Feb. 29, 1944. A. W. PLENSLER 2,342,691

CONTROL APPARATUS

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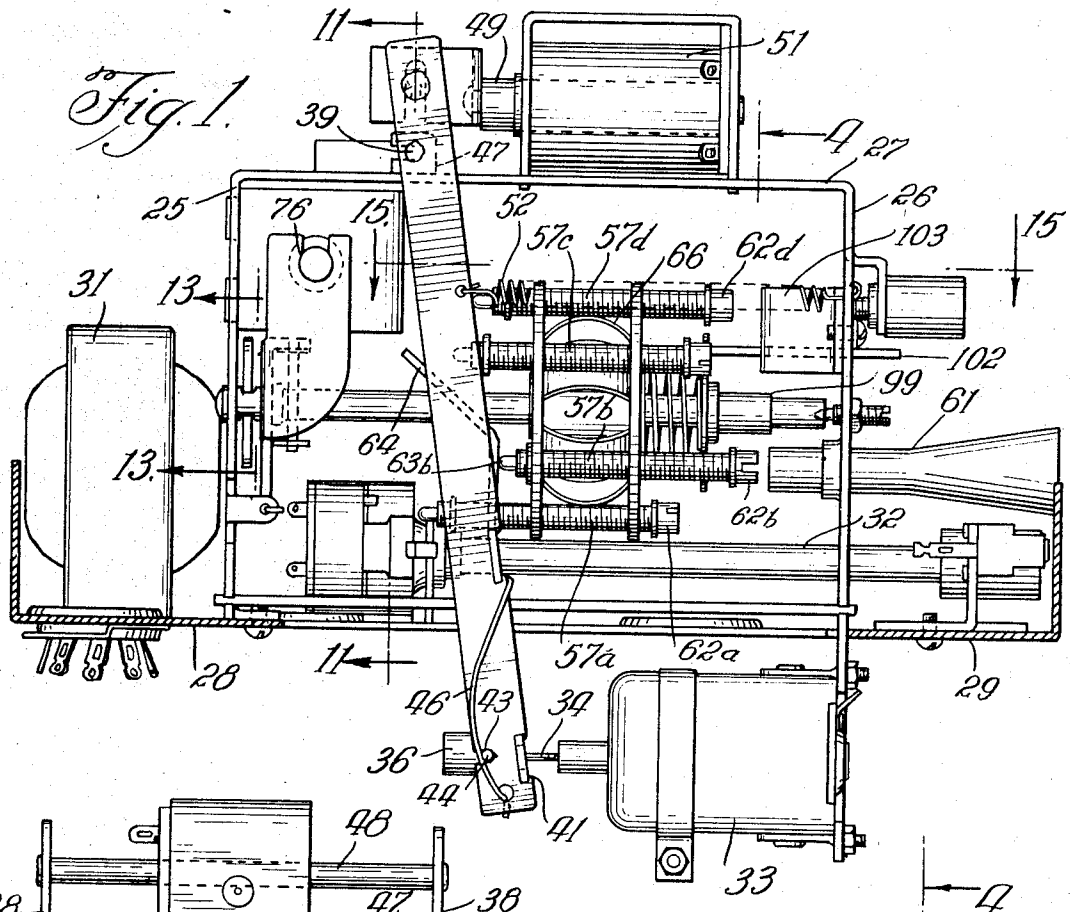


Fig. 1.

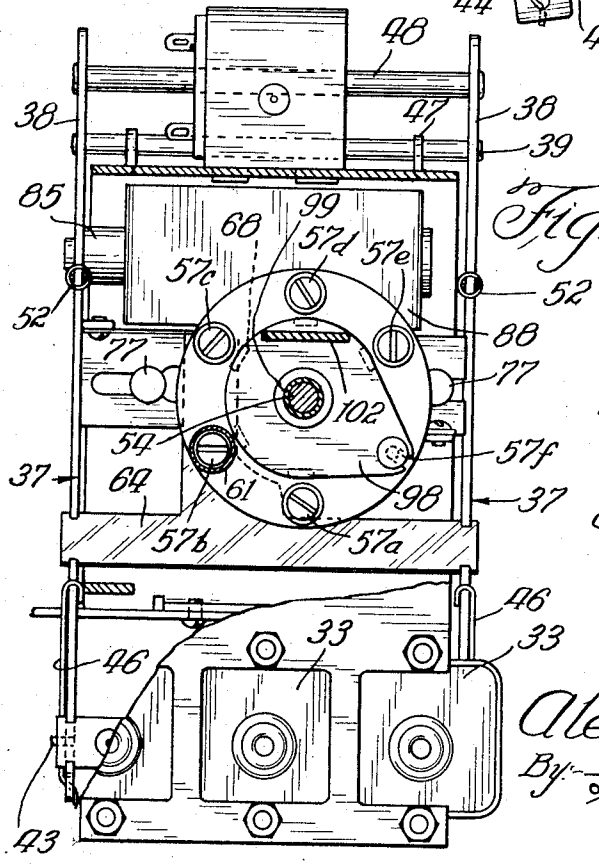


Fig. 4.

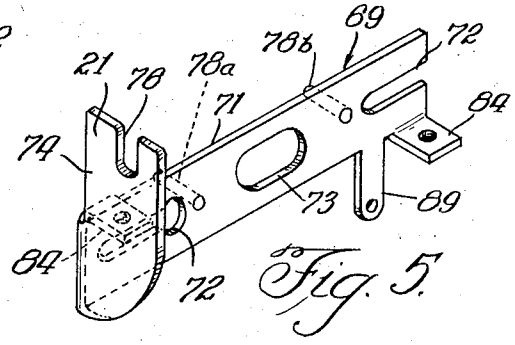


Fig. 5.

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CONTROL APPARATUS

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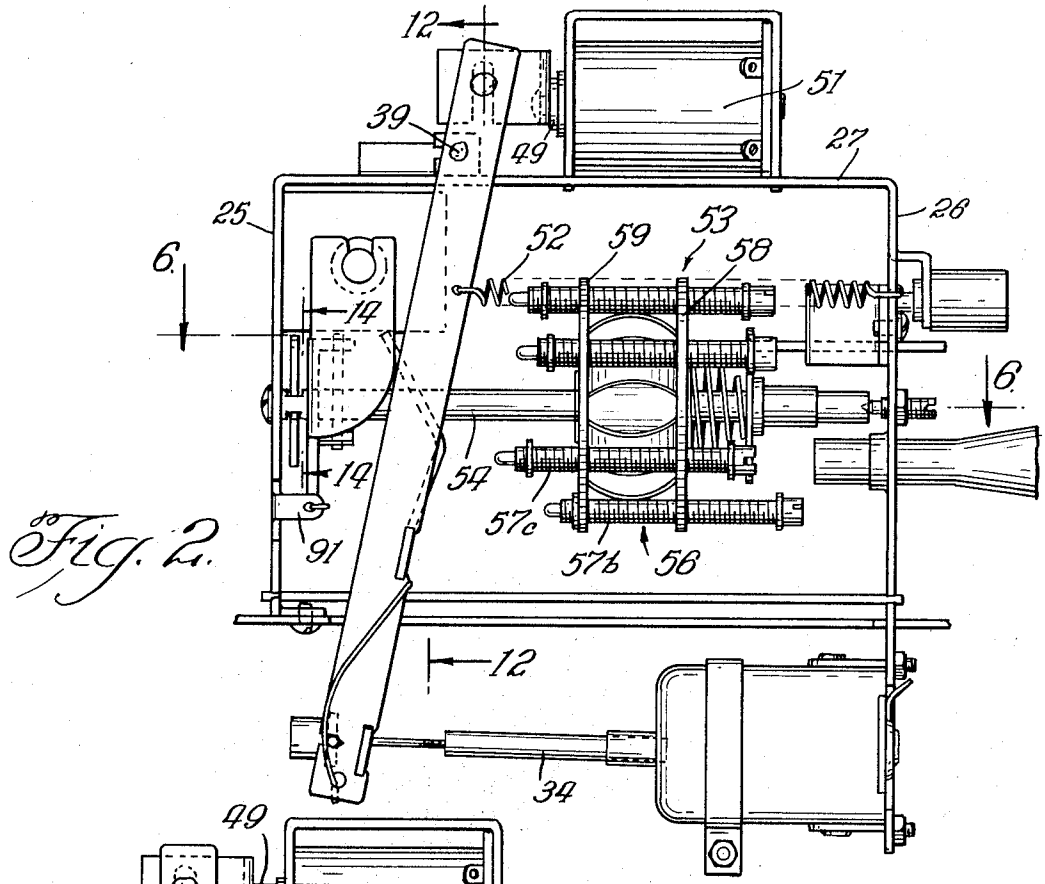


Fig. 2.

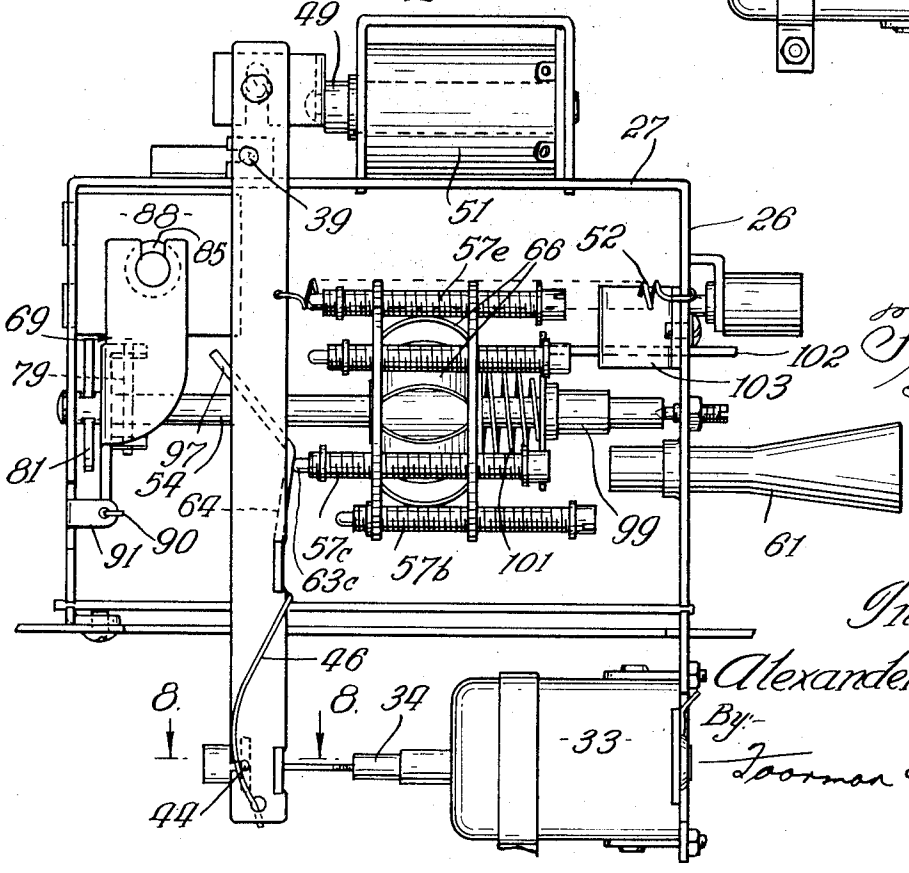


Fig. 3.

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CONTROL APPARATUS

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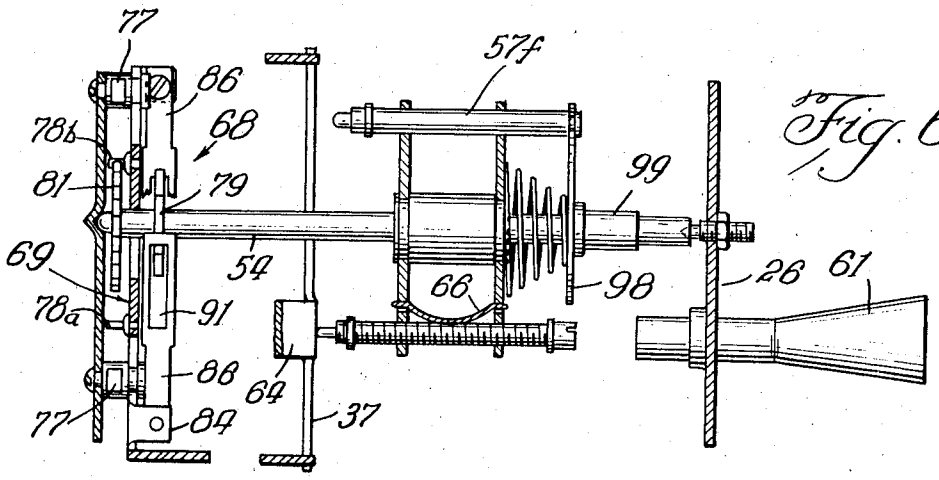


Fig. 6.

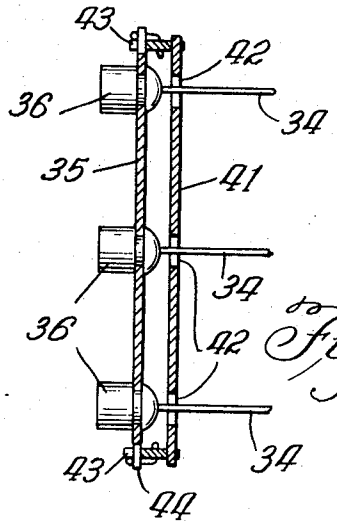


Fig. 8.

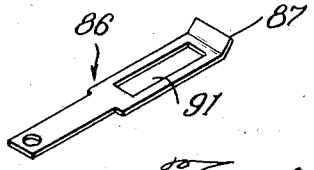


Fig. 7.

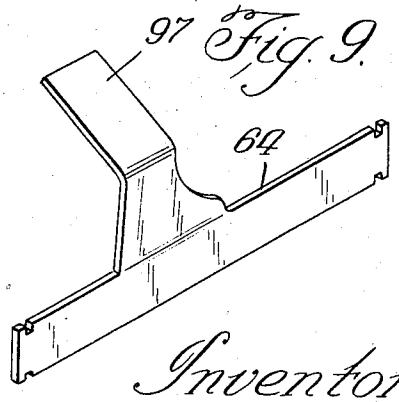


Fig. 9.

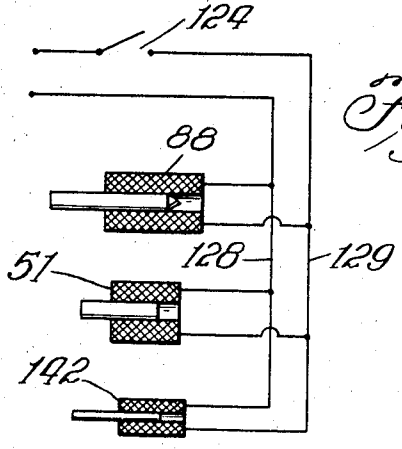


Fig. 10.

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CONTROL APPARATUS

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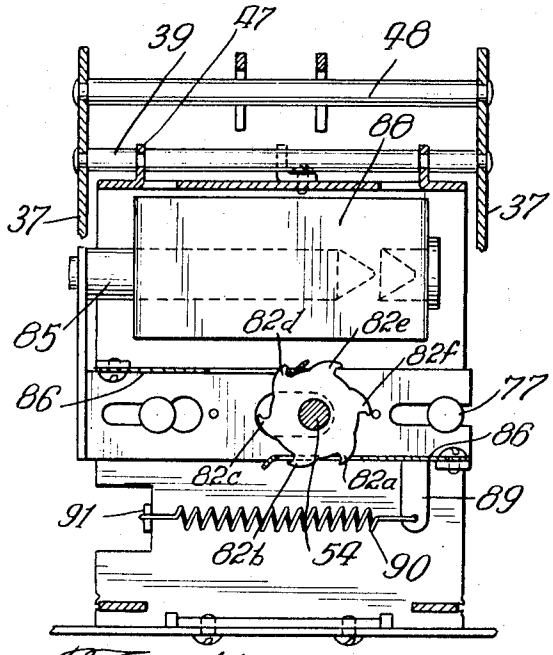


Fig. 11

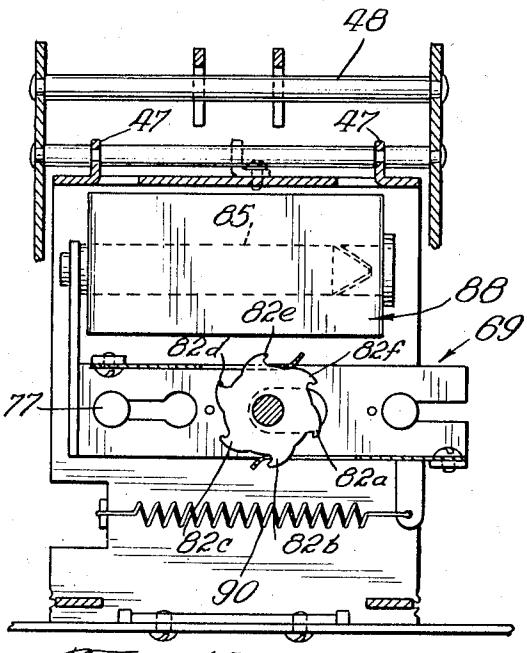


Fig. 12

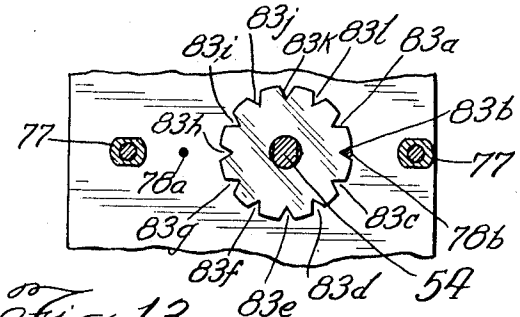


Fig. 13.

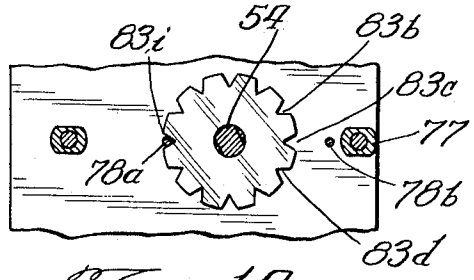


Fig. 14

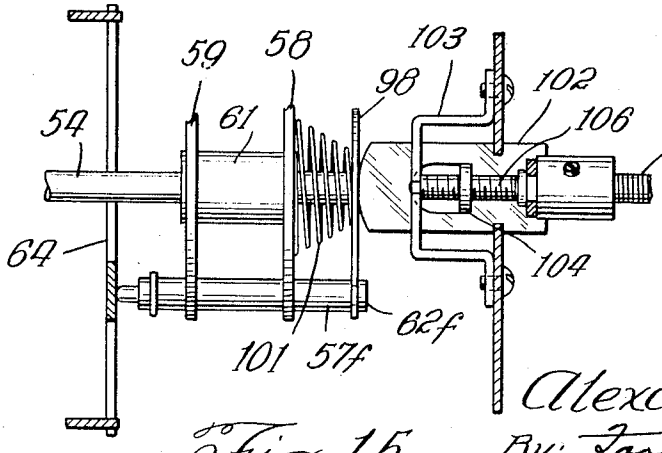


Fig. 15

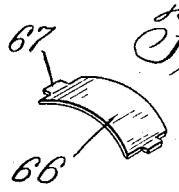


Fig. 16

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CONTROL APPARATUS

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Fig. 17.

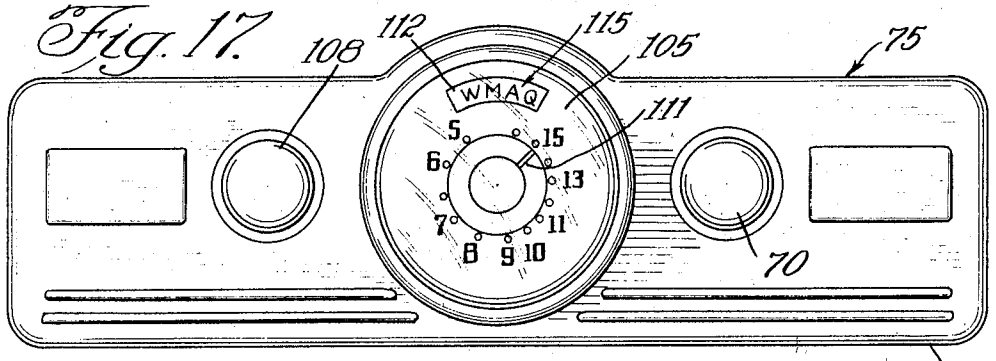


Fig. 18.

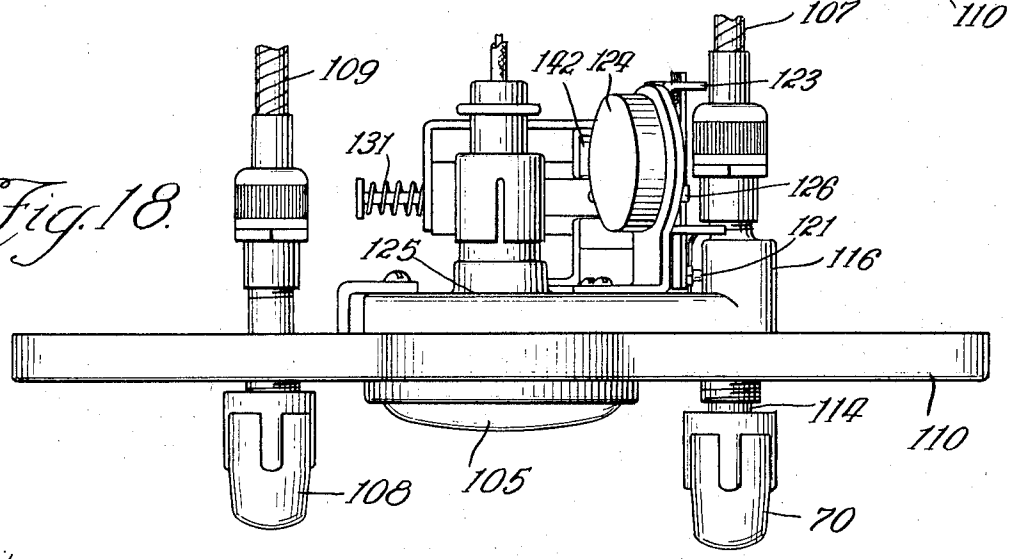
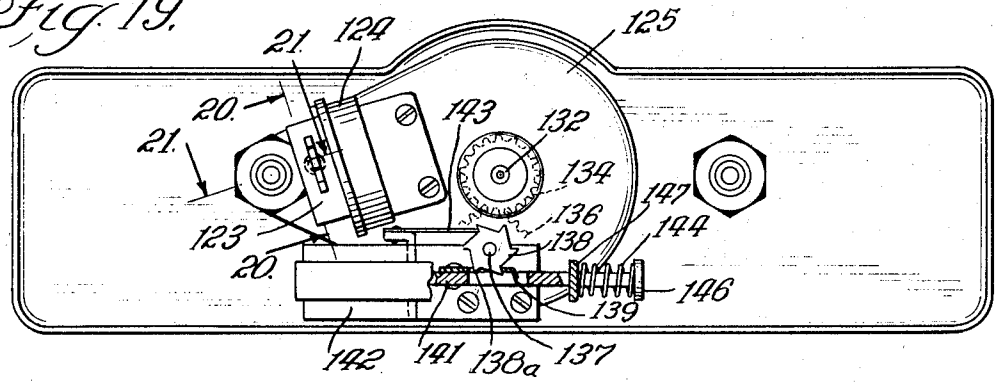


Fig. 19.



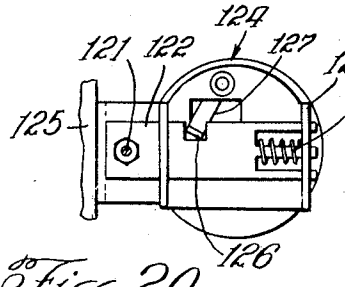


Fig. 20.

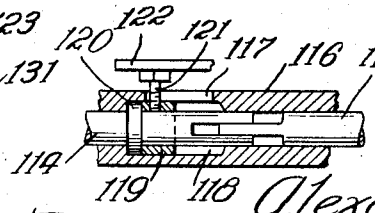


Fig. 21.

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Patented Feb. 29, 1944 2,342,691

UNITED STATES PATENT OFFICE

2,342,691

CONTROL APPARATUS

Alexander W. Plensler, Chicago, Ill., assignor to Belmont Radio Corporation, Chicago, Ill., a corporation of Illinois

Application February 10, 1941, Serial No. 378,232

18 Claims. (Cl. 74—10)

This invention relates to control apparatus and in particular to a tuning device for radio receiving apparatus which is operated step-by-step to all tuning positions by a single push button or actuator knob.

Radio receiving apparatus for automobiles is generally limited as to size because of the restricted spaces in which it can be installed. This restriction as to size is pertinent to the control head which is usually mounted on the dashboard as well as to the radio chassis generally located below or back of the dashboard. A control head, therefore, having a minimum of control knobs or push buttons arranged thereon is more readily applicable for mounting on different kinds of dashboards than a control head including a plurality of push buttons. It is well known that tuning devices of the step-by-step type may be operated by a single push button so as to require but a small control head in conjunction therewith. However, tuning devices of this type available in the prior art are generally cumbersome and relatively expensive in cost. As a result, the small size and compactness of a control head having a single push button are offset by the bulk of the tuning device so that these devices are generally unsuitable for use in automobile receiving sets. Because of this bulk these prior art devices need relatively large operating solenoids which require more electrical energy for their energization than can be obtained from the usual car battery. A further disadvantage is found in the fact that the step-by-step tuners of the prior art are generally unreliable in accurately and precisely tuning the receiver to a predetermined tuning frequency.

It is an object of this invention, therefore, to provide an improved tuning device for radio receiving apparatus.

Another object of this invention is to provide an improved radio tuning device of the step-by-step type.

A further object of this invention is to provide a tuning device for radio receiving apparatus which is simple in construction, inexpensive in cost, dependable in operation and of a size adapted to be positioned within relatively restricted spaces.

Another object of this invention is to provide an improved radio tuning device of step-by-step type which is compact and rugged in construction, and adapted to be either manually or electrically operated by a single actuating knob.

A feature of this invention is found in the provision of a radio tuning device of step-by-step type having a rotary control unit including a plurality of circularly arranged selector members adapted to be successively moved into operative engagement with frequency changing means to adjust the same to a predetermined tuning frequency. The successive rotation of the rotary control unit a predetermined angular distance is accomplished by a reciprocating actuating unit which is linearly slidable relative to the control unit and acts to rotate the same on linear movement in either direction.

A still further feature of this invention is found in the provision of a radio tuning device having a pivotally movable control or treadle unit which is adapted to be selectively engaged by a plurality of selector members to adjust linearly adjustable frequency changing means to a predetermined tuning position.

Another feature of this invention is found in the provision of an electrically operated radio tuning device in which the operated parts are so constructed and arranged as to be operated with a minimum of electrical energy. All of the actuating solenoids in the tuning device, therefore, may be of a relatively small size to facilitate their assembly in restricted spaces and to assure their efficient operation from a limited source of electrical supply, such as a car battery. It is also obvious that the use of small solenoids correspondingly reduces the initial cost of the tuning device.

Further objects, features, and advantages of this invention will become apparent from the following description when taken in connection with the accompanying drawings in which:

Fig. 1 is a longitudinal sectional view of the tuning device of this invention;

Fig. 2 is a view illustrated similarly to Fig. 1, showing the rotary control and treadle units in a changed position;

Fig. 3 is a view also illustrated similarly to Fig. 1 showing the rotary control and treadle units in yet another changed position;

Fig. 4 is a sectional view as seen along the line 4—4 in Fig. 1, showing the circular arrangement of the selector members and the relative position of the rotary control means transversely of the treadle unit;

Fig. 5 is a view in perspective of the reciprocating portion of the unit for actuating the rotary control means;

Fig. 6 is a view partly in section taken along the

line 6—6 in Fig. 2 and showing a plan view of the reciprocating actuator unit;

Fig. 7 is a view in perspective of a pawl member for the reciprocating actuator unit;

Fig. 8 is a fragmentary sectional view as seen along the line 8—8 in Fig. 3;

Fig. 9 is a view in perspective of a portion of the treadle unit;

Fig. 10 illustrates diagrammatically a control circuit for the tuning device of Fig. 1;

Fig. 11 is a sectional view taken along the line 11—11 in Fig. 1 showing a front elevation of the reciprocating unit;

Fig. 12 illustrated similarly to Fig. 11 is taken along the line 12—12 in Fig. 2 and shows the reciprocating unit in a changed position;

Fig. 13 is a fragmentary sectional view taken along the line 13—13 in Fig. 1 showing locking means for the rotary control means;

Fig. 14 illustrated similarly to Fig. 13 is taken along the line 14—14 in Fig. 2 and shows the locking means in a changed position;

Fig. 15 is a sectional plan view as seen along the line 15—15 in Fig. 1 showing the selector member adapted to manually tune the tuning device;

Fig. 16 is a view in perspective of a spring member for frictionally retaining the selector members in their adjusted positions;

Fig. 17 is a front elevational view of a control head for the tuning device of Fig. 1;

Fig. 18 is a plan view of the control head shown in Fig. 17;

Fig. 19 is a rear elevational view of the control head shown in Fig. 17;

Fig. 20 is a fragmentary sectional view as seen along the line 20—20 in Fig. 19; and

Fig. 21 is a fragmentary sectional view as seen along the line 21—21 in Fig. 19.

The radio tuning device of this invention is illustrated as being of the step-by-step type and having linearly adjustable frequency changing means of inductance type. Movable cores for tuning the frequency changing means to predetermined tuning frequencies are operatively connected to one end of a pivoted treadle or control unit which is pivotally movable in a direction toward and away from the frequency changing means. By variably limiting the movement of the treadle unit toward the frequency changing means the cores are adjusted to predetermined tuning positions. This limiting of the pivotal movement of the treadle unit toward the frequency changing means is accomplished by the provision of a rotary control unit including a plurality of selector members concentrically arranged about a control shaft. The selector members or screws are adjustable axially of the control shaft and arranged so that only one thereof is in operative engagement with the treadle unit at one time. By controlling the rotation of the control shaft, therefore, to engage successive selector members with the treadle unit there is provided a step-by-step operation of the tuning device. To accomplish this controlled rotation of the control shaft there is provided at one end thereof a ratchet wheel which is in operative association with a reciprocally movable actuating unit. Pawl members on the actuating unit are alternately engageable with the ratchet wheel so that for each reciprocal operation of the actuating unit the ratchet wheel is rotated a predetermined distance by each of the pawls. This rotation of the ratchet wheel during each reciprocal operation of the actuating unit is such as to successively rotate each selector member into engagement with the treadle unit.

In the practice of this invention it is contemplated that the tuning device be adapted for both electrical and manual tuning. In providing for manual tuning one of the selector members is assembled for slidable movement relative to the control shaft, and is operatively connected with a control knob such that rotation of the knob in either direction serves to either retract or extend the slidable member relative to the treadle unit to in turn adjust the movable cores of the inductance tuning units to a desired tuning position. It is contemplated further that this control knob also be used when electrical tuning of the device is desired.

Referring to the drawings, the invention is shown in Fig. 1 as including an inverted U-shaped frame member having leg or end portions 25 and 26 and a top or connecting portion 27. Each of the end walls or plates 25 and 26 has mounted thereon transversely extending frame members 28 and 29 of substantially right-angled shape. A transformer for the radio receiver is mounted on the end plate 25 and frame member 28, the end plate 26 and frame member 29 serving in part to support a portion 32 of the volume and off-and-on control means for the radio receiver. Frequency changing means for the tuning device are of the inductance tuning type, with each inductance unit 33 including a coil (not shown) and a linearly adjustable core member 34 movable within the coil. The inductance units 33 are arranged side by side in horizontal alignment and mounted to the end plate 26.

Each core element 34 is provided at its outer end with a rubber grommet 36 (Figs. 1 and 8) for connection to a pivoted bar 35 formed as a part of a pivoted treadle or control unit 37. The treadle unit includes a control arm or lever 38 (Fig. 4) arranged at each end of the aligned inductance units 33 and connected together at the top by a pin or axis means 39 and at the bottom by a brace or tie bar 41 having openings 42 formed therein for receiving the end portions of the cores 34. The bottom end of each lever 38 is formed with a recess 43 adapted to receive therein an axis portion 44 provided on each end of the pivoted bar 35. The axis portions 44 are retained in their corresponding recesses 43 by a wire spring 46 supported on each arm 38 and arranged to exert a holding pressure on the axis portions 44. Because of the tie bar or brace 41, the ends of the pivoted bar 35 are clear of the control levers 38 so that the bar 35 is freely and easily movable at all times. By virtue of the pivoted bar 35 the pivoted movement of the treadle unit 37 is transmitted to the cores 34 to provide for a substantially linear movement thereof within their corresponding coils whereby to adjust the inductance units to various tuning positions for the radio receiver.

The pin 39 connecting the upper ends of the control arms 38 is rotatably supported in journal portions 47 mounted on the top 27 of the frame means. The control arms or side frame members 38 for the treadle unit 37 are also connected together at their upper ends by a connecting pin 48 which is in operative engagement with a slidable plunger or core member 49 for an actuating solenoid 51 mounted on the frame wall 27. By virtue of the small distance between the connecting pins 39 and 48 as compared with the distance between the pin 39 and the axis portions 44 on the pivoted bar 35 it is readily apparent that a

relatively small movement of the plunger 49 effects a relatively large movement of the lower ends of the levers 38 and hence of the adjustable cores 34. As a result of this small movement of the plunger 49 a relatively small actuating solenoid 51 can be used to operate the adjustable members 34.

Since a particular tuning position for the radio receiver depends upon the positions of the cores 34 relative to their corresponding coils it is obvious that the position of the treadle unit relative to the inductance units 33 determines such tuning positions. The treadle unit on energization of the solenoid 51 is pivotally moved in a direction away from the inductance units 33 and adjustment of the cores 34 is obtained by variably limiting or stopping the pivotal movement of the treadle unit in an opposite direction, or in other words in its return movement toward the inductance units. The stop position of the treadle unit in its return movement corresponds to a desired position of the cores 34 in their respective coils and hence to a desired predetermined tuning frequency. The return movement of the treadle unit to a stop position is accomplished by tension springs 52 connecting each of the arms 38 with the end plate 26.

To variably limit the return movement of the control unit 37 there is provided a rotary control means or unit, designated generally as 53, including a control shaft 54 which extends between the lever arms 38 and is rotatably supported in the end plates 25 and 26. Mounted on the control shaft 54 and near one end thereof is a selector or barrel unit 56 including a plurality of selector members 57*a*—57*f*. The selector members 57 are equiangularly spaced in concentric arrangement about the shaft 54 by spacer plates 58 and 59 mounted on the shaft. Although six selector members are shown it is to be understood that the number may be changed to any aliquot part of 360 degrees. The spacing of the plates 58 and 59 is determined and retained by a spacer or collar 61 (Figs. 6 and 15) arranged therebetween. The selector members or screws 57*a*—57*e* are threadably engaged in axially aligned apertures formed in the plate members 58 and 59 so as to be adjustable axially of the shaft 54. It is contemplated that one of the selector members, such as the one indicated as 57*f* (Figs. 4, 6 and 15) be slidably movable relative to the plate members 58 and 59, rather than screwed therein to provide for a manual operating of the tuning device in a manner to be later explained. As will also be later explained, the selector members 57*a*—57*f* are successively moved to occupy similar positions for each complete revolution of the control shaft 54. By virtue of the arrangement and construction of the rotary control means 53 and treadle unit 37 only one of the selector members 57*a*—57*f* is in engagement with the treadle unit at any one time. In the adjustment of the selector members 57*a*—57*e*, therefore, it is only necessary to bring a selector member to its tuning position, the selector screw 57*b* being indicated in Fig. 1. In axial alignment with the selector screw 57*b* is a guiding element 61 for a screw driver. The element 61 may be mounted in either the end plate 26 or frame member 29 so as to be available through an opening in the radio receiver housing (not shown) for the ready insertion of a screw driver.

In this adjustment the screw driver inserted within the guiding element 61 is moved into engagement with the slotted end 62*b* of the screw 57*b*. The opposite end 63*b* of the screw 57*b* is operatively engageable with a stop or bracket member 64 (Figs. 1, 4 and 9), extending between and connected to the lever arms 38 of the treadle unit 37. The outermost position of the selector member is such as to permit the return of the core members 34 of the inductance units 33 to a substantially completely retracted position within their corresponding coils, so that the adjusting or threading of the selector member 57*b* within the plates 58 and 59 to a predetermined selected position moves the treadle unit 37 in a direction to prevent a complete retraction of the cores. Engagement of the bracket member 64 with the pin end 63*b*, therefore, limits the pivotal movement of the treadle unit 37 in a direction toward the inductance units 33 to adjust such units to the particular tuning position. The pivotal movement of the treadle unit 37 in response to the action of the springs 52 is thus in accordance with the adjusted position of the selector member 57*b*. The screws 57*a* and 57*c*—57*e* are similarly adjustable to a preselected control position. Retention of a selector member in its adjusted position is had by means of a flat spring 66 (Figs. 4 and 16) having ear portions 67 adapted to be inserted in corresponding apertures 68 formed in the plate members 58 and 59. Each spring 66 when inserted in the apertures 68 is bowed outwardly from the shaft 64 to frictionally engage a corresponding selector member 57*a*—57*f*.

In the step-by-step operation of the tuning device it is necessary that the control shaft 54 be rotated a predetermined angular distance whenever a selector member 57*a*—57*f* is to be moved out of engagement with the treadle unit 37. To accomplish this controlled rotation of the shaft 54 there is provided an actuating unit, indicated as 68 (Figs. 1, 4 and 6) including a slidable reciprocating member 69 (Fig. 5). Sliding member 69 is of integral construction and is comprised of a body portion 71 having a slot 72 formed near each end thereof and an elongated opening 73 formed therein between such slots. Member 69 includes further a laterally extending end portion 74 having a recess 76 therein. Slots 72 are adapted to receive supporting or guide pins 77 mounted in the end plate 25 (Figs. 4 and 6). Sliding member 69 is supported on the pins 77 such that pin or stop members 78*a* and 78*b* mounted thereon, one between each slot 72 and the opening 73, are positioned between the body portion 71 of the sliding member and the end plate 25. The opening 73 is of a size to receive the control shaft 54 therethrough, a ratchet wheel or rotary driven member 79 being mounted on the shaft 54 to one side of the sliding member 69 and a detent or notched wheel 81 being mounted on the control shaft on the opposite side of the member 69. The ratchet wheel 79 is illustrated as being formed with six ratchet or teeth portions 82*a*—82*f* while the wheel 81 is illustrated as being formed with twelve notches 83*a*—83*l*. It is thus seen that the rotation of the ratchet wheel 79 by an amount corresponding to one tooth thereon is equivalent to a rotation of the notched wheel 81 corresponding to two of the notches formed therein.

Supported on laterally extending ear portions or legs 84, formed integrally with the sliding member 69 are spring pawls 86 (Fig. 7) of substantially flat form and having bent or hooked ends 87. Each pawl 86 extends inwardly of the member 69 so that the hooked ends 87 are arranged substantially opposite each other and on each side of the opening 73. Wheel 79 is positioned on the

shaft 54 between the pawls 86 with its circumference in engagement therewith. The stop pins 78a and 78b are in longitudinal alignment with the axis of the control shaft 54 and on opposite sides of the notched wheel 81, to alternately engage the wheel 81 during reciprocation of the member 69, as will be hereinafter explained. The reciprocating or sliding member 69 is linearly moved in one direction by an actuating solenoid 88 mounted on the end plate 25 and having a plunger 85 movable therein which is operatively connected with the sliding member 69 at the recess 76 therein. On de-energization of the solenoid 88 the member 69 is moved in an opposite direction by a tension spring 90 connected at one end to a transversely extending portion 89 on the sliding member 69 and at its other end to a lug 91 formed on the end plate 25.

In the step-by-step operation of the tuning device it is contemplated that the solenoids 51 and 88 be simultaneously energized on linear actuation of a control knob 70 provided on a control head 75 (Fig. 17) to be later described. Prior to this energization of the solenoids let it be assumed that the parts of the tuning device are arranged as shown in Fig. 1, this positioning of the rotary control means 53 and treadle unit 37 in Fig. 1 being in correspondence with the position of the actuating unit 68 as illustrated in Figs. 11 and 13. As also shown in Fig. 1 selector member 57b is an engagement with the stop member 64 of the pivoted control unit 37. When the solenoids 51 and 88 are energized the control unit 37 is pivotally moved to the left as viewed in Fig. 1 and out of engagement with the selector member 57b to its position shown in Fig. 2. Concurrently with this movement of the control unit 37, the sliding member 69 is moved from its position shown in Fig. 1 to the position indicated in Fig. 12, which corresponds to Fig. 2. As the sliding member 69 moves from the position in Fig. 11 to the position in Fig. 12, the lower pawl 86 by virtue of the opening 91 therein, engages tooth 82b and rotates the ratchet wheel 79 in a counter-clockwise direction from its position in Fig. 11 to the position shown in Fig. 12. During this rotation of the ratchet wheel by the lower pawl 86, the upper pawl, by virtue of its hooked end 87, is sprung in an upward direction by the tooth 82e, until the tooth 82e is received in the opening 91 of the upper pawl.

As previously mentioned, the selector unit 56 is comprised of six selector members 57a—57f. Since the selector members are equally spaced about the control shaft 54, they are spaced a distance apart equal to 60 degrees. During the reciprocal operation of the sliding member 69, therefore, it is necessary that the control shaft 54 be rotated exactly sixty degrees to successively position the selector members in engagement with the stop member 64 of the pivoted control unit 37. Thus on energization of the solenoid 88 the ratchet wheel 79 is rotated one tooth portion by the lower pawl 86 to in turn rotate the control shaft 54 an angular distance equal to 30 degrees. When the solenoid 88 is deenergized, on release of the knob 70, the control shaft 54 is rotated the remaining 30 degrees by the engagement of the upper pawl 86 with the ratchet 82e on the return movement of the sliding member 69, to in all provide for a 60 degree rotation of the control shaft. Thus on completion of the sixty degree rotation of shaft 54 the screw 57c (Fig. 3) is positioned for engagement with the stop portion 64 of the treadle unit 37. During the return movement of the member 69 it is obvious that the lower pawl is sprung by the tooth 82c until such tooth is positioned in the opening 91 therein. On later energization of the solenoid 88, therefore, the actuating unit is again set to rotate the control shaft 54 a predetermined angular distance.

By virtue of the mass of the rotary control means 53, it is readily apparent that unless the shaft 54 is immediately stopped against rotation after each rotational movement by the actuating unit, the inertia forces thereof will tend to overthrow or carry the shaft beyond its predetermined position. To eliminate any overthrow of the shaft 54 and to accurately and positively stop the shaft 54 and hence the selector members in their predetermined positions, the stop pins 78a and 78b on the sliding member 69 are arranged or spaced relative to the notched wheel 81 so that one thereof is positioned within a notch 83 whenever the sliding member 69 reaches one end of its linear travel. Thus as shown in Fig. 13, which corresponds to Fig. 11, the pin 78b is positioned within a notch 83b. On movement of the slide member 69 to its position shown in Fig. 12 the pin 78b is moved out of the notch 83b and the wheel 79 is rotated with the shaft 54 the distance between two notches to the position shown in Fig. 14, which corresponds with Fig. 12. Thus when the sliding member 69 moves to its extreme position to the right, as viewed in Fig. 12, the pin 78a is moved into the notch 83i. Since the wheel 79 is formed with twelve notches it is readily apparent that the notched wheel has been rotated an angular distance equivalent to the space between two of the notches or 30 degrees. The shaft 54 is thus locked against further rotation after it has been rotated the first 30 degrees. On the return of the slide member 69 to its rest position by the tension spring 90, pin 78a is moved out of the notch 83i while the wheel 79 is additionally rotated in a clockwise direction by the pulling of the tooth 82e by the upper pawl 86. When the slide member 69 reaches its rest position the pin 78b is moved into the notch 83d and locks the shaft 54 against rotation after the second 30 degrees or completion of its 60-degree angular movement. As is clearly apparent from a comparison of Figs. 13 and 14, the shaft has been rotated a distance equivalent to the distance between the notches 83b and 83d for exactly a one-sixth revolution of the wheel or 60 degrees. By virtue of the locking action of the pins 78a and 78b and the notched wheel 81 the ratchet wheel 79 and control unit 53 are always retained in synchronism to assure a precise and accurate positioning of the selector members 57a—57f, in their successive positions. This rotation of the shaft 54 thus moves the screw 57b (Fig. 4) out of the tuning position for the selector members and moves screw 57c into such position.

During the time that the shaft 54 is being rotated, the energized solenoid 51 retains the control unit 37 in its outermost position shown in Fig. 2 out of engagement with the selector members. On release of the push button 70, therefore, to deenergize the solenoids 51 and 88, the selector member 57c is in a position for engagement with the stop member 64 to limit the return of the pivoted control or treadle unit to its rest or idle position. This position of the screw 57c is illustrated in Fig. 3. In the event the pivoted control unit should engage a selected selector member before such selector member has reached its preselected tuning position, the bent portion 97 of the stop member 64 engages

the selector member. As the selector member, therefore, is rotated to its tuning position, a camming action occurs between its engaging pin end and the bent portion 97 which moves the pivoted control unit away from the inductance units 33. It is contemplated, however, that each selector member be in the tuning position prior to any engagement with the treadle unit, so that the core members 34 are always moved in the same direction to their tuning position. Any lost motion in the connecting parts is thus the same for each tuning operation so that the tuning is more precise. A similar operation of the actuating and treadle units occurs whenever the knob is actuated to energize the solenoids 51 and 88. It is to be understood of course that the rotation of the shaft 54 is uni-directional so that each selector member 57a—57f is moved to a tuning position but once during each revolution of the shaft 54.

To manually operate the tuning device the control means 53 is successively rotated in the manner above described, until the selector member 57f is in a tuning position relative to the treadle unit 37. The end 62f of the selector member 57f is notched for connection with a plate or disc member 98 (Figs. 4, 6 and 15) having a hub portion 99 slidably supported on the control shaft 54. Arranged in compression between the plate member 58 and the axially slidable disc 98 is a spring 101 of trumpet form. Plate 98 is engageable with an actuating member 102 which is slidably supported in the end plate 26 and in a U-shaped bracket member 103 mounted on the end plate, for movement axially of the control shaft 54. The actuating member 102 has an upturned lug 104 thereon which is in threaded engagement with a screw shaft 106 having one end rotatably supported in the bracket member 103 and its opposite end in operative engagement with a flexible shaft 107 which in turn is operatively connected with the actuating knob 70. On rotation of the knob 70, which will be later explained, shafts 107 and 104 are rotated to move the actuating member 102, which in turn moves the plate 98 and selector member 57f axially of the control shaft 54. This movement of the selector member 57f directly changes the pivoted position of the control unit 37 and hence the position of the cores 34 in their corresponding coils. The tuning device may thus be tuned to any tuning frequency by simply rotating the knob 70. By virtue of the continuous engagement of the actuating member 102 with the plate member 98 the selector member 57f is retained in its last tuned position on later actuation or rotation of the rotary control means 53. It is seen, therefore, that selector members 57a—57e are adjusted to a predetermined tuning position by means of a screw driver or the like for later electrical operation, and that the selector member 57f, although manually operated to a plurality of tuning positions may be retained in its last tuned position to in all provide for fixed predetermined tuning positions of all of the selector members 57a—57f in the selector unit 56.

The knob 70 and control head 75 which have been previously mentioned and which are now to be fully described are shown in Figs. 17–21. As is clearly shown in Fig. 17 the control head is of very simple and compact design and besides the actuating knob 70 includes a panel 110, a control knob 108 for turning the radio receiver off and on and for controlling its volume, and a dial 105 arranged in the panel between the control knobs 70 and 108. Control knob 108 is adapted to rotate a flexible shaft 109 which is operatively connected with the control portion 32 previously mentioned and shown in Fig. 1. The dial 105 has an indicator 111 and a space 112 for visually observing station markings. Although the shafts 107 and 109 are illustrated as flexible shafts for remote control it is obvious that the control head is also readily applicable for direct control.

Shaft 107 is provided at the control end thereof with a shaft portion 113 (Fig. 21) which is in splined engagement with a second shaft portion 114. The control knob 70 is mounted directly on the shaft portion 114. Coupling of the shaft portions 113 and 114 in axial alignment is provided by a housing or sleeve portion 116 adapted to slidably receive such portions therein and having an opening or slot 117 formed in one side thereof. Sleeve 116 has an enlarged bore portion 118 therein for slidably receiving an enlarged section 120 of the shaft portion 114 and a collar member 119 axially movable relative to the shaft portion 114. The portion 118 is in registry with the opening 117 to permit connection of the collar member 119 with an actuating element or pin 121 secured to a sliding member 122. The sliding member 122 is slidably supported in a bracket member 123 (Fig. 20) which is mounted on an electrical control switch 124 supported on a housing 125 for the dial mechanism 105, the housing including the sleeve portion 116. A recess 126 formed in the slide member 122 is adapted to receive a switch arm 127 which is pivotally connected to the switch unit 124. On linear or axial movement of the control knob 70 inwardly toward the panel 110 the shaft portion 114 is axially moved relative to the shaft portion 113 because of their splined engagement. During this relative movement the shoulder portion 120 engages the collar 119 to in turn move the pin 121 and slide member 122. This movement of the slide member 122 pivotally moves the actuating arm 127 to close the switch unit 124 As shown in the control circuit for the tuning device, (Fig. 10) closing of the switch unit 124 closes the circuit for the solenoids 51 and 88 which are connected in parallel between supply lines or conductors 128 and 129. On release of the actuating knob 70 the switch arm 127 is pivotally moved to open the switch unit 124 by a spring 131 arranged in compression between a portion of the slide member 122 and the bracket member 123. Each linear actuation of the knob 70 thus energizes the solenoids 51 and 88 to progressively move or operate by steps the rotary control means 53, as above described.

When the knob 70 is linearly actuated for step-by-step operation of the tuning device the indicator 111 remains stationary and visual indication as to the identification of the station tuned in is given by the appearance of the call letters for such station in the space 112. The station call letters appearing in the space 112 are marked on a suitable disc member or station indicator 115 which is rotatably supported within the housing unit 125 on a shaft 132. Each station indicated corresponds to one of the selector members 57a—57f. A gear 134 (Fig. 19) mounted on shaft 132 engages a second gear 136 mounted on a shaft 137, which is also rotatably supported in the housing 125. A ratchet wheel 138 mounted on the shaft 137 is in operative engagement with a

pawl member 139 supported on a plunger 141 for a solenoid 142. As shown in Fig. 10 the solenoid 142 is connected in parallel with the solenoids 51 and 88 so as to be energized concurrently therewith on closing of the control switch 124. The ratchet wheel 138 is provided with teeth portions 138a corresponding in number to the number of selector members 57a—57f. When the solenoid 142 is energized the plunger 141 is moved to the left, as viewed in Fig. 19, whereby the ratchet wheel 138 is rotated by the pawl 139 one tooth portion or a sixth of a revolution to correspondingly move the station indicator 115 an angular distance of 60 degrees, the gears 134 and 136 having a one to one ratio. A carry over of the disc 115 is prevented by a detent or spring 143 which is mounted on the solenoid 142 and engages a tooth portion 138a after each reciprocal movement of the plunger 141. The ratchet wheel 138 is thus prevented from rotating in a counterclockwise direction (as viewed in Fig. 19) with the return of the plunger 141 to its rest position. The plunger 141 on deenergization of the solenoid is moved to its rest position by a spring 144 arranged in compression between a portion 146 on the plunger and a bracket 147 mounted on the housing unit 125.

It has been previously mentioned that the indicator 111 remains stationary when the tuning device is operated step-by-step. In adjusting the selector members or screws 57a—57e to tune in certain stations, a desired station is first identified by a radio set on which the stations are already marked. The program on the second receiver is then tuned in on the receiver being set up by manipulation of the screw being adjusted. The final adjusting of the tuned position is determined by ear. When the station has been thus identified, it is marked on the station disc 115 within the space 112. In this manner all of the stations corresponding to the selector members 57a—57e are identified for visual observation. By virtue of the synchronized action between the station disc 115 and the operation of the rotary control unit 53 each selector member and its identifying marker is always maintained in correspondence. Since the marking for each station appears in the space 112 only once during each complete revolution of the control shaft 54 it is readily apparent that the rotary unit 53 must be operated step-by-step by the knob 70 until the particular station shows up in the space 112.

A portion of the station indicator 115 is also reserved to indicate when the selector member 57f is in a tuning position so that the tuning device might be manually operated. When the selector member 57f is in such position rotation of the knob 70 concurrently rotates both of the shaft portions 113 and 114 to in turn rotate the shaft 107 and operate the sliding member 102 (Fig. 15). The indicator 111 is operatively connected with the shaft portion 114 for movement over the dial 105 when the knob 70 is rotated. Thus after the setting of the member 57f is indicated in the space 112, all tuning positions thereof are indicated directly by the indicator 111 on the dial 105.

From the foregoing description it is seen that the invention provides a tuning device which is simple in construction, relatively inexpensive in cost and dependable in operation. Both the electrical and manual operation of the tuner is accomplished by the actuation of a single control knob mounted on a control head which is very compact and of a size such as to be conveniently mounted on the dashboard of an automobile. All of the actuating solenoids are relatively small and capable of being efficiently operated on the current from a car battery. The bulk of the solenoids forms only a small proportional part of the entire tuning device so as not to interfere with its installation in restricted spaces.

Although the invention has been described with specific reference to a preferred embodiment thereof, it is to be understood that it is not to be so limited, since modifications and alterations therein can be made which are within the full intended scope of the invention as defined by the appended claims.

I claim:

1. In control apparatus having control means including a rotary control member, the combination of means for rotating said rotary control member to predetermined control positions including a reciprocating unit having oppositely arranged laterally extending projections thereon, and a longitudinally extending slot formed therein between said projections for receiving said control member, a driven member mounted on said control member having radially extending portions successively arranged thereon, means supporting said reciprocating unit for movement relative to said driven member, said driven member being positioned to one side of said reciprocating unit so that the radial extensions thereon are selectively engaged by said projections on reciprocal movement of said reciprocating unit to rotate said control member, means for reciprocally moving said reciprocating unit, with said reciprocating unit during each reciprocation thereof rotating said rotary control member from one of said control positions to a second control position, and means locking said rotary control member against rotation when said reciprocating unit is in a stop position including a toothed member mounted on said control member to the opposite side of said reciprocating unit, said reciprocating unit having spaced stop portions thereon, with one of said stop portions being engageable with said toothed member when said reciprocating unit is in a stop position.

2. In control apparatus having rotary control means including a control shaft having a ratchet wheel mounted thereon, the combination of means for rotating said rotary control means to predetermined control positions including a reciprocating unit having a longitudinally extending slot formed therein adapted to receive said shaft, a spring pawl supported on said reciprocating unit on each side of said slot, said ratchet wheel being arranged in a plane parallel to the plane of said reciprocating unit and to one side thereof between said pawls, with the circumference of said ratchet wheel extending into engagement with said pawls, means supporting said reciprocating unit for reciprocal movement relative to said ratchet wheel, means for reciprocally moving said reciprocating unit, said pawls on reciprocal movement of said reciprocating unit alternately engaging sad ratchet to successively rotate said shaft in the same direction, from one of said predetermined control positions to a second predetermined position, means for limiting the rotation of said control shaft to said predetermined control positions including a notched locking wheel mounted on said control shaft and positioned on the other side of said reciprocating unit, and a pair of stop portions spaced on said reciprocating unit such that one thereof is moved into engagement with said locking wheel after

each rotation of said control shaft by said reciprocating unit.

3. In tuning apparatus for a radio receiver having adjustable frequency changing means and control means for adjusting said frequency changing means to predetermined tuning positions including a control shaft, means rotatably supporting said control shaft, a pair of plate members mounted on said control shaft in an axially spaced relation, a plurality of axially extending adjustable members supported in said plates in concentric arrangement about said shaft, with at least one of said adjustable members being axially slidable relative to said plates, and the remaining adjustable members being threaded in said plates for adjustment relative to said plate members, a sliding member slidably supported on said control shaft for movement axially thereof, said sliding member being operatively connected with said one adjustable member, manually operated means for moving said sliding member axially of the shaft to in turn adjust said one adjustable element relative to said plate members, and electrically operated means for rotating said control shaft to successively move said adjustable members into operative engagement with said frequency changing means to adjust the same to a predetermined tuning position for said radio receiver, said manually operated means retaining said one adjustable member in an adjusted position on rotation of said control shaft by said electrically operated means.

4. In tuning apparatus for a radio receiver having frequency changing means, movable control means for adjusting said frequency changing means to a predetermined frequency tuning position for said radio receiver, control mechanism for manually and electrically operating said movable control means including a control knob, electrical means operatively associated with said control means to move the same, an energizing circuit for said electrical means including a normally open control switch, means operatively connecting said control means and control knob including a coupling unit having two shaft portions in splined engagement, said two shaft portions being relatively movable in an axial direction but rotatable together to provide for a moving of said connecting means to operate said control means, the control knob being mounted on one of said two shaft portions, a sleeve member having a bore therein for slidably receiving said two shaft portions and an axially extending opening formed in one side thereof, and means for mounting said control switch adjacent said coupling unit, said control switch having an actuating element positioned in said opening for operative engagement with said one shaft portion for movement with said one shaft portion on axial movement thereof, with rotation of said control knob moving said connecting means to manually operate said movable control means, and with pushing on said control knob moving said one shaft portion and actuating element and closing said control switch to electrically operate said movable control means.

5. In tuning apparatus for a radio receiver having frequency changing means, movable control means for adjusting said frequency changing means to predetermined tuning frequencies for said radio receiver, control mechanism for operating said control means either manually or electrically including a control shaft, means operatively connecting said control shaft with said movable control means, electrical means operatively associated with said movable control means to move the same, an energizing circuit for said electrical means including a control switch, said control switch having an actuating element, and said control shaft including two separable portions, means operatively connecting said two shaft portions for concurrent rotary movement but permitting relative axial movement therebetween, means operatively connecting said actuating element with one of said shaft portions to operate said actuating element when said one shaft portion is axially moved, with said movable control means being manually operated when said one shaft portion is rotated and electrically operated when said one shaft portion is linearly moved, said linear movement axially moving said one shaft portion and moving said actuating element to operate said control switch.

6. In control apparatus having rotary control means and axis means therefor, and a ratchet and detent wheels carried on said axis means, the combination of means for rotating said rotary control means to successive control positions including a linearly movable reciprocating unit located intermediate said two wheels, with the longitudinal axis of said reciprocating unit being in the plane of said axis means, means supporting said actuating unit for movement in a path normal to said axis means, a pair of spring driving portions carried on said reciprocating unit for linear movement therewith and projected laterally in the same direction from one side of said reciprbcating unit, said driving portions being alternately engageable with opposite portions on said ratchet wheel to rotate the same in one direction during each reciprocation of said reciprocating unit, and stop portions projected laterally in the same direction from the opposite side of said actuating unit movable into locking position with said detent wheel to stop rotation of said axis means at each end of the reciprocal travel of said reciprocating unit to define said control positions.

7. In radio tuning apparatus having frequency changing means and control means for adjusting said frequency changing means to predetermined tuning positions including a rotary control shaft, a plurality of selector members concentrically arranged about said control shaft, and adjustable axially thereof, supporting means for said selector members mounted on said control shaft, with at least one of the said selector members being slidable relative to said supporting means, means operatively connecting said selector members with said frequency changing means, means for rotating said rotary control shaft to successively move said selector members into operative engagement with said frequency changing means to adjust the same to predetermined tuning positions, and other means for slidably moving said one selector member when it is in operative engagemet with said frequency changing means to adjust said frequency changing means to any desired tuning position.

8. In tuning apparatus for a radio receiver having frequency changing means and movable control means for adjusting said frequency changing means to predetermined tuning frequencies for said radio receiver, the combination of control mechanism for operating said control means either manually or electrically including a rotatable control shaft operatively connected with said movable control means, finger means

for rotating said control shaft, means supporting said finger means for axial but non-rotatable movement relative to said control shaft, electrical means operatively associated with said movable control means to move the same, an energizing circuit for said electrical means including a control switch operatively connected with said finger means, with axial movement of said finger means relative to said control shaft actuating said control switch to electrically operate said movable control means, and rotary movement of said finger means rotating said control shaft to manually operate said movable control means.

9. In control apparatus having movable control means, the combination of means for moving said control means in a step-by-step manner to predetermined control positions including a reciprocating unit, spring driving portions oppositely arranged on said reciprocating unit for movement therewith, each of said driving portions having an opening therein, a rotary member having radial projections thereon and connected with said control means, and means rotatably supporting said rotary member between said driving portions so that said projections are movable within said openings, said driving portions on movement of said reciprocating unit alternately engaging said projections at said openings to rotate said rotary member in one direction to move said control means from one control position to a second control position.

10. In control apparatus having movable control means, the combination of means for moving said control means step-by-step to predetermined control positions including a reciprocating unit, spring operating portions oppositely arranged on said unit and extended laterally in the same direction from one side thereof, a toothed wheel connected with said control means and rotatably supported between said operating portions with the teeth thereof movable into the path of travel of said operating portions, said operating portions on reciprocation of said reciprocating unit alternately engaging said teeth to rotate said wheel in one direction a predetermined angular distance.

11. In control apparatus having movable control means, the combination of means for moving said control means to predetermined control positions including a linearly movable reciprocating unit, spring operating portions oppositely carried on said reciprocating unit and extended laterally from one side thereof, a rotary member having radial projections thereon and connected with said control means, means rotatably supporting said member between said operating portions, each of said operating portions having one end fixed relative to said reciprocating unit, with said projections being movable into the path of travel of the opposite ends of said operating portions, and means for reciprocally moving said reciprocating unit, said operating portions during such reciprocal movement alternately engaging said propections to rotate said rotary member a predetermined angular distance.

12. In control apparatus having rotary control means including axis means and a toothed wheel member mounted on said axis means, the combination of means for uni-directionally rotating said rotary control means including a linearly movable reciprocating unit having a pair of driving portions oppositely arranged thereon for movement therewith, said portions projecting laterally in the same direction from one side of said reciprocating unit, means supporting said reciprocating unit for linear travel in a path normal to said axis means, with said toothed member being disposed intermediate said driving portions, with the linear path of movement of said driving portions being substantially tangential to said toothed member, said driving portions on reciprocation of said reciprocating unit being alternately moved into engagement with said teeth to successively drive said control means, with the linear movement of said driving portions providing for the retention of said engagement during the driving operation of each driving portion.

13. In tuning apparatus for a radio receiver having adjustable frequency changing means and control means for adjusting said frequency changing means to predetermined tuning positions including a control shaft, a pair of plate members mounted on said control shaft in an axially spaced relation, a plurality of axially extending adjustable members supported in said plate members in concentric arrangement about said shaft, with at least one of said adjustable members being axially slidable relative to said plates, and the remaining adjustable members being threaded in said plates for adjustment relative to said plate members, manually operated means for moving said one adjustable member relative to said plate members, and electrically operated means for rotating said control shaft to successively move said adjustable members into engagement with said frequency changing means to adust the same to a predetermined tuning position for said radio receiver, said manually operated means retaining said one adjustable member in an adjusted position on rotation of said control shaft by said electrically operated means.

14. In control apparatus having movable control means including a control shaft, a plurality of adjustable members, controllable means having a movable portion for engaging said adjustable members, means supporting said adjustable members in concentric arrangement about said shaft, manually operated means for adjusting one of said adjustable members relative to said supporting means, and electrically operated means for rotating said control shaft to successively move said adjustable members into an engaging position with said movable portion to define a predetermined control position of said controllable means, said manually operated means retaining said one adjustable member in an adjusted position on rotation of said control shaft by said electrically operated means.

15. In control apparatus having movable control means, the combination of means for moving said control means in a step-by-step manner to predetermined control positions including a reciprocating unit of substantially L-form having one leg thereof of substantially flat shape, means supporting said unit for movement of said one leg in a linear path, solenoid means extended longitudinally adjacent said one leg and substantially within the longitudinal dimension of the other leg, said solenoid means being connected with said other leg to move said unit in one direction, spring means for moving said unit in an opposite direction, driving portions carried on opposite sides of said one leg and projected laterally in the same direction from one face thereof, a toothed member rotatably supported adjacent said one face and between said driving portions, with the teeth on said toothed member being successively movable into the path of linear movement of said driving portions, said driving portions on recip-

rocation of said unit alternately engaging said teeth to successively move said control means, stop portions projected laterally in the same direction from the opposite face of said one leg, and a detent wheel rotatably supported adjacent said opposite face, said stop portions being alternately movable into locking engagement with said detent wheel to stop the actuating unit at each end of its reciprocal travel to define said control positions.

16. In control apparatus, movable control means including spaced adjustable elements, controllable means, movable means connecting said control means and controllable means including a stop portion engageable with said adjustable elements, means for moving said control means in a step-by-step manner to successively move said adjustable elements into a position for engaging said stop portion, means operated concurrently with said moving means for moving said stop portion in one direction out of an engaging position with said adjustable elements, and means for moving said stop portion in an opposite direction on completion of a step movement of said control means to provide for said stop portion always being moved in the same direction into engagement with an adjustable element.

17. In control apparatus which includes a plurality of adjustable members, controllable means having a portion for engaging said adjustable members, supporting means for said adjustable members, manually operable means for adjusting one of said members relative to said supporting means, and electrically operated means for moving said supporting means to successively actuate said adjustable members into an engaging position with said portion of said controllable means, said manually operable means retaining said one adjustable member in its adjusted position during movement of said supporting means by said electrically operated means.

18. In tuning apparatus for a radio receiver having frequency changing means and movable control means for adjusting said frequency changing means to predetermined tuning frequencies for said radio receiver, the combination of means for operating said movable control means either manually or electrically, including a rotatable control shaft operatively connected with said movable control means, finger means for rotating said control shaft, means supporting said finger means for movement in two different directions, an energizing circuit for said electrical means, means responsive to movement of said finger means in one direction for completing said circuit, and means including a mechanical connection between said finger means and said control shaft for directly actuating said control shaft when said finger means is moved in the other direction.

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