electric circuits, of the improvements which consists in a switch common to a plurality of said electric circuits, a cam on each of said push-button plungers for closing the switch and then releasing control of the switch upon movement of the plunger to its circuit closing position, and a relay connected into a plurality of said circuits for holding the circuits closed until the respective tuning operations are completed.

9. The combination of a tuning element, of automatic tuning means comprising motor mechanism and a plurality of electric circuits for causing the motor mechanism to move the tuning element to different, preselected positions respectively, push-button plungers for alternatively closing said electric circuits, and latching means for retaining the plungers alternatively in position to close their respective circuits, and of the improvement which consists in a switch common to a plurality of said electric circuits, means on each of said push-button plungers for closing the switch and then releasing control of the switch upon movement of the plunger to its latched position, and an electromagnet connected into a plurality of said circuits for holding the circuits closed until the respective tuning operations are completed.

10. The combination of a tuning element, of automatic tuning means comprising motor mechanism and a plurality of electric circuits for

causing the motor mechanism to move the tuning element to different, preselected positions respectively, push-button plungers for alternatively closing said electric circuits, latching means for retaining the push-button plungers alternatively in position to close their respective circuits, of the improvement which consists in auxiliary switching means associated with the electric circuits, means operatively associated with each of said push-button plungers for closing the auxiliary switching means and then releasing control of the auxiliary switching means during movement of the plunger to its latched position, and electromagnetic means connected into a plurality of said circuits for holding the respective electric circuits closed until the respective tuning operations are completed.

11. In a radio tuning control system, a tuning device to be adjusted, a motor for actuating said device, means for moving the device to predetermined positions including a conductive position-determining disc having a stop gap movable with the tuning device and a plurality of radially adjustable stationary brush contacts, a plurality of selectively operable push-buttons each corresponding to one of said positions, a normally open switch for each push-button electrically connected with a respective one of the brush contacts, an additional normally open switch, the motor requiring for its operation the closure of any one of the push-button switches and said additional switch and the electrical contact between a corresponding brush contact and the position-determining disc, means adapted upon selective operation of a push-button to lock its associated switch in closed position and to momentarily close the additional switch whereupon the motor is energized provided its circuit is closed at the disc, and an electromagnet included in the motor circuit for holding the additional switch closed only until the circuit is broken at the disc whereupon the tuning device will be adjusted to a desired position, the arrangement being such that subsequent manual adjustment of the tuning device involving incidental movement of the disc will be ineffective to complete the motor circuit.

12. Control mechanism for a radio receiver for automatically effecting adjustment of the tuning device thereof to selected positions corresponding each to one of a plurality of predetermined broadcasting stations, and for permitting manual adjustment of the tuning device subsequent to the automatic selection of a station, comprising a motor for actuating the tuning device, a selector disc movable with said device and electrically associated with the motor for determining the position to which said device is to be actuated, a plurality of adjustably set brush contacts disposed in permanent contacting relation with the selector disc and each corresponding to one of the predetermined stations, a series of normally open switches each associated with one of the brush contacts, an additional normally open switch included in the motor circuit, a plurality of push-buttons, one for each of the first-mentioned switches, adapted upon operation of any one of the push-buttons for momentarily closing said additional switch, and an electromagnet included in the motor circuit for holding said additional switch closed for only the duration of the motor operation.

13. In a radio tuning control system, a tuning device to be adjusted, a motor for actuating said device, means for moving the device to predetermined positions including a conductive position-determining disc having a stop gap movable with the tuning device and a plurality of radially adjustable stationary brush contacts, a plurality of selectively operable push-buttons each corresponding to one of said positions, a normally open switch for each push-button electrically connected with a respective one of the brush contacts, an additional normally open switch, the motor requiring for its operation the closure of any one of the push-button switches and said additional switch and the electrical contact between a corresponding brush contact and the position-determining disc, means adapted upon selective operation of a push-button to lock its associated switch in closed position and to momentarily close the additional switch whereupon the motor is energized provided its circuit is closed at the disc, an electromagnet included in the motor circuit for closing the additional switch, and a time delay device for keeping said additional switch closed for a brief interval after the circuit is first broken at the disc and for introducing a resistor to reduce the motor operation until the final breaking of the circuit, the arrangement being such that subsequent manual adjustment of the tuning device involving incidental movement of the disc will be ineffective to complete the motor circuit.

14. Control mechanism for a radio receiver for automatically effecting adjustment of the tuning device thereof to selected positions corresponding each to one of a plurality of predetermined broadcasting stations, and for permitting manual adjustment of the tuning device subsequent to the automatic selection of a station, comprising a motor for actuating the tuning device, a selector disc movable with said device and electrically associated with the motor for determining the position to which said device is to be actuated, a plurality of adjustably set brush contacts cooperatively associated with the selector disc and each corresponding to one of the predetermined stations, a series of normally open switches each associated with one of the brush contacts, an additional normally open switch included in the motor circuit, a plurality of push-buttons, one for each of the first-mentioned switches, adapted upon operation of any one of the push-buttons for momentarily closing said additional switch, an electromagnet included in the motor circuit, an armature under the control of said electromagnet for effecting closure of said additional switch, and a time delay device associated with said armature for causing the opening of said additional switch to be delayed for some time after the electromagnet is deenergized.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,081,686	Thomas	May 25, 1937
2,108,607	Nelson	Feb. 15, 1938
2,153,865	Gersch	Apr. 11, 1939
2,177,683	Benton	Oct. 31, 1939