Oct. 21, 1941. E. H. ALLEN 2,259,719

RADIO STATION SELECTOR

Filed May 20, 1938 3 Sheets-Sheet 1

FIG. 1.

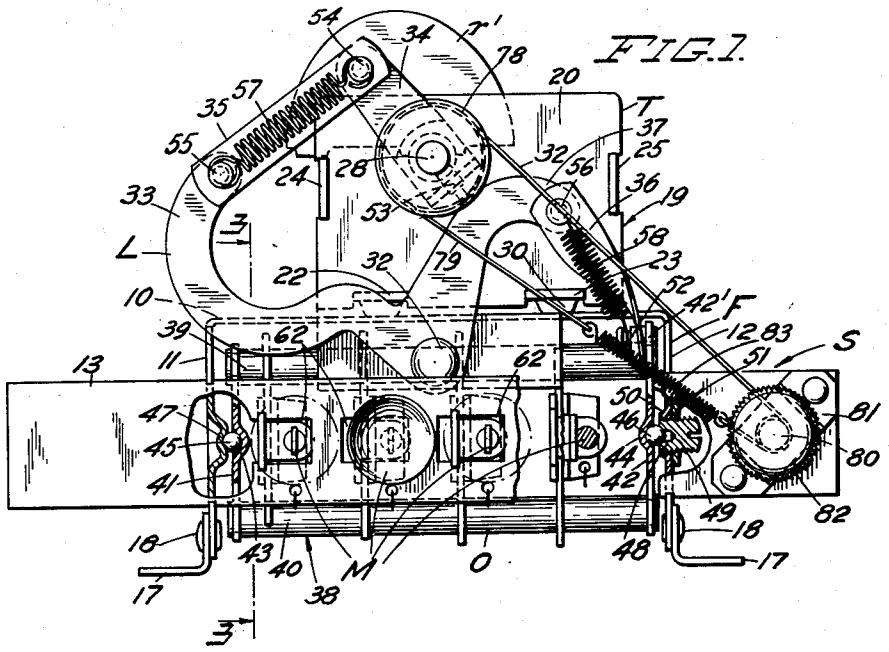

FIG. 2.

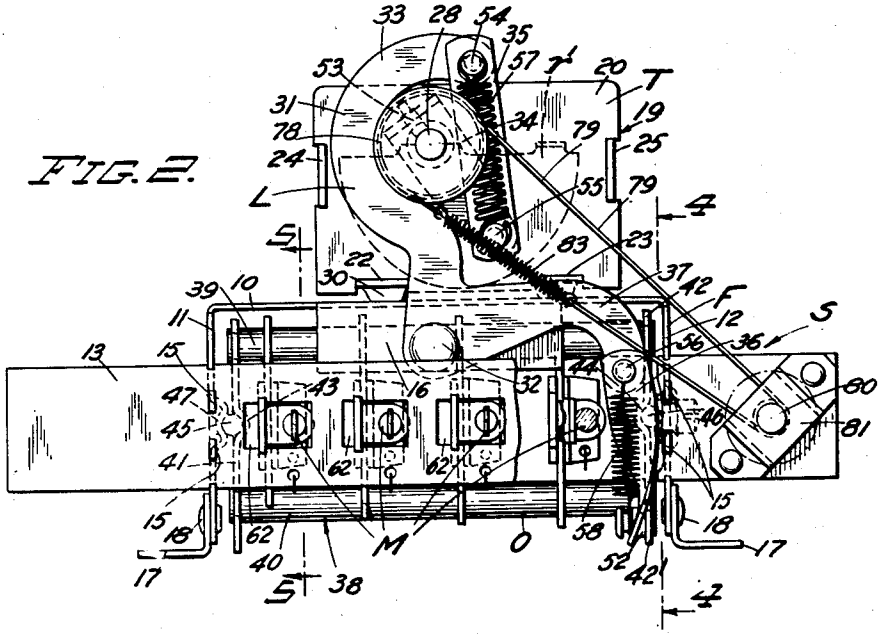

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FIG. 3.

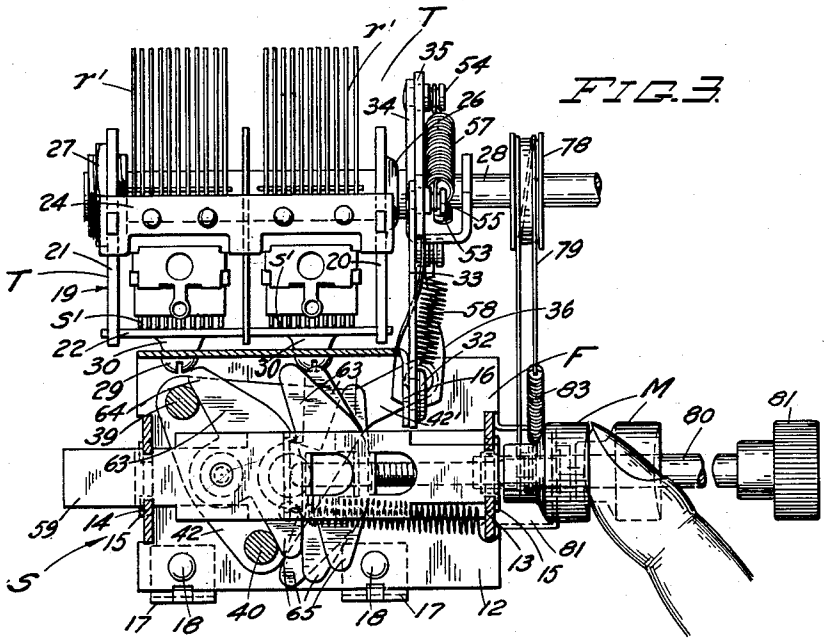

FIG. 4.

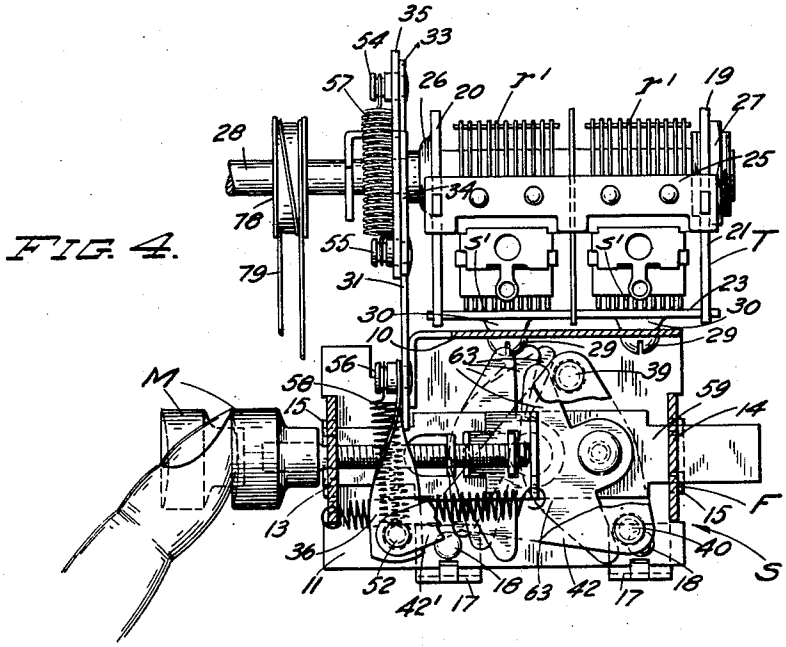

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FIG. 5.

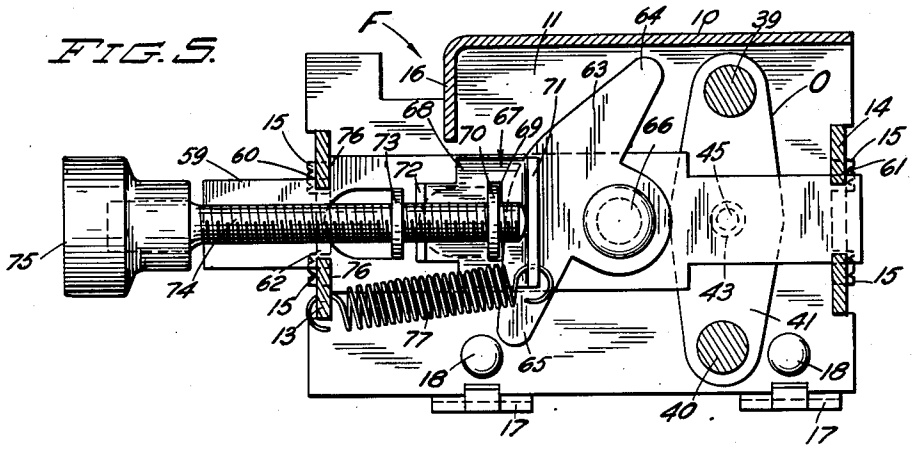
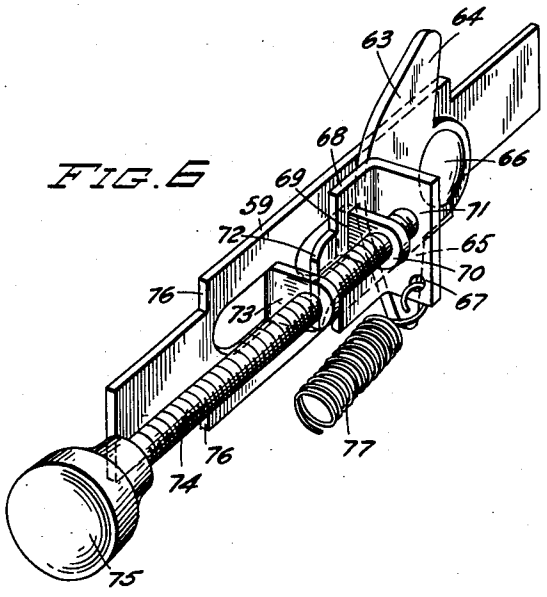


FIG. 6



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UNITED STATES PATENT OFFICE

2,259,719

RADIO STATION SELECTOR

Earl H. Allen, Fanwood, N. J., assignor, by mesne assignments, to Condenser Development Corporation, Newark, N. J., a corporation of New Jersey

Application May 20, 1938, Serial No. 209,005

2 Claims. (Cl. 74—10)

This invention relates to a radio station selector and more particularly to one in which push-button manuals, each representing a given frequency or station, are selectively operable for actuating the tuning unit of the radio receiver.

The present invention pertains to certain improvements to the type of Radio station selector described in the copending application of Samuel Cohen and Earl H. Allen, Serial No. 193,886, filed March 4, 1938.

The broad object of the invention (as set forth in said copending application) centers about the provision of a push-button type of tuning selector for a radio receiver designed to operate mechanically in a way to meet the high accuracy requirements of repeatable tuning selection. In the structure of the present invention, this object is attained by means of a simplified mechanism, organized to produce a low-cost unit.

The selector of the present invention is intended for use with a variable tuning unit such as a variable condenser, the rotor of which is movable over a relatively large arc such as 180 degrees. The rotor is connected to an operating member which is common to and operable by any of a plurality of push-button manuals (each representing a given frequency or station), translationally movable over short linear paths. To convert and multiply the short linear movements of the push-button manuals into the large arc rotation of the tuning unit rotor, a motion-multiplying all-linkage mechanism connecting the operating member with the rotor is employed, which all-linkage mechanism is constructed and designed so as to be characterized by a freedom of play and back lash and a minimum of friction loss, whereby the selector unit is capable of high accuracy repeatable operations.

In the apparatus of the present invention, it is desired that the variable tuning unit be mounted so as to be capable of a direct drive or operation by the user over the full tuning range in conjunction with the selective operation thereof by the actuation of the selector. A prime object of the improvements of the present invention, therefore, pertains to the construction and design of an all-linkage mechanism connecting the so mounted tuning unit rotor with the operating member of the selector, which all-linkage mechanism is characterized by the desired substantial freedom of play and back lash and minimum of friction loss which will enable the obtaining of the high accuracy repeat operations of the system.

Tuning units such as one class of variable condensers now on the market are manufacturable in the present advanced stage of the art at a comparatively low cost. It is desirable that the selector unit with which such a low-cost tuning unit is combined be manufactured at a correspondingly low cost. It is, therefore, a further object of the present invention to build the selector unit in a simplified way without material sacrifice, however, to the attainment of the high accuracy repeatable operations of the selector system.

A further object of the invention resides in the provision of separable selector units and tuning units and an all-linkage mechanism for mechanically connecting these units together, which all-linkage mechanism permits the ready assembly and disassembly of the selector unit and the tuning unit.

To the accomplishment of these objects and such objects as may hereinafter appear, the invention relates to the structural combinations hereinafter sought to be defined in the claims and described in this specification in connection with the appended drawings, in which:

Figure 1 is a vertical elevational view of the radio station selector and the tuning unit of the present invention, with parts shown in section to disclose some of the details of construction;

Figure 2 is a similar vertical elevational view thereof, showing the parts in a position of operation different from that depicted in Figure 1;

Figure 3 is a left side elevational view thereof, with parts taken in cross-section in the plane of the line 3—3 of Figure 1;

Figure 4 is a right side elevational view thereof, taken in cross-section in the plane of the line 4—4 of Figure 2;

Figure 5 is a cross-sectional view on an enlarged scale of the selector mechanism, taken in cross-section in the plane of the line 5—5 of Figure 2; and

Figure 6 is a perspective view of one of the push-button manuals of the selector mechanism.

Referring now more in detail to the drawings, the radio station selector comprises a selector unit S embodying a supporting frame F with which is fixedly associated the separable tuning unit T such as a variable condenser. The frame F supports all of the elements of the selector unit S; and the separable tuning unit T carries all of the elements of the variable condenser.

The essential components of the selector unit S comprise an operating member O connected by means of a linkage mechanism L to the rotor of the tuning unit T, the said operating member O

being common to and being actuatable by any of a plurality of push-button manuals all collectively designated as M. These components of the selector unit are designed to readily convert and multiply short linear movements of the push-button elements into a 180° rotation of the rotor of the tuning unit and to do this with that freedom of play and back lash and with that minimum of friction loss which will permit the obtaining of high accuracy repeat operations. The linkage mechanism L is so designed that it is composed only of linkage elements (no gears or pinions). The tuning unit T is arranged and mounted on the frame F of the selector so as to be capable of direct front drive or operation, and parts of the linkage mechanism L are arranged for quick detachment so as to permit ready assembly or disassembly of the tuning unit T and the selector unit S.

The frame F is built in simple fashion to provide a firm, rigid and inexpensive support. It consists of an inverted U-shaped body having the top wall 10 and the opposite side walls 11 and 12 braced together by the front and rear wall strips 13 and 14, respectively, which latter are secured as by being staked to the edges of the side walls 11 and 12. This staking is shown at 15, 15 (see particularly Figures 2 to 5), and the staking elements simply comprise lugs integral with the edges of the side walls 11 and 12 received by suitable apertures in the front and rear wall strips 13 and 14, which lugs are upset upon or staked to the exterior faces of the wall strips. The top wall of this frame F is suitably provided at its front with a turned-down integral flange portion 16. The frame F may be supported for suitable attachment to the radio cabinet by the angle pieces 17, 17 which may be riveted as at 18, 18 to the side walls 11 and 12 of the frame, the said angle pieces defining supporting legs. Parts of this frame F are otherwise fashioned in the manner hereinafter described to support the operating parts of the selector unit.

The tuning unit T may be of any modern variety; and this is illustrated in the figures as a condenser of the two-gang type. More specifically, such a condenser comprises a fabricated frame 19 having front and rear walls 20 and 21, two bottom connecting strips 22 and 23 and two side connecting strips 24 and 25, which parts are suitably staked together. The side connecting strips 24 and 25 pendingly support the stator sections *s'*, *s'*, and the frame end walls 20 and 21 are provided with suitable bearings 26 and 27, preferably of the ball-bearing type, for supporting the rotor shaft 28, which latter carries the condenser rotor sections *r'*, *r'*. These rotor sections are movable into and out of interleaving relation with the stator sections *s'*, *s'*. These parts composing the tuning unit T thus comprise a unit which is separable from the selector unit; and the two units may be assembled by means of the screws 29, 29 (see Figures 3 and 4) which are received by suitably threaded bosses 30, 30, which latter are integral with (and suitably pressed out of) the bottom connecting strips 22 and 23 of the tuning unit frame. The rotor of the condenser unit is movable over its entire 180° tuning range.

One of the important components of the mechanical system is the means for linking the operating member O of the selector unit to the rotor shaft 28 of the tuning unit. The operating member O is designed to be movable over a relatively small arc such as an arc of about 45°, and, therefore, the means for linking this operating member to the rotor shaft is made to comprise a mechanism for multiplying the 45° rotation of the operating member to the 180° rotation of the rotor shaft. To controllably eliminate back lash in this part of the system and to reduce the friction loss to a minimum, and also to provide a simplified mechanical structure of low cost, the invention at this point includes connecting the operating member to the condenser rotor by an all-linkage motion-multiplying mechanism embodying three linkage elements connecting the frame F and the rotor shaft of the tuning unit T, and a fourth linkage element connecting the same with the operating member O, with the relatively movable parts thereof localized to pivot points at which back lash or play is controllably eliminated.

This all-linkage motion-multiplying mechanism includes a lever element 31 fulcrumed as at 32 to the downturned frame flange 16 by means of a pivoting rivet (32), the said lever having a partly arcuate shaped arm 33, a short arm 34 fixedly joined at its outer end to the shaft 28 and an intervening link element 35 pivotally connected at its ends to the lever arm 33 and the outer end of the arm 34. This (three-element) part of the linkage mechanism is movable between the extremes of an open link formation shown in Figure 1 of the drawings, to a convolute link formation shown in Figure 2 of the drawings, the condenser rotor being thereby movable over its full range (180°) motion. This linkage mechanism further includes a fourth element in the form of a link 36 which is pivotally connected at its outer ends to a second arm 37 of the lever 31 and to a part of the operating member O.

The operating member O comprises in detail an oscillatable or rockable cradle generally designated as 38, which is oscillatably mounted in the side walls 11 and 12 of the frame F. The cradle simply consists of the upper and lower cam rods 39 and 40, the cross-connecting strip 41 on one side, and the cross-connecting plate 42 on the other side. The cross-strip 41 and the cross-plate 42 are suitably recessed at 43 and 44 (see Figure 1) to define ball-bearing seats receiving the bearing balls 45 and 46, respectively. The corresponding bearings in the frame F consist in the seat 47 suitably pressed out of the frame wall 11 and the seat 48 provided by the inner end of the set screw 49, which latter is threadedly received by the correspondingly threaded boss 50 integral with the frame wall 12, the lock nut 51 serving to lock the set screw in adjusted position. The cross-plate 42 is generally of triangular formation and is provided at its front apex with an extension 42' carrying a pivot pin 52 to which the linkage element 36 is connected. This operating member O thus constructed and mounted provides a light weight, inexpensive, readily assemblable, smooth-oscillating and no-play structure.

The mode of operation of the operating member O and the manner of connecting the same to the tuning unit T by means of the linkage mechanism L will now be considered more in detail. A pushing engagement of the upper cam rod 39 of the operating member O by a suitable cam or contact member will cause rotation of the cradle 38 in one direction (to cause the condenser rotor to move out of interleaving relation with the condenser stator), while a pushing engagement of the lower cam rod 40 by a suitable cam or contact

member will cause rotation of the cradle 38 in the opposite or reverse direction (to cause the condenser rotor to move into interleaving relation with the condenser stator). The cam rods 39 and 40 are also so related that when either cam rod serves as the engaging or actuating one, the other cam rod serves or acts (in conjunction with its contact member) as a means for stopping the operating member O in its selected position. The tuning unit T is mounted on the selector frame F with the shaft 28 of the tuning unit projecting forwardly so that this shaft may extend through the radio cabinet for direct operation or drive, the rotor shaft being thus mounted at right angles to the axis of the operating member O. The all-linkage mechanism L is, therefore, so designed as to convert and multiply the short arcuate motion of the operating member movable about one axis to a long arcuate motion of the rotor shaft movable about an axis at right angles thereto. The short arm 34 of the linkage mechanism is fixedly joined to the rotor shaft 28 by any conventional means such as the integral collar and the set screw 53. The intervening link element 35 is pivotally connected to the aforesaid arms 33 and 34 by means of pivot pins 54 and 55 set into the ends of these arms and which are received by suitable orifices in the link 35. The fourth link element 36 is pivotally connected at one end to the lever arm 37 by means of a pivot pin 56 set into the end of this arm, and this link 36 twisted through a 90° angle is connected at its other end to the aforesaid pivot pin 52 forming part of the operating member O. The operating member O is thus united or linked to the condenser rotor through the medium of four pivot pins, where all of the loose play or back lash may be or is localized. The play at these four pivot pins is eliminated by additionally coupling the parts by means of the two tensioning springs 57 and 58 arranged respectively and parallel with the links 35 and 36, the said springs being anchored at their opposite ends to extensions of the described pivot pins.

Therefore, by this described means, all play or back lash in the linkage mechanism L is localized and is then eliminated. This linkage mechanism, obviating the use of gears and pinions and reducing the movable connections to pivot pins of small diameter, reduces the friction loss between the operating member O and the tunable rotor to a minimum. The ball-bearing mounting and the light weight structure of the operating member also serve to eliminate all play and to minimize the friction loss. Also, the linkage elements are exceedingly simple in structure and may be readily assembled for use, thus enabling the manufacture of these parts with uniformity in quantity production and their assembly with speed. It will be further noted that after assembling and attaching the tuning unit T to the selector frame F, the operating member O may be mechanically linked to the rotor shaft of the tuning unit by merely slipping the intermediate link element 35 into position on the pivot pins and by then anchoring to the pivot pins the coupling spring 57. Conversely, when it is desired to remove the condenser unit to detach the condenser unit from the selector frame, the only preliminary step that need be taken is that of simply detaching the coupling spring and its parallel link. These assembling and disassembling operations do not disturb the relation of any of the other parts.

The push-button manuals M comprise a plurality of push-button elements each representing a given frequency or station and each linearly or translationally movable to actuate the operating member O, which latter is common to all the push-button elements. In the exemplification of the invention shown in the drawings, four push-button elements are shown, and since these are identical in structure and operation (except that the different ones are adjusted for different stations), only one of these need be described in detail. It may be premised, however, that Figure 3 shows the manual actuation of the left end manual and Figure 4 shows the manual actuation of the right end manual, the parts being so adjusted that in the former case the rotor is moved to a position nearly out of complete interleaving relation and, in the latter case, the rotor is moved to a position nearly into full interleaving relation. It may be also added that the adjustments of the two intermediate manuals shown in the drawings is such that actuation thereof will operate the rotor to different positions both intermediate those depicted respectively in Figures 3 and 4 of the drawings.

Each push-button manual (see particularly the details shown in Figures 5 and 6) comprises a key 59 slidable in keyways 60 and 61, cut, respectively, in the front and rear wall strips 13 and 14 of the frame F, the said wall strips being also suitably orificed by the rectangular cut-outs 62, 62 therein (see Figures 1 and 2) to permit movement particularly through the front wall strip of all of the parts carried by the key. Each key 59 is provided with a cam shoe 63 which is adjustably locked in a predetermined position thereon with the upper and lower cam fingers 64 and 65 arranged to cooperate, respectively, with the cam rods 39 and 40 of the operating member O. The cam shoe 63 is mounted for rotatable adjustment on a headed stud 66 anchored to the key 59, the mounting being such that when the shoe is unclamped, it will move with rotational freedom on this stud and may thus be moved to any adjusted position. The clamping means for the shoe in its preadjusted position comprises an angular shaped clamp element 67 having a wall 68 adapted to clampingly engage the shoe 63, which wall is provided with a rectangular orifice 69 freely received by a lug 70 which is pressed out of the material of the key 59, the said clamp element also including a wall 71 generally at right angles to the wall 68, the wall 68 having a reduced outturned anchoring end 72. A second lug 73 is also pressed out of the material of the key 59, and both of these lugs 70 and 73 are provided with registering tapped orifices for receiving the locking screw 74, the inner end of which bears against the wall 71 of the clamp element and the outer end of which carries a push-button element 75. The key 59 is also desirably provided with stop shoulders 76 which are adapted to bear against the inner face of the front wall strip 13 to define the limit of the outward motion of the manual. A tension spring 77 anchored at its opposite ends to the wall strip 13 and the clamp element 67 urges the manual to its outermost or inoperative position.

By means of this recited construction of the push-button manual, it will be seen that each manual may be preset or adjusted to a given station by loosening the clamp element 67 (effected by counter-clockwise rotation of the push-button 75 thereby unclamping the cam shoe 63), by then moving the rotor of the tuning unit T manually by the operation of the rotor shaft 28 (direct drive thereof) to a given station, by then

pushing the push-button 75 until the cam fingers 64 and 65 of the cam shoe 63 engage the cam rods 39 and 40 and are locked in position thereby, and by then clamping the clamp element 67 (effected by the clockwise rotation of the push-button 75). Thereafter, push-button operation of the push-button element will repeat the thus obtained setting of the tuning unit rotor. Obviously, the different push-button manuals are preset for different stations.

In addition to the direct drive and the selective actuation of the tuning unit, I also prefer to provide an indirect speed reducing drive operable from the front of the radio cabinet. To this end, the tuning unit rotor shaft is provided with a pulley 78 secured thereto, and this is connected by means of the belt (cord) drive 79 to a spindle 80 which is rotatable in spaced bearings in the front wall strip 13, the said bearings being provided by spaced orifices in the wall strip and in a bracket 81 riveted to the wall strip, the spindle 80 having a front extension to which a finger knob 82 is secured, the cord 79 being preferably provided with a tensioning section 83.

The structure and operation of the radio station selector of the invention and the various advantages thereof will in the main be fully apparent from the above-detailed description. It will be seen that the movement of any push-button manual over a short (about ½ inch) linear or translational movement operates the selector mechanism to rotate the condenser rotor to any preset position within its 180° rotation range. This operation is accomplished by the simple mechanism described, the parts of which are inter-related so that there is substantial freedom of play and back lash combined with a minimum of friction loss; all to the end there may be obtained a high degree of total accuracy in the repeated operations of the manuals.

All of the manuals M are operable for preselecting a frequency or station. The tuning unit T may also be operated manually over the full range by the direct operation of its rotor shaft and indirectly by a speed reducing operation thereof. No gears are employed in the mechanism of the selector; and the elements of the operating mechanism of the selector are so designed by their uniformity and simplicity as to be capable of being manufactured in large quantities and assembled with facility and rapidity. Moreover, all of the operating elements are substantially rugged in construction and subject to very little wear and tear in the repeated operations to which a selector of this character is normally subjected, thereby affording long usage life. All of the parts are readily accessible for repair or replacement.

It will be understood that numerous changes may be made in the construction shown and described, without departing from the spirit of the invention defined in the appended claims.

I claim:

1. In a radio station selector, a station tuning device having a stator and a rotor, said rotor being movable over a relatively large arc, a rotatable operating member, a plurality of selectively operable manuals for actuating said operating member, said operating member being movable over a relatively small arc, the axes of said rotor and operating member being at angles to each other, and a four-element motion-multiplying linkage mechanism connecting said operating member with said rotor, said linkage mechanism comprising a lever fulcrumed on the selector frame, an arm fixed at its outer end to the rotor, a link connecting said arm with one arm of said lever and a link connecting the operating member with the other arm of said lever, and a tensioning means in parallel with each of said links coupling together the elements coupled by said links.

2. In a radio station selector, a station tuning device having a stator and a rotor, said rotor being movable over a relatively large arc, a rotatable operating member, a plurality of selectively operable manuals for actuating said operating member, said operating member being movable over a relatively small arc, the axes of said rotor and operating member being at angles to each other, and a four-element motion-multiplying linkage mechanism connecting said operating member with said rotor, said linkage mechanism comprising a lever fulcrumed on the selector frame, an arm fixed at its outer end to the rotor, a link pivotally connected at its ends to said arm and to one arm of said lever and a second link pivotally connected at its ends to the operating member and to the other arm of said lever, the pivots of said second link being at angles to each other, and tensioning means in parallel with each of said links coupling together the elements coupled by said links.

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