March 30, 1948. R. C. MARHOLZ 2,438,760

RADIO CONTROL APPARATUS

Filed June 12, 1944 2 Sheets-Sheet 1

FIG. 1

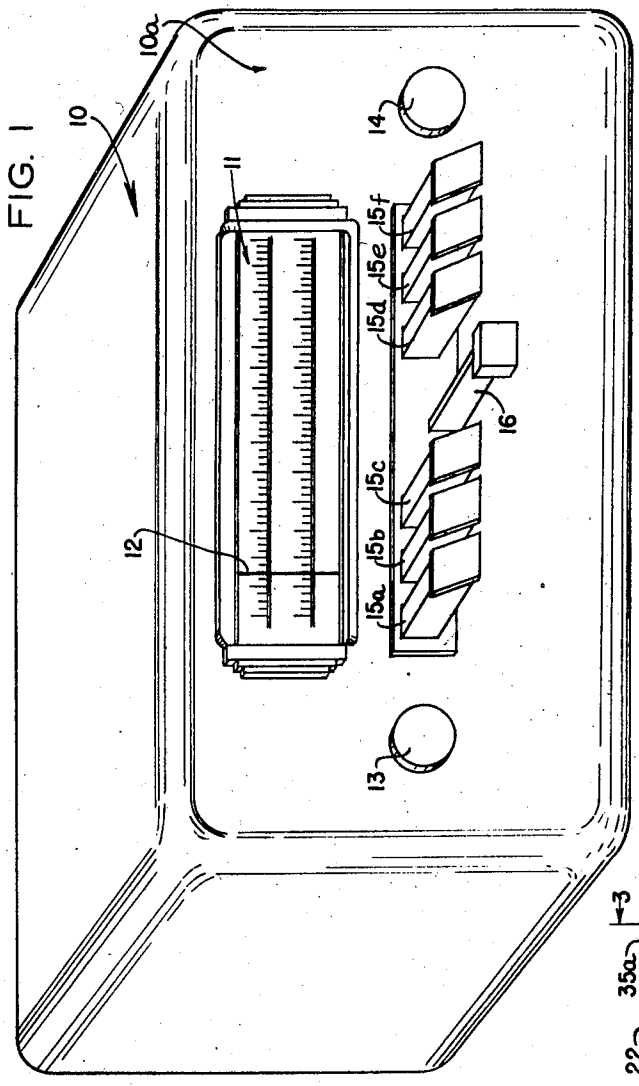


FIG. 2

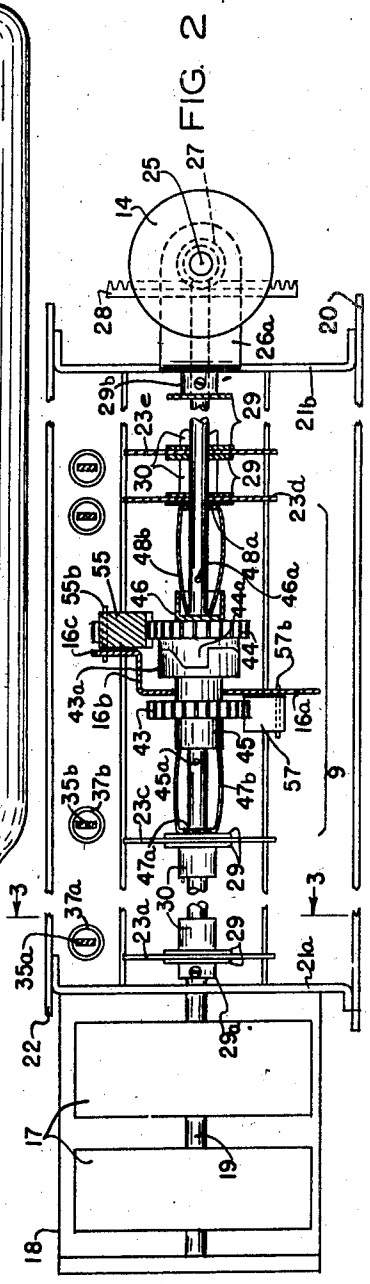
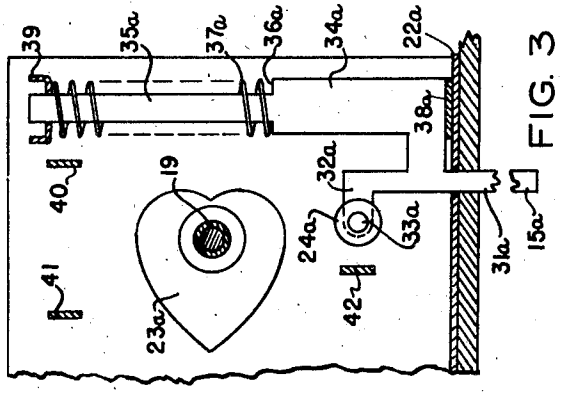


FIG. 3



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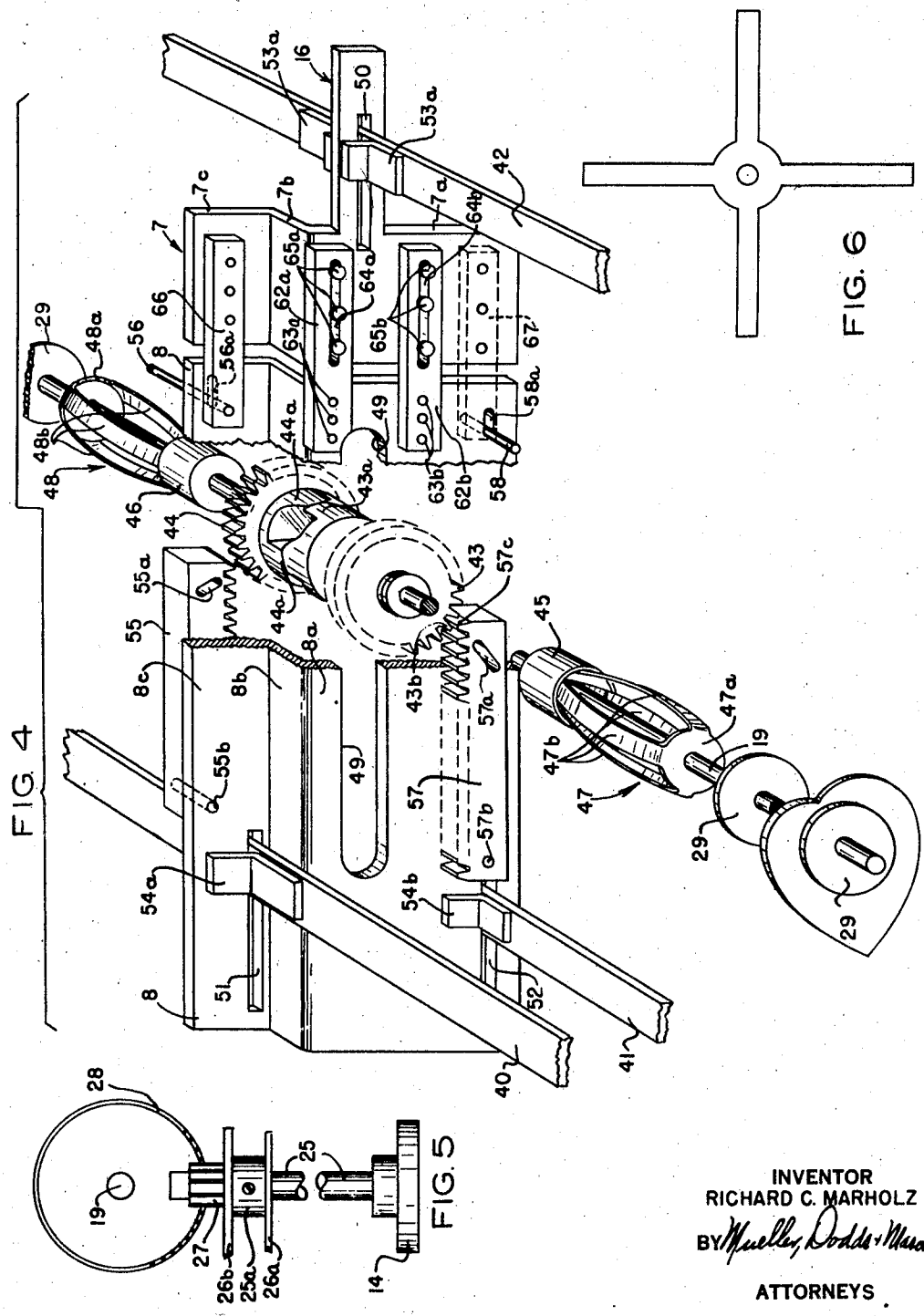


FIG. 4

FIG. 5

FIG. 6

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RADIO CONTROL APPARATUS

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8 Claims. (Cl. 74—10)

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The present invention relates to control devices and more particularly to improved facilities for releasably restraining the station selector cams or control elements of a push button actuated radio receiver tuning mechanism against rotation relative to the control or tuning shaft upon which the control elements are mounted.

It is an object of the present invention to provide improved facilities of the character described which are of simple, sturdy and yet cheap construction, and may be easily actuated either to release the control elements for rotation relative to the control shaft or to positively restrain the control elements against such relative movement.

It is another object of the invention to provide an improved releasable control element restraining mechanism of the character described, which is so arranged that it may be positioned intermediate the ends of the control shaft between two of the control elements without in any way interfering with the normal rotary movement of the shaft and control elements.

In accordance with a further object of the invention, the restraining mechanism is so arranged that the releasing parts thereof are normally completely disengaged from the control element restraining parts of the mechanism and may be operated to actuate the restraining parts for the purpose of releasing the control elements and shaft for relative rotation when the control shaft occupies any setting within the limits of its rotational range.

According to still another and more specific object of the invention, an exceedingly simple assembly made up of bowed leaf springs extending longitudinally of the control shaft and thrusting in opposite directions against the control elements, is provided for releasably restraining the control elements against rotation relative to the control shaft.

In accordance with a still further object of the invention, improved facilities occupying a minimum of space are provided for moving parts of the leaf springs radially toward and away from the control shaft in order to release the control elements for rotation relative to the control shaft and positively to restrain the shaft and control elements against such relative movement.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the specification taken in connection with the accompanying drawings, in which:

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Fig. 1 is a full perspective view, illustrating a radio receiver which is equipped with improved tuning control apparatus characterized by the features of the present invention;

Fig. 2 is a fragmentary side sectional view of the tuning mechanism embodied in the receiver shown in Fig. 1;

Fig. 3 is a sectional view taken along the lines 3—3 in Fig. 2;

Fig. 4 is a fragmentary perspective view in which certain parts of the mechanism are cut in two and moved apart in order better to illustrate certain features of the mechanism;

Fig. 5 is a fragmentary view illustrating the manual tuning facilities provided in the mechanism; and

Fig. 6 is a detail view of one of the parts included in the mechanism.

Referring now to the drawings, the present improved control apparatus is there illustrated in its embodiment in a radio receiver 10, for the purpose of adjusting the gang connected frequency changing elements which are provided to tune the receiver to different signal channels, i. e., to tune the receiver for the reception of signals radiated at different carrier frequencies. Along its front wall 10*a*, the cabinet of the receiver is provided with a station indicating scale 11 adapted to be traversed by an indexing element 12 which is connected in any conventional manner to be driven by the tuning shaft of the receiver. The frequency changing means of the receiver comprises a pair of tuning condensers 17 carried by a supporting member 18, and having a rotatable shaft 19 which carries the rotor plates of the condensers and may be rotated through a predetermined angle to provide the full tuning range for the receiver. These condensers are electrically included in the receiver circuit in any conventional manner, and the supporting member 18 therefor is mounted upon the frame which supports the control or tuning apparatus. This frame is made up of end plates 21*a* and 21*b*, a top plate 22 and a side plate 22*a*, and is suitably mounted upon the top wall of the chassis 20. The chassis and the parts carried thereby are mounted within the cabinet of the receiver.

The rotor shaft 19 is suitably journalled within bearings carried by the frame member 18 and the parallel extending end plates 21*a* and 21*b* of the supporting frame. It also carries a plurality of control or tuning selector elements 23 in the form of heart-shaped cams which are spaced axially along the shaft at the correct points for

engagement by cam rollers 24 rotatably supported upon movably mounted manuals 15 of identical construction. The control elements 23 are divided into two sets of three each, i. e. the set comprising the elements 23a, 23b (not shown) and 23c, and that comprising the elements 23d, 23e and 23f (not shown), and the elements of each set are evenly spaced along the shaft 19. As best shown in Fig. 3 of the drawings, the manual 15a, selected by way of example, is in the form of a plunger having a part 31a slidably mounted in an opening through the side wall 22a of the frame, and an offset part 34a slidably mounted in a slot provided in a channel member 39 extending between the end plates 21a and 21b of the frame. The manual 15a is also provided with a second offset portion 32a at the end of which the roller 24a is pivotally supported by a pivot pin 33a. This roller is normally biased away from its associated cam or control element 23a by means of a coil spring 37a which embraces the part 35a of the manual and is tensioned between the member 39 and a stepped portion 36a of the manual. The various manuals 15 extend transversely of the tuning shaft 19 and are spaced longitudinally of this shaft so that the rollers 24 respectively carried thereby are positioned directly opposite their respective associated cams 23. In other words, the spacing of the manuals 15 along the shaft 19 corresponds precisely to the spacing between the control elements 23 along the shaft. The parts 31 of the manuals in addition to being slidably mounted within openings through the side plate 22a of the frame also extend through registering openings in the front wall 10a of the receiver cabinet and carry push-buttons at their respective outer ends in the manner illustrated in Fig. 1 of the drawings. At its inner side, the side plate 22a carries a strip of soft rubber 38a which is positioned for engagement by the ends of the manual parts 34 to act as a cushioning stop for absorbing the impact of any one of the manuals which is operated and then released.

The control elements 23 are maintained in spaced-apart relationship axially of the shaft 19 by means of spacing sleeves 30 and friction washers 29, the latter elements being keyed or otherwise locked to shaft 19 to restrain the control elements 23 against movement relative to the shaft 19 when a clamping pressure of suitable magnitude is exerted axially of the shaft upon the stacked elements 23, 29 and 30 in the manner explained below. More specifically, the identified control elements are adapted to be clamped against the end sleeves 29a and 29b which are set screw mounted upon the shaft 19 at opposite ends of this shaft within the end plates 21a and 21b, by means of the control element locking mechanism indicated generally at 9 and disposed centrally of the shaft between the two control elements 23c and 23d.

For the purpose of tuning the receiver for the reception of any desired signal within its signal receiving range independently of the push-button tuning facilities just described, manual tuning facilities are provided which are illustrated in Fig. 5 of the drawings as comprising a tuning knob 14 connected to drive the shaft 19 through a driving connection which includes a shaft 25, a pinion 27 fixedly carried by this shaft and a crown gear 28 rigidly mounted upon the extreme right end of the shaft 19. More in detail, the shaft 25 projects through an opening in the front wall 10a of the receiver cabinet to receive the knob 14 upon the projecting end thereof, and is rotatably supported by means of bracket parts 26a and 26b formed integral with the end plate 21b. Intermediate these two bracket parts the shaft 25 carries a sleeve 25a which is set screw mounted upon the shaft 25 and serves to restrain this shaft against longitudinal movement. With this arrangement and due to the meshing engagement of the pinion 27 with the crown gear 28, the tuning shaft 19 may be rotated to any desired setting intermediate the limits of its rotational range by appropriate manipulation of the knob 14 to rotate the shaft 25.

As pointed out above, the control element locking mechanism 9 is arranged to exert oppositely directed forces axially of shaft 19 for the purpose of clamping the control elements 23 against rotation relative to the shaft 19. All parts of the mechanism 9 are either carried directly by the shaft 19 intermediate the two control elements 23c and 23d, or upon slide bars 40, 41 and 42 which extend parallel to the shaft 19 longitudinally thereof and are rigidly connected at their ends to the end plates 21a and 21b of the frame. This mechanism comprises a two part manual 16 consisting of a carriage member 8 and a connecting member 7 having an end portion of reduced cross-sectional area projecting through openings in the side plate 22a and the front cabinet wall 10a intermediate the two push button manuals 15c and 15d to receive an actuating knob thereon at the outer end thereof. The two members 7 and 8 are respectively provided with elongated slots 51, 52 and 50 within which the bars 40, 41 and 42 are respectively received in order slidably to support the two members. In order to permit limited lost motion between the members 7 and 8 while holding the same in alignment transversely of the shaft 19, connecting bars 62a and 62b are provided which are fixedly connected to the member 8 by means of pins 63a and 63b and are slotted at 64a and 64b to receive slide pins 65a and 65b fixedly carried by the member 7. The two members 7 and 8 are restrained against movement longitudinally of the slide bars 40, 41 and 42 by means of three sets of guide pieces respectively carried by the slide bars 40, 41 and 42. Thus, guide pieces 54a are pinned or bolted to the slide bar 40 upon opposite sides of the upper carriage member part 8c in order to restrain this part against movement longitudinally of the bar 40. Similarly, guide pieces 54b are mounted upon the bar 41 upon opposite sides of the carriage member part 8a in order to restrain this portion of the carriage member against movement longitudinally of the bar 41. Finally, guide pieces 53a mounted upon the slide bar 42 are utilized to restrain the member 7 against movement longitudinally of the bar 42. Intermediate the ends thereof, the carriage member part 8a is provided with an elongated slot 49 for receiving the shaft 19, thereby to permit movement of the manual 16 transversely of the shaft 19. Such movement is utilized to lock the control elements 23 against movement relative to the shaft 19 and to release these elements for rotary movement to adjusted positions relative to the shaft 19. To this end, rack bars 55 and 57 are pivotally supported upon the parts 8c and 8a of the carriage member 8 and are provided with oppositely disposed teeth which are adapted to engage pinions 44 and 43 rotatably supported by the shaft 19. More specifically, pivot pins 55b and 57b rigidly carried by the

parts 8c and 8a of the carriage member 8 are utilized pivotally to support the rack bars 55 and 57 at their respective inner ends. Adjacent their opposite ends, the rack bars 55 and 57 are provided with angularly disposed cam slots 55a and 57a extending through the thickness thereof, within which cam pins 56 and 58 are received. The cam pins 56 and 58 are respectively mounted at the ends of bars 66 and 67 which are rigidly pinned or riveted to the parts 7c and 7a of the member 7 at their opposite ends. More specifically, the bar 66 overlies the step parts 7b and 8b of the two members 7 and 8, and the pin 56 extends through a slot 56a in the part 8c of the member 8 so that movement of this pin relative to the member 8 may occur. Similarly, the bar 67 underlies the step parts 7b and 8b of the two members 7 and 8, and the pin 58 projects outwardly through a slot 58a in the member 8 to enter the camming slot 57a of the rack bar 57. With this arrangement, it will be apparent that when the manual 16 is moved outwardly through the front wall 10a of the receiver cabinet, the cam pins 56 and 58 coact with the slots 55a and 57a to move the free ends of the rack bars 55 and 57 radially outward from the shaft 19. Conversely, when the manual 16 is pushed inwardly, the identified cam pins coact with the slots 55a and 57a to force the free ends of the rack bars toward the shaft 19. In this regard, it is pointed out that the guide pieces 54a and 54b adjacent the carriage member part 8 are resilient and that the non-anchored ends thereof are biased to engage the surfaces of the member 8. Further, the identified ends of the guide pieces may be faced with a suitable friction material which contacts the member 8. Thus a substantial friction drag, resisting movement of the member 8 transversely of the two slide bars 40 and 41, is provided.

In order to effect movement of the pinions 43 and 44 axially of the shaft 19 in response to relative rotary movement therebetween, thereby to change the clamping pressure applied to the control elements 23, the two pinions are provided with opposed camming portions having cam teeth 43a and 44a at the engaging ends thereof which are adapted to be moved into and out of meshing engagement. These teeth are provided with flatted ends disposed in planes normal to the tuning shaft 19, which ends are maintained in engagement when the two pinions are rotated to settings wherein the control elements 23 are clamped against rotation relative to the tuning shaft 19. Movement of the pinion 43 axially of the shaft 19 is utilized to increase and decrease the clamping pressure exerted upon the control elements 23a, 23b and 23c disposed to the left of the locking mechanism 9 as viewed in Fig. 2 of the drawings. More specifically, the identified control elements are normally maintained under tension by means of a plurality of bowed leaf springs 47b which radiate from a hub 47a abutting the friction washer 29 adjacent the control element 23c. The free ends of the bowed leaf springs are confined within the annular rim portion of a cam cup 45, the bottom of which is in abutting engagement with the adjacent end surface of the pinion 43. With this arrangement, the leaf springs 47b are deformed from their normally flat configuration to the illustrated bowed configuration to exert a thrust axially of the shaft 19 which serves to maintain the control elements 23a, 23b and 23c under slight clamping pressure at all times regardless of the position of the pinion 43 axially of the shaft 19. An identical arrangement comprising the bowed leaf springs 48b radiating from the hub 48a and confined within the rim of the cup 46 is provided for normally maintaining the other three control elements 23d, 23e and 23f clamped against the sleeve 29b. Preferably, each of the two spring members 47 and 48 is formed by stamping a part of the configuration shown in Fig. 6 of the drawings from a sheet of thin resilient metal stock and then bending the legs of the stamping toward each other at the junction lines between these legs and the hub portion of the stamping. This bending is preferably limited so that when completed the legs of the stamping extend at an angle of approximately 90 degrees relative to the hub portion of the stamping, whereby the bowed configuration is imparted to the legs when the ends thereof are confined to engage the shaft 19 in the manner shown in Fig. 4 of the drawings.

From the preceding explanation, it will be understood that normally the members 7 and 8, and the rack bars supported thereby occupy positions such that the teeth of the rack bars are disengaged from the pinions 43 and 44, and that these two pinions occupy the relative angular settings illustrated in Fig. 4 of the drawings such that the control elements 23 are clamped or locked against rotation relative to the tuning shaft 19. It will also be understood that the control elements occupy different angular positions relative to the tuning shaft, such that the tuning condensers 17 may be operated to signal channel settings respectively corresponding to the different control elements through selective manipulation of the manuals 15.

If, with the apparatus in the condition just described, it is desired to tune the receiver for the reception of the particular signal corresponding to the manual 15a, for example, this manual may be pushed inwardly from the position illustrated in Fig. 3 of the drawings to bring the cam roller 24a into engagement with the camming surface of the control element 23a. During continued movement of the parts 15a and 24a toward the tuning shaft 19, the engaged roller 24a and control element 23a coact to rotate the tuning shaft 19 to the particular angular setting corresponding to the desired signal channel. This tuning position of the shaft is reached when the roller 24a is moved to engage the low point of the element 23a. After it is reached, the manual 15a may obviously be released to return to its normal position under the influence of the biasing spring 37a. In a manner entirely similar to that just described, the other manuals 15 may be selectively actuated for the purpose of selectively tuning the receiver to the other signals to which these manuals respectively correspond. Tuning of the receiver to a signal within the signal reception band of the receiver but not corresponding to one of the manuals 15, is accomplished through manual actuation of the knob 14 in the manner explained above.

Referring now more particularly to the manner in which the clamping pressure is applied axially of the shaft 19 to restrain the control elements 23 against rotary movement relative to this shaft and is partially relieved to permit these control elements to be rotated relative to the shaft, it is pointed out that incident to relative rotation of the pinions 43 and 44 to bring the flatted ends of their associated cam teeth 43a and 44a into engagement, these pinions are moved apart

axially of the shaft. Incident to this movement of the cups, the unconfined segments of the leaf springs 47b and 48b are moved away from the shaft 19 to shorten the bows therein and correspondingly increase the axial thrust exerted by these springs in opposite directions against the two sets of control elements. Thus a sufficient clamping pressure is exerted upon the control elements to restrain these elements against movement relative to the shaft 19. In this regard, it is pointed out that when the rim of the cup 45, for example, engages the stop pin 45a, full clamping pressure is exerted upon the three control elements 23a, 23b and 23c, and further movement of the parts 45 and 43 toward the identified control elements is arrested. A similar stop function is performed by the stop pin 46a to limit movement of the parts 46 and 44 axially of the shaft 19. Further, the cam teeth 43a and 43b are of such length that when the flatted ends thereof are fully engaged the rims of the cups 45 and 46 are just out of touching engagement with the two pins 45a and 46a. Thus the application of equalized clamping pressures to the two sets of control elements is assured when the pinions 43 and 44 are rotated to bring the flatted ends of the cam teeth 43a and 44a into full engagement.

In order to release the clamping pressure exerted upon the control elements 23 by the leaf springs 47b and 48b, the manual 16 is pulled outwardly from the front wall of the receiver cabinet, thereby to move the members 7 and 8 and the rack bars 55 and 57 carried thereby transversely of the tuning shaft 19 in a direction to rotate the pinions 43 and 44 so that the cam teeth 43a and 44a thereof are brought into full meshing engagement. During the initial outward movement of the manual 16 the member 8 remains stationary due to the frictional engagement of the guide pieces 54a and 54b with the sides thereof. Incident to the resulting relative movement between the members 7 and 8, the cam pins 56 and 58 coact with the cam slots 55a and 57a to move the free ends of the rack bars 55 and 57 away from the shaft 19. The purpose of this limited pivotal movement of the rack bars 55 and 57 during the initial outward movement of the manual 16 is to prevent the leading teeth of the two rack bars from lockingly engaging displaced teeth of the two pinions 43 and 44 and to insure the same pinion tooth displacement between the leading teeth of the two rack bars during successive operations of the manual 16 to relieve the clamping pressure exerted upon the control elements 23. In this regard, it will be understood that should the rack bar tooth 57c, for example, engage the end of the pinion tooth 43b and the leading tooth of the rack bar 55 engage the end of a similarly positioned tooth on the pinion 44, with no facilities for pivotal movement of the two rack bars 55 and 57, a locking connection would be set up between the two rack bars 55 and 57 through the pinions 43 and 44 and the shaft 19 which would positively prevent further transverse movement of the members 7 and 8. The limited pivotal movement of the two bars 55 and 57 permits the leading teeth of the rack bars to ride over or not engage the ends of the identified teeth and insures the same pinion tooth displacement between the leading rack bar teeth during successive transverse movements of the manual 16 to the control element release position.

After the lost motion between the two parts 7 and 8 has been taken up in the manner just

explained these two parts and the two rack bars 55 and 57 are moved in unison transversely of the shaft 19. Accordingly, the rack bar teeth are moved into meshing engagement with the teeth of the pinions 43 and 44, following which these pinions are rotated relatively to each other in the proper directions to bring the cam teeth 43a and 44a into full meshing engagement. As these cam teeth are brought into mesh, the cups 45 and 46 are moved toward each other due to the action of the leaf springs in relieving themselves of the stresses therein. More specifically, as the pinions 43 and 44 are rotated to bring the cam teeth 43a and 44a into mesh, the unconfined segments of the leaf springs 47b and 48b spring toward the shaft 19 to move the parts 45, 43, 44 and 46 toward each other. The resulting lengthening of the leaf spring bows serves to relieve the clamping pressure exerted axially against the control elements sufficiently to permit these elements to be adjusted to new angular settings relative to the shaft 19.

Following the operations just described, the control element 23a, for example, may be set to a new angular position relative to the shaft 19, so that it will coact with the manual 15a to tune the receiver for the reception of a different desired signal. To this end, the manual tuning knob 14 is first actuated in order manually to tune the receiver to the desired signal frequency. After the signal is selected, the knob 14 is held against further rotation, and the manual 15a is actuated for the purpose of rotating the control element 23a to the desired new setting relative to the shaft 19. After the new setting is thus established, the manual 15a may be released. In a manner entirely similar to that just described, any one or all of the remaining five control elements may be set to new positions relative to the shaft 19. In this regard, it is emphasized that the pressure exerted axially of the shaft 19 upon the control elements 23 is only partially relieved when the cam teeth 43a and 44a are in full meshing engagement. The residual clamping pressure exerted by these leaf springs is entirely sufficient to prevent the control elements from being rotated relative to the shaft otherwise than in the manner just described. It is pointed out further that since the pinions 43 and 44 are freely rotatable on the shaft 19, these elements may be held against rotation by the rack bars 55 and 57 during operation of the knob 14 manually to tune the receiver to the desired signal channels. During such rotation of the shaft 19, the cups 45 and 46 are rotated with the shaft relative to the pinions 43 and 44. By virtue of this arrangement, the necessity of twice actuating the manual 16 between successive control element adjusting operations is entirely eliminated.

After all or a part of the control elements have been adjusted in the manner just explained, they may be relocked against movement relative to the shaft 19 by pushing the manual 16 inwardly toward the front wall 10a of the receiver cabinet, thereby to move the parts 7, 8, 55 and 57 back to their respective normal positions. During the initial backward movement of the member 7, the member 8 remains stationary and the pins 56 and 58 coact with the slots 55a and 57a to rotate the free ends of the rack bars 55 and 57 toward each other, thereby to move the teeth of these rack bars into deeper meshing engagement with the teeth of the pinions 44 and 43. After the lost-motion between the two members 7 and 8 is fully taken up, these two parts are moved in

unison, thereby reversely to rotate the two pinions 43 and 44 relative to each other until the cam teeth 43a and 44a are engaged only at their flatted ends in the manner shown in Fig. 4 of the drawings. Incident to the described relative movement of the cam teeth 43a and 44a, the pinions 43 and 44 and cups 43a and 44a are moved apart to shorten the bows in the unconfined segments of the leaf springs 47b and 48b, thereby to restore the clamping pressure to the control elements 23. During the final movement of the members 7 and 8 back to their respective normal positions, the rack bar teeth are disengaged from the teeth of the pinions 43 and 44. Thus the tuning shaft 18 and the control elements carried thereby are freed for unrestricted rotation.

While the invention has been described with particular reference to a specific embodiment thereof, it will be understood that various modifications may be made therein which are within the true spirit and scope of the invention as defined in the appended claims.

I claim:

1. In a control device which includes a plurality of control elements spaced axially along a shaft, a pair of pinions rotatably carried by said shaft intermediate the ends of said shaft and between two of said control elements, bowed leaf springs extending longitudinally of said shaft and having their removed ends respectively thrusting against said two control elements, means movable axially of said shaft with said pinions to bow said springs away from said shaft, thereby to exert an axially directed clamping pressure against said control elements sufficient to restrain said control elements against movement relative to said shaft, means interconnecting said pinions to move said pinions axially toward each other in response to opposite rotation of said pinions relative to said shaft, thereby to at least partially relieve the clamping pressure exerted upon said control elements by said leaf springs, means movable transversely of said shaft and provided with offset rack elements aligned with said pinions upon opposite sides of said shaft, said rack elements including teeth engageable with said pinions upon movement of said last-named means transversely of said shaft, whereby said pinions are oppositely rotated to move toward each other under the influence of said springs in response to movement of said last-named means transversely of said shaft.

2. In a control device which includes a plurality of control elements spaced axially along a shaft, a pair of pinions rotatably carried by said shaft intermediate the ends of said shaft and between two of said control elements, bowed leaf springs extending longitudinally of said shaft and having their removed ends respectively thrusting against said two control elements, means movable axially of said shaft with said pinions to bow said springs away from said shaft, thereby to exert an axially directed clamping pressure against said control elements sufficient to restrain said control elements against movement relative to said shaft, means for moving said pinions axially toward each other in response to rotation of said pinions relative to said shaft, thereby to at least partially relieve the clamping pressure exerted upon said control elements by said leaf springs, and means for rotating said pinions relative to said shaft to produce movement of said pinions axially toward each other.

3. In a control device which includes a plurality of control elements spaced axially along a shaft, bowed leaf springs extending longitudinally of said shaft and having their non-adjacent ends thrusting in opposite directions against two of said control elements to exert axially directed clamping forces upon said control elements, and means for axially moving said non-adjacent ends of said springs toward and away from each other to increase and decrease the clamping pressure exerted upon said control elements by said springs.

4. In a control device which includes a plurality of control elements spaced axially along a shaft, a pair of clamping elements movably carried by said shaft intermediate the ends of said shaft and between two of said control elements, resilient means interposed between each of said clamping elements and the adjacent one of said two control elements to exert axially directed clamping forces upon said control elements, and means for adjustably moving said clamping elements toward and away from each other to vary the clamping forces exerted upon said control elements.

5. In a control device, a rotatable control shaft, a plurality of control elements spaced axially along said shaft, and releasable means disposed between two of said control elements intermediate the ends of said shaft for releasably restraining said control elements against movement relative to said shaft.

6. In a control device, a rotatable control shaft, a plurality of control elements spaced axially along said shaft, resilient means disposed between two of said control elements intermediate the ends of said shaft and spaced apart axially of said shaft to exert opposite axially directed clamping forces upon the control elements upon either side thereof, and means disposed between said resilient means for adjustably controlling the clamping forces exerted upon said control elements by said resilient means between values at which said control elements are restrained against movement relative to said shaft and are released for movement relative to said shaft.

7. In a control device which includes a plurality of control elements spaced axially along a shaft, a bowed leaf spring extending longitudinally of said shaft and having one end thrusting against one of said control elements to exert an axially directed clamping force upon said control elements, a clamping pinion mounted on said shaft for movement axially of said shaft when rotated relative to said shaft, an annular ring movable with said pinion axially of said shaft and overlying the opposite end of said spring to adjustably move a segment of said spring toward and away from said shaft as said pinion is moved in opposite directions axially of said shaft, thereby to increase and decrease the clamping force exerted on said control elements by said spring, and a rack bar movable transversely of said shaft to engage said pinion and then rotate said pinion relative to said shaft.

8. In a control device which includes a plurality of control elements spaced axially along a shaft, a bowed leaf spring extending longitudinally of said shaft and having one end thrusting against one of said control elements to exert an axially directed clamping force upon said control elements, an annular ring embracing said shaft and overlying said spring to adjustably move a segment of said spring toward and away from said shaft as it is moved in opposite directions

axially of said shaft, thereby to increase and decrease the clamping force exerted on said control elements by said spring, and means for moving said ring in either direction axially of said shaft and for restraining said ring in any position to which it is moved.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,783,292	Kent	Dec. 2, 1940
1,954,645	Perkins	Apr. 10, 1934
1,996,993	Gaubert	Apr. 9, 1935
2,153,865	Gersch	Apr. 11, 1939
2,189,455	Tyzzer	Feb. 6, 1940
2,200,211	Benton	May 7, 1940
2,239,067	Wells	Apr. 22, 1941
2,320,893	Schwarz et al.	June 1, 1943