Nov. 30, 1937. D. H. MITCHELL 2,101,009

RADIO TUNING APPARATUS

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Fig. 1.

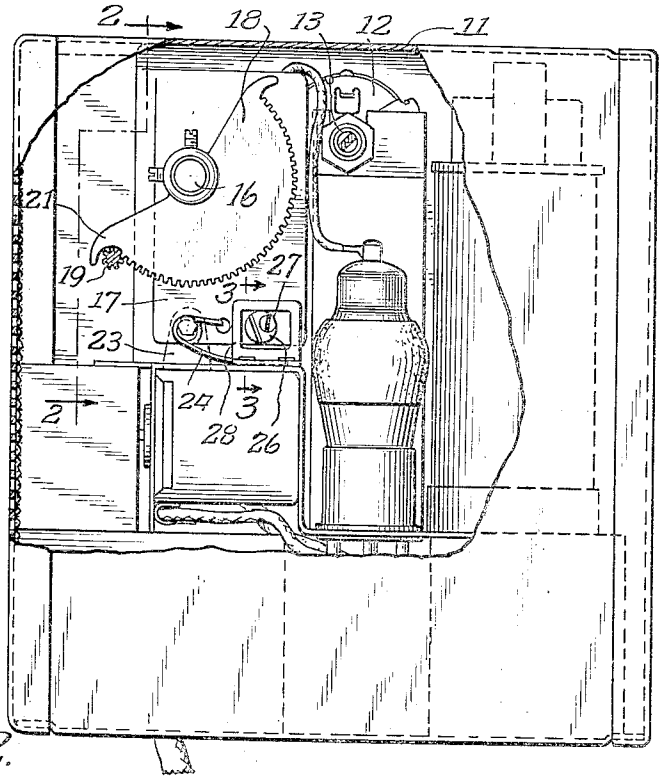


Fig. 2.

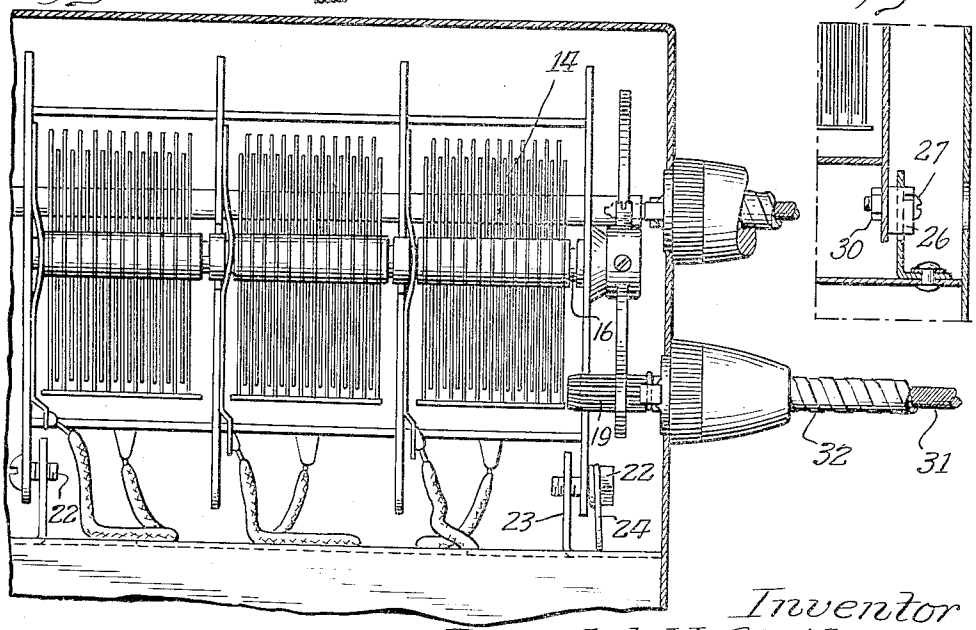


Fig. 3.

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RADIO TUNING APPARATUS

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Fig. 5.

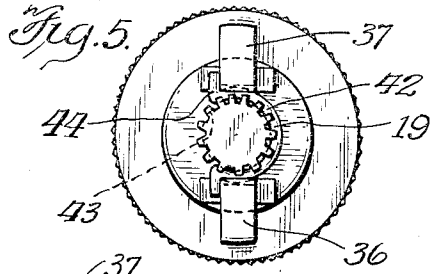
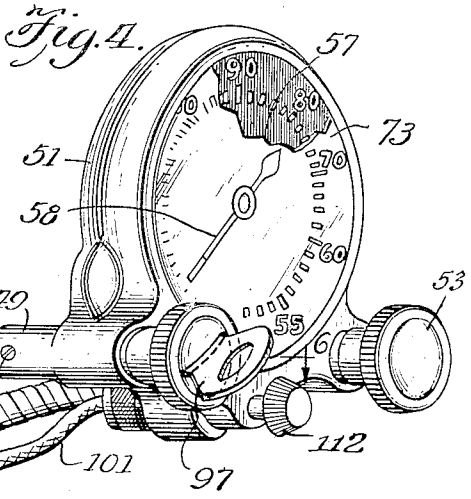


Fig. 4.



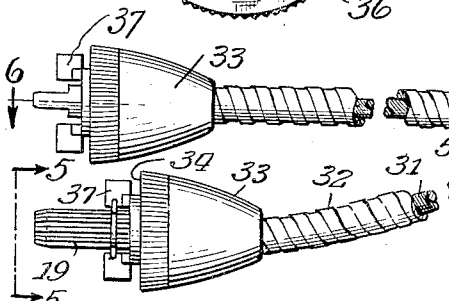


Fig. 6.

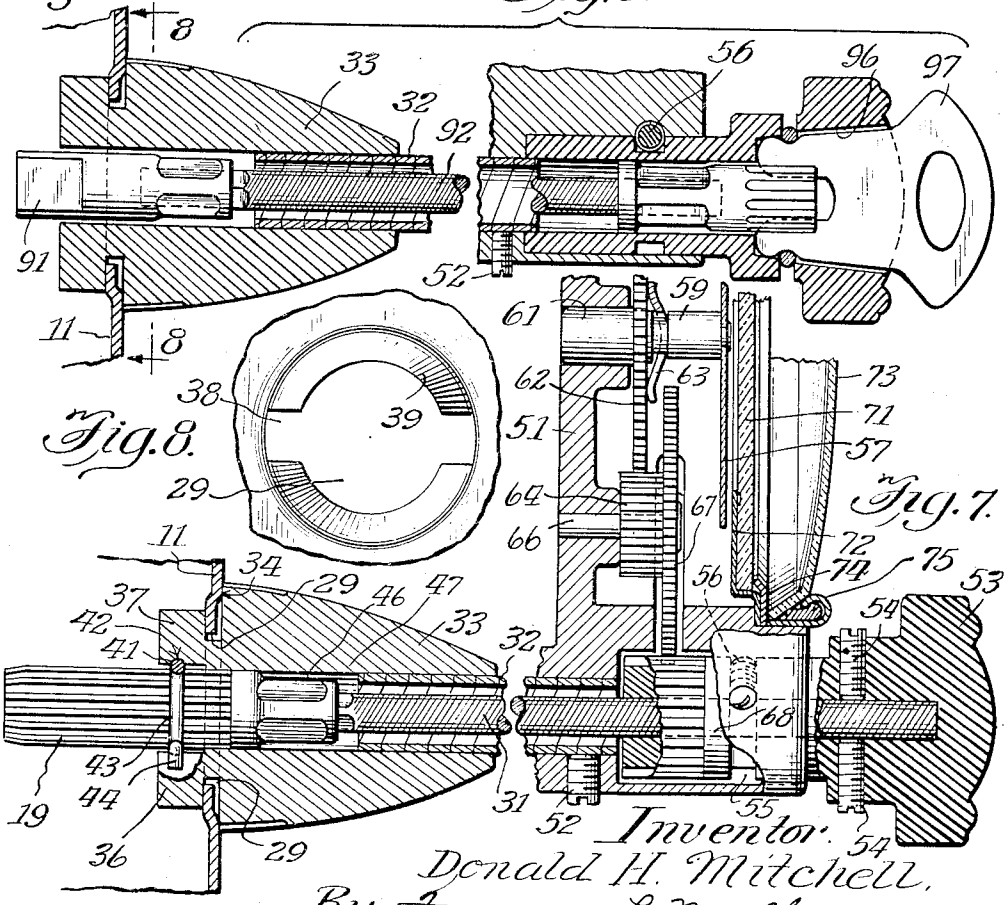


Fig. 8.

Fig. 7.

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Fig. 9.

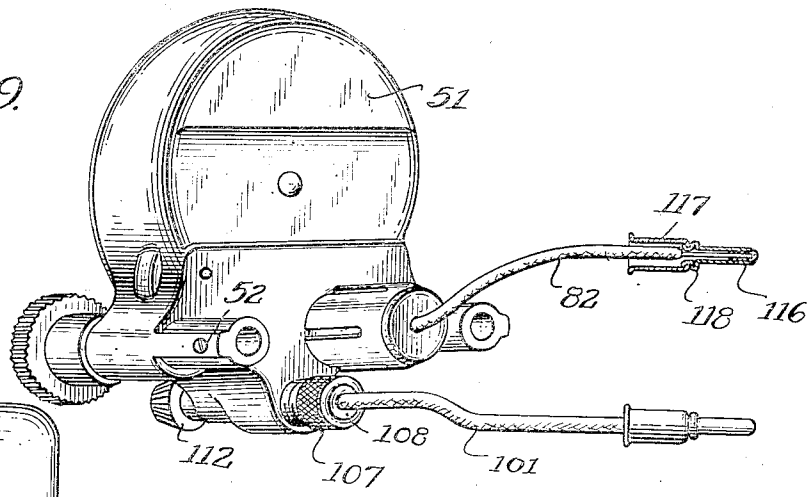


Fig. 10.

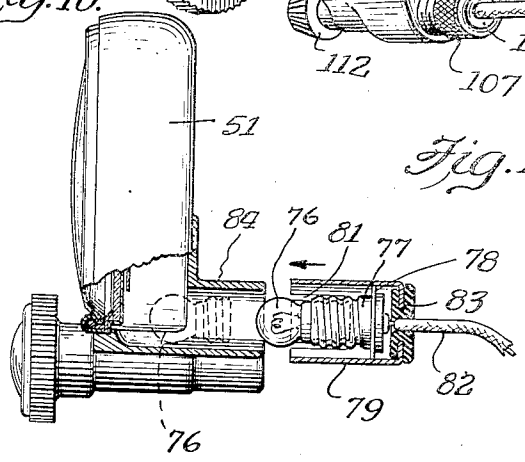


Fig. 12.

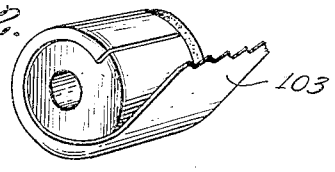
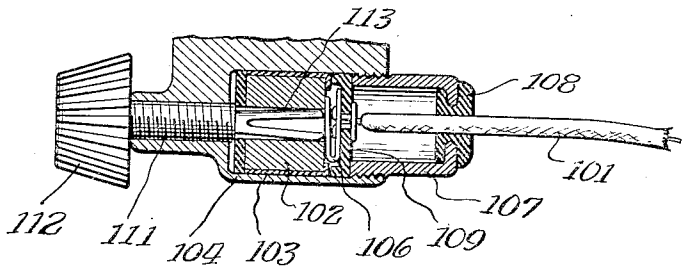


Fig. 11.



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UNITED STATES PATENT OFFICE

2,101,009

RADIO TUNING APPARATUS

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Application June 24, 1935, Serial No. 28,037

12 Claims. (Cl. 250—14)

This invention relates to remote control apparatus and has been illustrated in combination with a radio receiving set. The invention is particularly suitable for use in automobiles or other vehicles in which the receiving set is mounted on the dashboard, and the control head is positioned on the instrument board, or the steering post, the connection between the two being partly mechanical. In some of its aspects the invention relates more broadly to control apparatus for radio receiving sets, even though it may be mounted directly on the cabinet or case of the set.

In the past there have been several forms of remote control apparatus of types suitable for the use described, but they have for the most part been unreliable, or expensive to manufacture, or troublesome in adjustment when installing the set.

It is an important object of the present invention to provide remote control apparatus which may be attached to the radio set in a simple manner and without the necessity of accurate positioning of the chassis within its housing.

A related object is to provide a simple means of adjustment of the position of the axis of a gear on the chassis which is driven by a pinion forming a part of the control device and extending through the housing.

Another object of the invention is to provide a simple control device which requires a removable key to turn on the radio.

A further object is to provide means for easily and satisfactorily coupling the control device to the receiving set.

An additional object is to provide a simple and effective arrangement for mounting the dial light on the remote control head.

A further object is to provide a simple but delicately adjustable rheostat, and especially one which is suitable for use as a volume control unit in the remote control head; and

A still further object is to provide a coupling member for the flexible shaft to connect the shaft housing to the chassis housing in a positive mechanical and electrical connection.

Other objects and advantages of my invention will be apparent from the following description taken with the drawings, in which:

Fig. 1 is a side elevation of a portion of a radio receiver set with part of the casing broken away to show interior portions thereof.

Fig. 2 is a fragmentary sectional view taken substantially along the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary sectional view taken substantially along the line 3—3 of Fig. 1.

Fig. 4 is a perspective view of the remote control apparatus chosen for illustration in this application.

Fig. 5 is an end view of one of the couplers as indicated by the line 5—5 of Fig. 4.

Fig. 6 is a fragmentary sectional view substantially along the line 6—6 of Fig. 4.

Fig. 7 is a corresponding fragmentary sectional view taken longitudinally along the station selector portion of this invention.

Fig. 8 is a fragmentary view illustrating one of the attachment holes in the casing of the set.

Fig. 9 is a perspective view showing the rear of the control head illustrated in Fig. 4.

Fig. 10 is a side view of the control head of Fig. 9 with a portion broken away to show a vertical section through the dial light assembly.

Fig. 11 is a fragmentary vertical sectional view through the rheostat used as a tone control unit.

Fig. 12 is a partially opened out view of the resistance unit in said rheostat.

Although this invention may take numerous forms, only one has been chosen for illustration. According to this form, a suitable housing 11 is provided, in which may be located the chassis of a radio receiving set. The details of the receiving set need not be considered, for the most part, it being sufficient to state that it includes a switch and volume control element 12 such as a rheostat rigidly secured to the chassis and operated by a slotted stem 13; and one or more tuning condensers 14 or other tuning means controlled by a shaft 16. The condensers are all carried by a suitable frame 17 through the end plate of which the shaft 16 extends. Mounted on the exposed end of the shaft 15 is a suitable gear segment 18 adapted to be turned by a pinion 19 through 180° and having stops 21 for limiting the movement of the segment 18 to 180°. Since the pinion 19 is supported at a definite position on the housing 11 (in a manner described below) and since it is difficult in commercial production to always locate the chassis at exactly the same position in the housing, there has heretofore been difficulty in keeping the gears properly meshed. If they are too close they bind and if they are not close enough they permit play which is very undesirable in tuning. To overcome this difficulty, I provide means for adjusting the spacing of the gears by adjusting the position of the frame 17. This frame 17 is preferably pivotally mounted as by means of bolts 22 carried by upstanding brackets 23 rigidly secured to the frame

of the chassis. The frame 17 is urged toward the pinion 19 by a spring 24, and its movement is limited by an eccentric 26 pivotally secured to the frame 17 as by bolt 27. The bolt 27 may be screwed into nut 30, tightened until the eccentric 26 may be turned only with difficulty, and soldered to the nut to prevent loosening. The eccentric 26 bears against any suitable stop, such as the inner wall of a rectangular hole in a bracket 28 mounted rigidly on the chassis. Thus it is seen that turning the eccentric 26 adjusts the position of the frame 17 and consequently of the segment 18 with respect to the pinion 19 which is separately supported, thereby assuring proper spacing of the segment 18 and the pinion 19 to permit smooth operation thereof.

The pinion 19 is carried rigidly on the end of a flexible cable 31 which extends through a hole 29 in casing 11 and through a flexible tube or sheath 32 to the remote control head.

Rigidly or frictionally secured on the end of the flexible sheathing 32 is a coupler 33 having a flat annular face 34 adapted to rest against the housing 11 of the set. Extending through the hole 29 is the nose 36 of the coupler 33. This nose is provided with two or more lugs 37 spaced from the face 34 and extending radially, as illustrated. The hole 29 is provided with radially extending slots 38 through which the lugs 37 may pass. The arcuate portions 39 of the casing adjacent the slots 38 are cam-shaped so that, as the coupler 33 is twisted after the lugs 37 are inserted through the slots 38, the lugs 37 ride up onto the cam portions 39 and draw the face 34 of coupler 33 tight against the housing 11. This secures the coupler 33 quite rigidly to the wall of the housing 11 and, since the pinion 19 is relatively firmly, though rotatably, held by the coupler 33, no further supporting of the pinion 19 is necessary. The housing 11 should be scraped clean where the coupler contacts it so that the sheathing will be well grounded to the housing.

The pinion 19 is held properly positioned longitudinally with respect to the coupler 33 by any suitable means, as by a wire 41 passing between and interlocking with the lugs 37 and the pinion 19. The interlocking is secured by means of grooves 42 formed on the inner sides of the lugs 37 and an annular groove 43 formed on the pinion 19 in a position to register with the groove 42. The two registering grooves form a channel only slightly larger than the wire 41. The wire 41 may also serve as a bearing for the pinion, although the shank of the pinion preferably fits so well in the coupler 33 that the wire 41 is not necessary as a bearing. The wire 41 may be a substantially U-shaped wire having its ends bent over, as at 44, to secure it in place. It will be understood, of course, that in applying this wire a long piece of wire may be threaded between the pinion 19 and one of the lugs 37 and back between the pinion and the other lug 37, drawn tight, bent over and cut off; or it may be a properly sized U-shaped wire slipped through both openings at once and bent over at both ends.

The pinion 19 may be secured to the flexible cable 31 in any suitable manner, as by welding or crimping. Relative rotation between the two members is preferably prevented by flattening the sides of the pinion, as at 46, and the corresponding sides of the cable, as at 47, the cable being telescoped within the end of the pinion.

The flexible sheathing 32 passes into a suitable sleeve 49 or other opening in the casing or shell 51 of the control head and is secured firmly in place therein, as by a set screw 52. This not only assures proper operation of the cable, but also grounds the control head to the housing. Of course, it will usually be grounded also through the member on which it is supported. The flexible cable 31 projects from the end of the sheathing 32 and is rigidly secured to a handle 53 in any suitable manner, as by one or more set screws 54. The handle 53 is rotatably held in place by a set screw 56 which is mounted in the control head casing 51 and slidably engages an annular groove 55 in a shank of the handle 53. Thus it is seen that the handle 53 turns the flexible cable 31 which turns the pinion 19 which meshes with the gear segment 18 and therefore slowly revolves movable portions of the tuning condensers 14.

In order to indicate the position of the condensers and therefore the radio frequency to which the receiving set is tuned, suitable indicating means is provided in the head. In the illustrated form this comprises a disc 57 having painted or formed thereon a needle 58 which points to suitable markings arranged concentrically with the axis of the disc 57. The disc 57 may be secured rigidly to a stud 59 having an enlarged head 61 against which rests a gear 62 being urged thereagainst by a spring clip 63 engaging a slot in the stud 59. The head 61 may rotate in a suitable hole in the shell 51. The gear 62 may be in mesh with the smaller gear 64 of an intermediate gear set supported as by a stud 66, cold-pressed into a hole in the casing of the head, or otherwise secured therein. A large gear 67 is rigidly secured to the small gear 64 and meshes with gear teeth formed on the shank 68 of handle 53.

From the foregoing it is seen that as the handle 53 adjusts the condensers it also rotates the gears 67, 64 and 62 and thereby turns the indicator disc 57 to cause the needle 58 to move a distance corresponding to the movement of the condensers. When the receiving set is tuned to a broadcasting station of known frequency the indicating disc 57 may be rotated independently of the gearing to point to the number corresponding to said frequency. To facilitate this initial setting of the disc 57 the head 61 is provided with a slot for a screw driver, as shown. The movement of the disc 57 independent of the gearing is permitted by the fact that the clip 57 comprises a friction clutch, since it clamps the gear 62 against the head 61, the stud 59 and gear 62 being relatively rotatable except for the friction thus produced.

The indicating numbers may be formed in any desired manner, one preferred form being that they are indented on the back side of a plate of glass 71, the indentations preferably being painted with a light paint to make them show up more clearly. An annular disc 72 of a blackened metal may be provided for supporting the glass 71 and for furnishing an optical contrast with the markings thereon. A crystal 73 of a non-breakable transparent material, will usually be provided for the sake of appearance and protection. The glass plate 71 may be held in position by a narrow ring of metal 74 which in turn is held in place by the crystal 73, the latter being held in place as by a ring 75 pressed into the casing of the head.

To illuminate the figures an electric light bulb 76 is provided, which may be screwed into a socket 77 rigidly carried by a disc 78 which frictionally engages and electrically contacts a cup

79 having slots 81 along most of its length to make its open end resilient. The center terminal of the socket extends through and is insulated from the disc 78 and is connected to a wire 82 insulated as by a specially shaped rubber bushing 83, as illustrated. In assembly, one end of the wire 82, with the disc and socket attached to the other end, is threaded through the cup 79 (and through the bushing 83), and the disc and socket are drawn into the cup where they are held by the friction of the disc on the cup.

The cup 79 may be telescoped over and frictionally held on a rearwardly extending sleeve 84 formed on the shell 51 of the control head, the lamp 76 simultaneously being telescoped within the sleeve 84 to the position indicated by the dotted lines. Thus it is seen that the whole lamp assembly is put together by simple operations without special securing means. From the lamp in its inner position light may pass, either directly or by reflection, through a slot 86 in annular disc 72 and into the glass plate 71 to illuminate the numbers formed thereon.

The needle 58 or the tip thereof may be specially illuminated by a slit cut through the disc 57 and closed by a translucent member, as a piece of paper on the back, which will be caused to glow brightly by reflected light from the bulb 76. The brightness of the glowing portion of the arrow 58 may be increased by white or other light-reflecting paint on the inside surface of the casing of the control head, especially at the upper portion thereof. It should be understood, of course, that the lamp 76 will be controlled through the wire 82 in any suitable manner, usually by a switch which causes the lamp to light when the set is turned on.

The switch and volume control rheostat 12 of the set is operated by a slotted stem 13, as previously described. This slotted stem is engaged by a key 91 shown best in Fig. 6. This key is rigidly secured to the end of a flexible cable 92 in the same manner as the pinion 19 is secured on the cable 31. Cable 92 is provided with a flexible sheathing 32 having fixed at its end a coupler 33, as described in connection with the cable 31. The other end of the sheathing 32 is secured in the control head, as by a set screw 52 which is really in the position shown in Fig. 4 rather than that shown diagrammatically in Fig. 6. Secured to the control head end of the flexible cable 92 is a pinion 94 which extends into handle 96, which is preferably freely rotatable with respect to the pinion 94, being rotatably held in the casing of the control head by a set screw 56.

It is preferred that the handle 96 be rotatable with respect to the pinion 94 to prevent the receiving set beng turned on by meddlers. To turn it on when desired, a removable key 97 is provided which extends through a slot in the end of handle 96 and engages the pinion 94. Turning the key 97, either directly or by means of the handle 96, will then turn the pinion 94, the cable 92, the key 91 and by it the stud 13 operating the receiving set switch and volume control rheostat 12.

In inserting the key 91 in the receiving set, it may first be drawn out by the amount of play between the sheathing 32 and the inner end of the shank of pinion 94. This makes it easy to manipulate the key 91 to cause it to engage the slot in slotted stem 13 after which time the associated coupler 33 may be inserted through the case of the set and turned to a locked position, as described in connection with pinion 19. Thrusting the coupler 33 through the casing has the effect of pushing the key 91 relatively into the coupler 33 and therefore pushing the pinion 94 to its original position, as shown in Fig. 6.

A tone control wire 101 extends from the receiving set to the control head. Since the circuits with which it is connected may be conventional and are not considered a part of the invention covered by this application, they need not be described. It is sufficient to explain that, if the wire 101 is grounded to the metal frame of the car, as through the casing of the control head, the tone of the sound issuing from the loud speaker of the set is altered and, if a variable resistance or rheostat is inserted between the wire 101 and the ground, the tone may be varied at will. To this end a resistance block 102 of a suitable material, such as carbon, is placed in a recess in the control head shell 51 and thoroughly insulated from said shell as by a wrapping 103 of insulating paper and an insulating washer 104 at its inner end. Engaging the outer end of the resistance block 102 is a spring contact member 106 insulated from and carried by a screw cap 107. The wire 101 extends through the cup 107 to the contact 106, being insulated from the screw cap by a rubber bushing 108 and by the disc 109 of insulating material which carries the contact 106. Screwed into the front of the casing of the control head is a stud 111 having a handle 112. Formed on the inner end of the stud 111 is a bifurcated contact member, the prongs 113 of which are resiliently urged outwardly and normally extend into a central bore in the block 102 and engage the sides thereof. When the stud 111 is screwed all the way in, the tips of the prongs 113 engage the spring contact 106 and connect the wire 101 to ground substantially without resistance. As the stud 111 is screwed outwardly the resistance 102 is placed in the circuit, thereby varying the control. As the stud 111 is screwed outwardly, the resistance increases until, when the bifurcated contact member 113 passes out of contact with the resistance block 102, the circuit is completely broken.

Suitable spring jacks are provided within the case of the receiving set for connection with the wires 101 and 82. To make contact with these spring jacks, plugs or connectors are provided, including tips 116 which are preferably soldered to the respective wires and may have handles 117 of insulation secured thereto to facilitate insertion and removal and to protect the wires. In forming these plugs hollow metal tips 116 having annular shoulders 118 crimped thereon are slipped into the insulator 117 which may previously have had an inwardly extending flange formed on its engaging end. The end of the tip 116 within the insulator 117 is then upset to hold the insulator in place. In the same operation the insulator may be flared at its free end.

I claim:

1. In a radio receiving set, a housing, a chassis removably located in said housing and including spaced brackets, a frame pivoted to said brackets, at least one tuning condenser carried by said frame and including a rotatably mounted shaft, a gear carried by said shaft and fixed thereon, a pinion rotatably mounted on said housing for driving said gear, a spring urging said frame and gear toward said pinion, and means adjustable after said chassis is in said housing for limiting said movement, whereby free

driving action of said gear by said pinion without play may be obtained.

2. In a radio receiving set, a housing, a chassis removably located in said housing and including spaced brackets, a frame pivoted to said brackets, at least one tuning condenser carried by said frame and including a rotatably mounted shaft, a gear carried by said shaft and fixed thereon, a pinion rotatably mounted on said housing for driving said gear, a spring urging said frame and gear toward said pinion, and adjustable means for limiting said movement, whereby free driving action of said gear by said pinion without play may be obtained.

3. In a radio receiving set, a housing, a chassis removably located in said housing and including spaced brackets, a frame pivoted to said brackets, at least one tuning condenser carried by said frame and including a rotatably mounted shaft, a gear carried by said shaft and fixed thereon, a pinion rotatably mounted on said housing for driving said gear, and a spring urging said frame and gear toward said pinion.

4. In a radio receiving set, a housing, a chassis removably located in said housing and including spaced brackets, a frame pivoted to said brackets, at least one tuning condenser carried by said frame and including a rotatably mounted shaft, a gear carried by said shaft and fixed thereon, a pinion rotatably mounted on said housing for driving said gear, and means adjustable after said chassis is in said housing for pivoting said frame to position said gear a proper distance from said pinion.

5. In a radio receiving set, a housing, a chassis removably located within said housing, a tuning condenser on said chassis including a rotatably mounted shaft, a gear mounted on said shaft for rotating said tuning condenser, a pinion rotatably mounted on said housing and meshing with said gear, and means accessible from the outside of the housing for adjusting one of said meshing members with respect to its support means to properly space said meshing members with respect to one another in spite of variations in the position of said chassis within said housing.

6. In a radio receiving set, a housing having a control pinion rotatably mounted thereon with a portion extending therethrough, a radio chassis removably secured within said housing and including a main portion and support means pivoted thereto, a control element rotatably mounted on said support means, a toothed operating member mounted on said control element and engaging said pinion, and means for pivoting said pivoted support means to properly space said pinion and said operating member so that the two will properly mesh in spite of variations in the relative position of the chassis within the housing.

7. In a radio receiving set, a housing having a control pinion rotatably mounted thereon with a portion extending therethrough, a radio chassis removably secured within said housing and including a main portion and support means pivoted thereto, a control element rotatably mounted on said support means, a toothed operating member mounted on said control element and engaging said pinion, and means adjustable from the outside of the housing for properly positioning said pivoted support means to properly space said pinion and said operating member so that the two will properly mesh in spite of variations in the relative position of the chassis within the housing, said positioning means including resilient means for urging said controlling member toward said pinion and an adjustable stop device for limiting its movement toward said pinion.

8. In a radio receiving set, a housing having a control pinion rotatably mounted thereon with a portion extending therethrough, a chassis removably secured within said housing and including pivoted support means, a control element rotatably mounted on said support means, a toothed operating member mounted on said control element and engaging said pinion, and means for properly positioning said pivoted support means to properly space said pinion and said operating member so that the two will properly mesh in spite of variations in the relative position of the chassis within the housing, said positioning means including resilient means for urging said controlling means toward said pinion and an adjustable stop device for limiting its movement toward said pinion, said adjustable stop device comprising an eccentric rotatably mounted on one of the relatively movable members and a stop engaged by said eccentric, said housing having a hole positioned to give access to said eccentric for the adjustment thereof through said case.

9. The combination of a radio receiver having a chassis with a receiver circuit and receiver elements thereon, including control elements in the receiver circuit, a housing for said receiver chassis and remote control means for adjustably operating said control elements, said remote control means including a control head having flexible cables extending therefrom and corresponding in number to the control elements on said receiver chassis, with one of said flexible cables including a flexible conduit fixedly secured on said control head and extending to a housing coupling at the other end fixed thereon, and a flexible shaft in said conduit, connecting means on each end of said shaft, one of said connecting means rotatable at the control head and the other of said connecting means rotating at the coupling, with said flexible shaft and connecting means longer than said conduit, and longitudinally as well as rotatably movable therein, with each of said connecting means having a shoulder thereon cooperating at the control head and at the coupling to limit the longitudinal movement of the flexible cable in the conduit, said coupling on the end of said conduit having a pair of slotted lugs thereon for mounting the coupling in a corresponding aperture in said housing adjacent a control element, with the slots in the lugs receiving the edge of said aperture to lock said coupling on said housing, with said length of each of said flexible shafts providing a lost motion between said control head and said conduit upon connecting and disconnecting said coupling at the housing, whereby the connecting means on the end of the shaft may be partially withdrawn with the shaft from said conduit to be inserted into proper position in a control element before said coupling is connected to said housing, such withdrawing movement of said flexible shaft being limited by the shoulder on the connecting means at the control head end of said shaft.

10. In a radio receiving set, a housing, a control element within said housing, a handle on the outside of said housing, a toothed member rotatable within said handle and normally connected in driving relation to said control element, and a key having its front end bifurcated and shaped to engage the teeth on said toothed member, said handle being slotted to receive said key without permitting its rotation with respect to said handle whereby, when said key is in place, said han-

dle is in driving relation with said toothed member.

11. In a radio receiving set, a housing, a control element within said housing, a handle on the outside of said housing, a toothed member rotatable within said handle and normally connected in driving relation to said control element, and a key having its front end bifurcated and shaped to engage the teeth on said toothed member, said handle being slotted to receive said key without permitting its rotation with respect to said handle whereby, when said key is in place, said handle is in driving relation with said toothed member, a means for retaining said key in place comprising a resilient split ring positioned in an annular groove on the outside of said handle, said key having notched sides which extend into said groove except when the notches therein register with said groove.

12. In a radio receiving set, a housing, a receiver chassis removably located within said housing and substantially fixed with respect to said housing in said located position, a tuning condenser mounted on said chassis, including a rotatably mounted shaft having a gear thereon for rotating said tuning condenser, a driving pinion meshing with said gear, means fixed with respect to said housing for rotatably mounting said pinion on said housing, and adjusting means accessible from the outside of said housing for moving said condenser with respect to said chassis to properly space said meshing members with respect to one another irrespective of variations in the located position of said chassis within said housing.

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