Oct. 28, 1941. H. Z. BENTON ET AL 2,260,599

RADIO TUNING APPARATUS

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Fig. 1

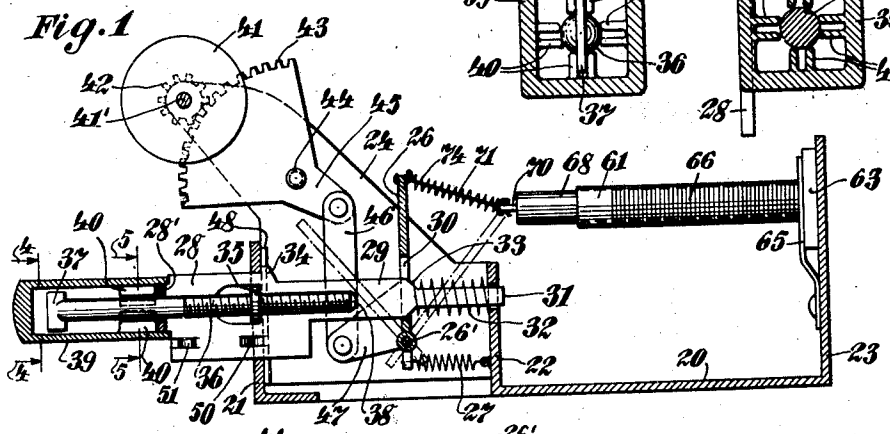


Fig. 4

Fig. 5

Fig. 2

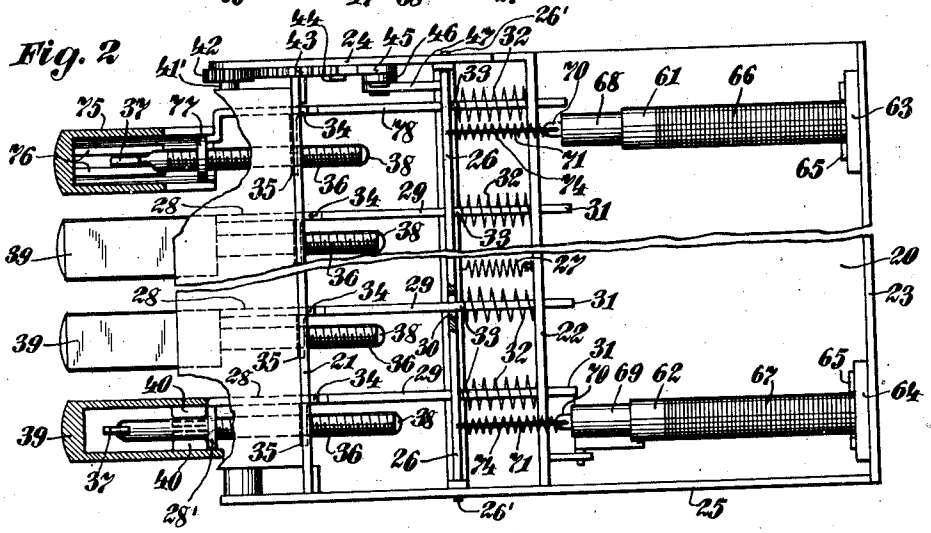
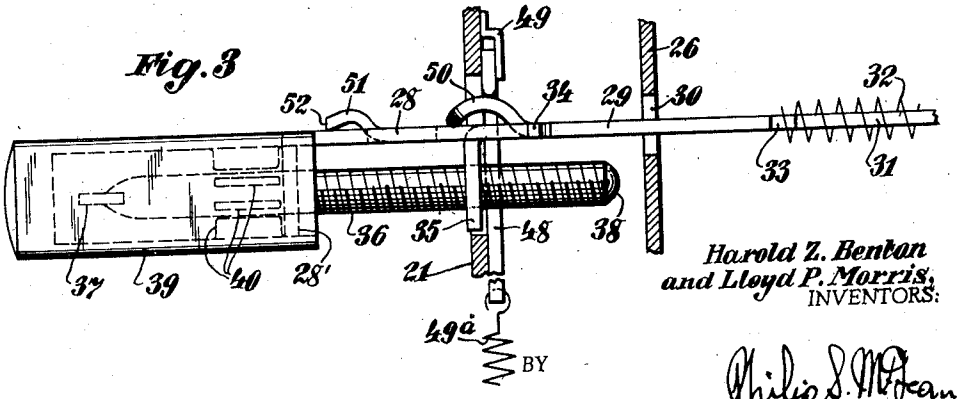


Fig. 3



Harold Z. Benton and Lloyd P. Morris, INVENTORS.

BY

Philip S. McLean. ATTORNEY.

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RADIO TUNING APPARATUS

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Fig. 6

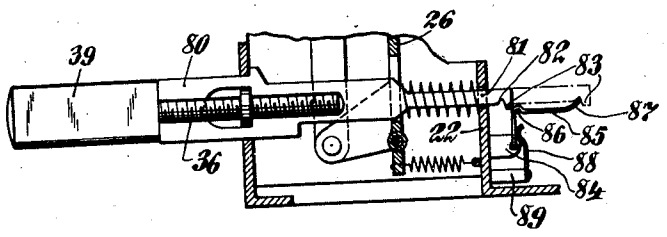


Fig. 7

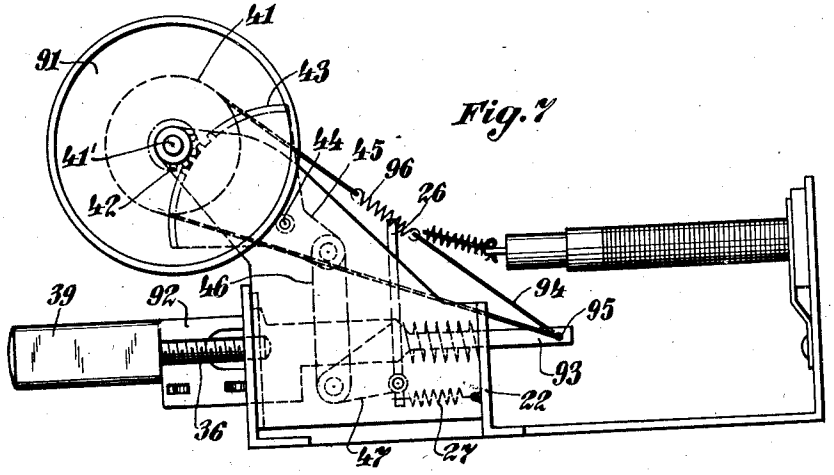


Fig. 8

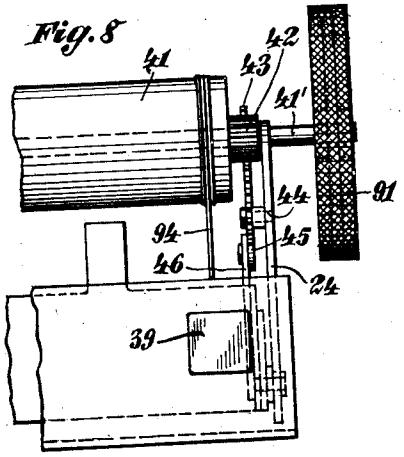
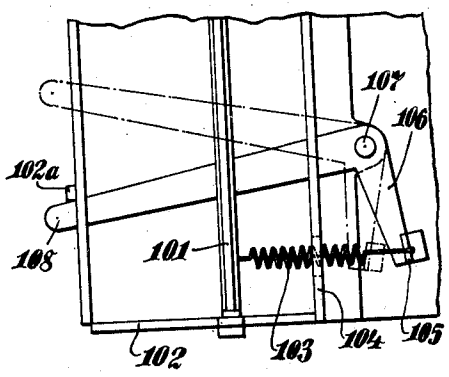


Fig. 9



Harold Z. Benton and Lloyd P. Morris, INVENTORS:

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RADIO TUNING APPARATUS

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Fig. 10

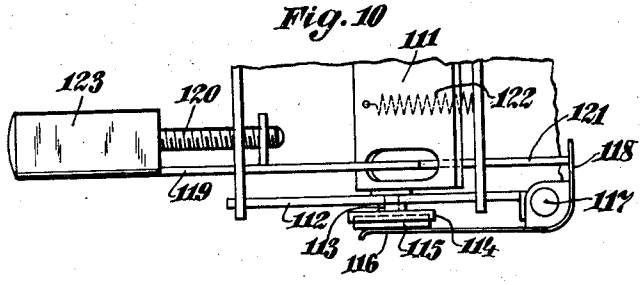


Fig. 11

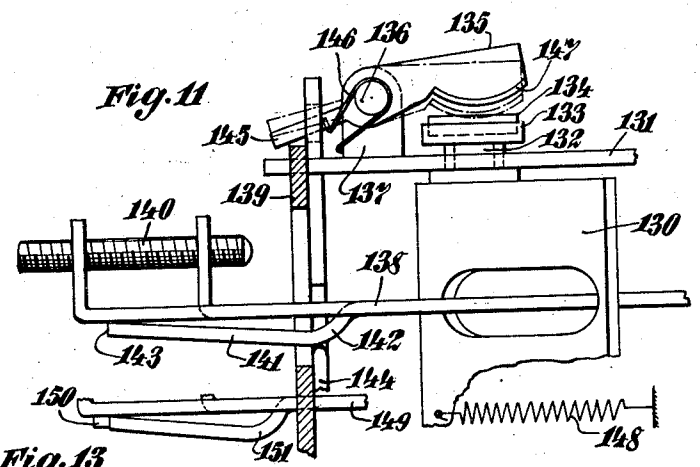


Fig. 13

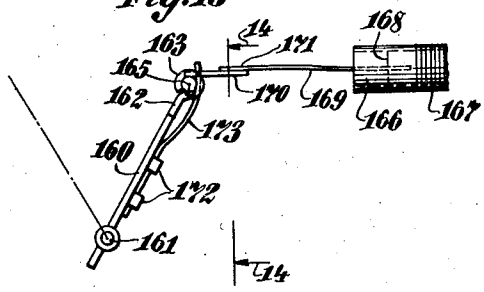


Fig. 14

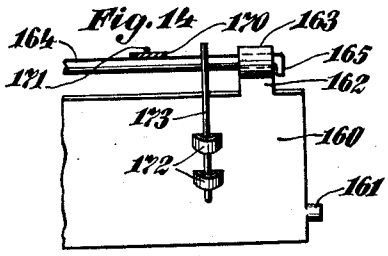


Fig. 15

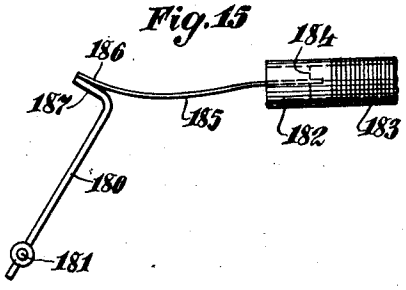
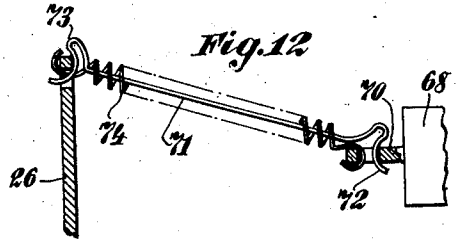


Fig. 12



Harold Z. Benton and
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RADIO TUNING APPARATUS

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Fig. 16

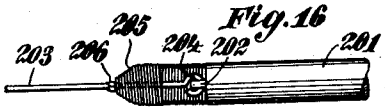


Fig. 17

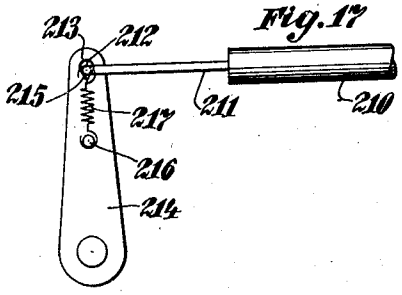


Fig. 20

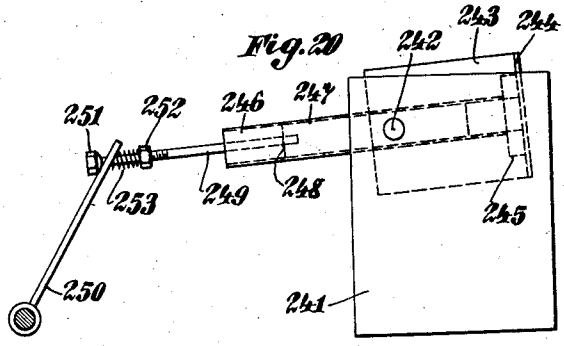


Fig. 21

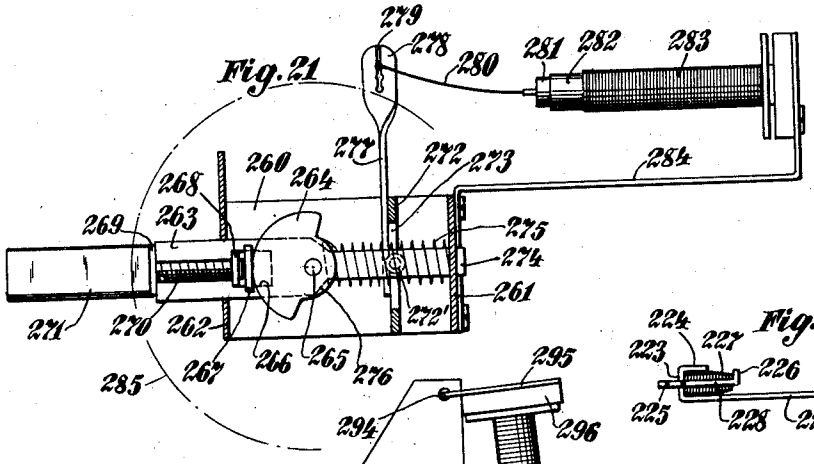


Fig. 18

Fig. 22

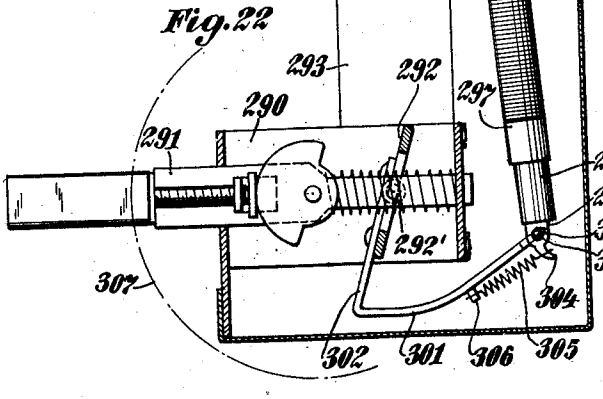
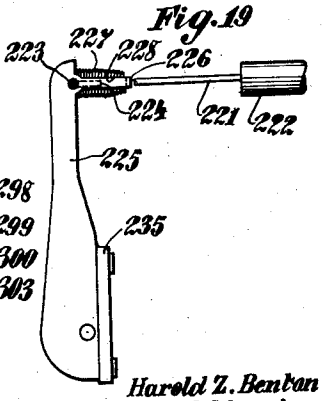


Fig. 19



Harold Z. Benton and Lloyd P. Morris, INVENTORS.

BY

Philip S. McGrath ATTORNEY.

Patented Oct. 28, 1941

2,260,599

UNITED STATES PATENT OFFICE

2,260,599

RADIO TUNING APPARATUS

Harold Z. Benton, Glencoe, and Lloyd P. Morris, Chicago, Ill., assignors to Crowe Name Plate and Manufacturing Co., Chicago, Ill., a corporation of Illinois

Application August 15, 1940, Serial No. 352,692

3 Claims. (Cl. 74—10)

This invention relates to a new and improved radio control device and more particularly to devices of this character adapted for push button operation.

While our control device is especially adapted for push button operation, it is capable of continuous manual operation for tuning throughout its range. The invention further relates to details of construction of push buttons and their adjustment mechanism and to means for connecting the movable tuning parts to movable tuning elements of the radio circuit.

The present trend in radio tuner design is to provide means for continuously tuning the radio receiver and also means, such as push buttons, for rapid and accurate tuning of selected stations. A large proportion of commercially produced receivers are now made in small and compact sizes which requires that the tuning devices and the elements of the tuned circuits be reduced in size.

The tuning of circuits requires a change in the inductance or capacity in the circuit, the usual method being a change in effective tuning by means of variation in capacity connected in parallel to an inductance. Such capacity variation is caused by rotary variable condensers, the sizes of which are such that they occupy the major portion of the space occupied by the tuning elements. The method of permeability tuning by the use of small cores movable relative to the coils affords a more compact tuning element than a variable condenser and coils, and this is especially true when the circuit tuning elements are directly and closely assembled with the mechanical tuning members such as the push buttons and dials.

Permeability tuning can be accomplished over the usual broadcast band by relatively short movement of a core of suitable effective permeability associated with a small solenoid coil. Since a slight movement of the core makes a substantial change in the frequency response of the tuned circuit, it is essential that the core movement be always exactly uniform for a given dial or push button setting which requires that play and backlash in the connected operating elements be substantially eliminated.

It is an object of the present invention to provide a new and improved radio control device of the character including push button operation and permeability tuning of the radio circuits.

It is a further object to provide constructions of this character in which the push button adjustment may be readily made from the front of the unit without the use of additional tools.

It is also an object to provide constructions with simple and compact mechanism for translating rotary action of a tuning member to linear movement of the movable core with the elimination of backlash or play between the parts.

It is an additional object to provide tuning apparatus composed of but few parts and adapted for commercial production and use.

Other and further objects will appear as the description proceeds.

We have shown certain preferred embodiments of our invention in the accompanying drawings, in which—

Figure 1 is a side elevation, partly in section, of one form of push button tuning apparatus;

Figure 2 is a plan view, partly in section and partly broken away, of the construction shown in Figure 1;

Figure 3 is a fragmentary plan view, partly in section and partly broken away, of the latching mechanism of the construction shown in Figure 1;

Figure 4 is a fragmentary section on an enlarged scale, taken on line 4—4 of Figure 1;

Figure 5 is a fragmentary section on an enlarged scale taken on line 5—5 of Figure 1;

Figure 6 is a fragmentary side elevation, partly in section of a construction similar to Figure 1 but showing a modified form of latch means for the push button slides;

Figure 7 is an elevation similar to Figure 1 showing a construction with a drum for manual operation and a brake for the dial and drum;

Figure 8 is a fragmentary front elevation of the construction of Figure 7;

Figure 9 is a fragmentary plan view showing a release for the flapper bar spring;

Figure 10 is a fragmentary plan view showing a construction of flapper bar brake;

Figure 11 is a view similar to Figure 10 but showing a different form of construction;

Figure 12 is a fragmentary view on an enlarged scale showing the form of connection between the flapper bar and core used in the forms of construction shown in Figures 1 to 8, inclusive;

Figure 13 is a fragmentary side elevation of a modified form of connection between a moving bar and core;

Figure 14 is a view taken on line 14—14 of Figure 13;

Figure 15 is a view similar to Figure 13 but showing a modified form of construction;

Figure 16 is a fragmentary view showing an-

other form of connection between a core and core moving means;

Figure 17 is a fragmentary elevation showing a form of connection between a core pull rod and core moving means;

Figure 18 is a fragmentary plan view showing a connection between a core pull rod and driving means;

Figure 19 is a fragmentary side view of this same form of connection between a core pull rod and core swinging arm;

Figure 20 is a fragmentary side elevation showing a coil and core supporting and moving construction;

Figure 21 is a side elevation, partly in section, showing a form of push button tuner; and

Figure 22 is a view similar to Figure 21 showing a modified form of construction.

Referring first to the form of construction shown in Figures 1 to 5, inclusive, the tuner is provided with a frame **20** having a front vertical flange **21**, an intermediate vertical guide flange **22**, and a rear flange **23**. The frame is also provided with side flanges **24** and **25**. The swinging flapper bar **26** is pivotally supported in the side flanges **24** and **25** at **26'**. Its lower portion is connected to flange **22** by the spring **27** which tends to swing the bar in the counterclockwise direction as seen in Figure 1. The push button slides **28** are guided in the front flange **21** and have reduced portions **29** passing through narrow slots **30** in the bar **26**. They are further provided with narrow inner end portions **31** guided in slots in the intermediate cross frame member **22**.

Each slide **28** has a coil spring **32** fitted about the narrower portion **31** of the slide. One end of this spring presses against the front face of the intermediate frame member **22**, while the other end of the spring presses against the shoulder **33** between slide portions **29** and **31**. This spring, therefore, normally keeps the push button slides at their outer limit of movement or to the left as shown in Figures 1 and 2. Movement in this direction is limited by the lugs **34** which engage the inner face of the front frame flange **21**.

Each slide **28** is provided with a struckup portion **35** extending laterally at right angles to the body of the slide, this portion **35** having a threaded opening to receive the plunger screw **36**. This screw **36** is provided with a narrow flattened adjusting end **37** and with a rounded inner end **38** adapted to engage the face of the flapper bar **26** at one side of the slot **30** through which the slide passes. The slide **28** is further provided with an outer face member **28'** bent at right angles to the body of the slide, parallel to the struckup portion **35**. This member **28'** is square in shape and is provided with a guide opening through which the screw **36** passes. The hollow push buttons **39** fitted on the slide portions **38**, are provided adjacent their open end with a plurality of pairs of flanges **40**, as shown in detail in Figures 4 and 5. These flanges are of such depth as to extend closely adjacent the surface of the screw **36**, and each pair is spaced apart a distance sufficient to permit the flattened portion **37** of the screw **36** to pass or fit between them, as shown in Figure 4.

The drum dial **41** is carried in arms extending upwardly from the side flanges **24** and **25** of the frame and its shaft **41'** is provided at one end with a small gear **42** which meshes with the gear sector **43**. This gear sector **43** is pivotally supported at **44** on the side frame member **24** and is provided with an inwardly extending arm **45**. This arm **45** is connected by link **46** to an arm **47** extending from the flapper bar **26**.

As best shown in Figure 3, the cross frame member **21** carries the sliding latch bar **48** held in place by clips **49** and normally drawn against the slides by the coil tension spring **49a**. The latch bar **48** is provided with openings through which the slides **28** pass. Each slide **28** is provided with two struckup projections, these being the release cam **50** and the stop **51**. The release cam **50** is higher than the stop **51** and will thus slide the latch bar sufficiently to fully release the stop **51** of another bar as the slide is pushed in. The release takes place early in the travel of the slide so that the released slide comes out in ample time to permit the latching of the slide being pushed in. The stop **51** has a square front face **52** to engage the latch while the cam **50** is rounded at both ends and the slide spring **32** is sufficiently stronger than the latch spring **49a** so that the slide comes out quickly when the stop **51** is released.

The tubular coil forms **61** and **62** are provided with insulating bases **63** and **64** which are held against the rear transverse frame member **23** by clips **65**. These coil forms **61** and **62** carry the coils **66** and **67**. Into the coil forms **61** and **62** are fitted the cylindrical cores **68** and **69**, these cores being adapted to freely slide back and forth within the coil forms. Each core is provided with a connecting lug **70** having an opening therein, the opening being non-circular in shape with a pointed section extending toward the core. As shown in detail in Figure 12, the push rod **71** is provided with a reversely bent curved end **72** passed through the opening in the connecting lug **70** and seating in the pointed section of the opening in the lug **70** adjacent the core. The opposite end **73** of the push rod **71** extends through an opening in the upper portion of the flapper bar **26** and has a bent portion thrusting against the flapper bar. The tension coil spring **74** is fitted around the push rod **71**, one end of it being hooked through the opening in the flapper bar **26** and the other fitting in the opening in lug **70** on the core. This coil spring, therefore, serves to take up any backlash in the connection between the flapper bar and core during the operation of the apparatus.

In order that the tuning apparatus may be manually tuned over the broadcast band or over the tuning band covered by means of the particular coils and cores provided, one push button is constructed for such tuning. The upper button **75** of Figure 2 is constructed for this purpose. The button has continuous interior guides **76** for engaging the flattened portion **37** of the associated screw **36**. The transverse end **77** of slide **78** is circular in shape so that the button **75** may be rotated without withdrawing it from the slide. The slide **78** is otherwise the same as slides **28**. In the use of the button **75** for manual tuning, it is pushed in and latched in in the usual manner. The drum dial **41** will show the tuning adjustment at which the button was left when last used. Rotating the button **75** moves the screw **36** in or out and thus moves the bar **26** and tunes the set, the movement being shown by corresponding movement of the drum dial.

It is to be understood that the cores **68** and **69** may be finely divided powdered iron, if permeability inductive tuning is used, or brass or other similar metal if variable high frequency coaxial inductive tuning is desired. If tubular capacitive

tuning is used the cores will be metal and will slide within the shells 61 and 62, being insulated therefrom, the shells being of a metallic conductor and co-operative with the cores in such manner that the capacity between the movable cores and outside metal forms 61 and 62 will vary as the cores are moved within the hollow metal forms 61 and 62.

A modified form of latch construction for the push button slides has been shown in Figure 6. The slide 80 is similar to the slide 28 of Figures 1 to 3, but is provided with a different form of narrow rear extension 81 having a notch 82 and a downwardly extending rear end 83. The cross frame member 22 is provided with rearwardly extending side arms 84 between which is pivoted a swinging latch bar 85. The latch bar has an intermediate hump 86 and upturned end 87. The flat spring 88 is supported by a stud 89 from the frame member 22, and engages the rearward face of the upwardly extending portion of the latch bar 85 as shown in Fig. 6. The parts are proportioned so that the hump 86 of the latch bar will pass freely under the reduced rear portion 81 of the slide, but will be engaged by the downwardly extending end 83 of the slide. The spring 88 serves to normally urge the latch bar in the counterclockwise direction.

The construction operates by pushing in any push button, this serving to swing the latch bar 85 in the clockwise direction due to the engagement of the slide end portion 83 with the hump 86 of the latch bar. This forces the upturned end 87 of the latch bar out of the notch 82 in the slide previously pushed in, which was held in the inner position by the latch bar. As the downwardly extending end 83 passes over the hump 86 of the latch bar, the bar swings upwardly so that after the upturned end 87 passes under the downwardly extending portion 83 of the latch bar it catches in the notch 82 to latch this slide in the operative position.

The form of construction shown in Figure 7 is generally similar to that shown in Figures 1 to 5, inclusive, with the exception that instead of manually turning the device by means of one of the push buttons it is manually tuned by means of the knurled hand wheel 91, which is secured to the drum dial shaft 41'. The spring 27 connecting the frame portion 22 and the lower portion of the paddle bar 26 tends to urge the drum to its counterclockwise limit of movement through means of the arm 47, link 46, arm 45, gear sector 43 and dial gear 42. Consequently, if means were not provided to counteract the effect of the spring 27, the device could be manually tuned only by holding the dial in the desired position.

The slide 92 is generally similar to the slides 28 previously described, with the exception that it has an extended inner end 93. The brake cable 94 passes through an opening 95 in this slide extension 93 and passes around the drum 41, as shown in Figures 7 and 8. The tension spring 96 is connected in the cable 94 so that a positive tension is imparted to the cable 94. With the push button slide 92 in its outer position, this tension of the spring 96 and the braking effect of cable 94 are not sufficient to overcome the normal movement of the drum under the influence of the spring 27. When slide 92 is pushed inwardly, however, and latched in its inner position, the spring 96 is stretched and its tension increased sufficiently so that it overcomes the tendency of the spring 27 to move the drum in the counterclockwise direction and causes the drum to remain in any position to which it may be manually moved by means of wheel 91. It will be understood that this does not necessarily make the wheel 91 hard to turn, as the braking effect need not be excessively great after counterbalancing the spring 27.

A different means for releasing the tension of the paddle bar spring is shown in Figure 9. Here the paddle bar 101 is pivoted in the frame 102 and its lower edge is provided with the spring 103 which is similar in effect to the spring 27 of the constructions previously described. The opposite end of this spring, however, instead of being connected to the frame member 104, passes through that frame member and is connected to an upturned lug 105 carried by the bell crank member 106. This bell crank is pivoted in the frame at 107 and has a lever 108 for manual operation extending through the forward face of the frame. With the parts in the full line position shown in Figure 9, with lever 108 retained by latch 102a the spring 103 will be put under tension, while if the bell crank is moved to the broken line position, the tension on the spring will be released and the dial and tuning apparatus may be manually rotated to the desired position and will remain in that position without any action by spring 103.

A further modified form of brake for permitting manual adjustment of the dial and tuning mechanism is shown in Figure 10. In this construction the paddle bar 111 is supported in the frame 112 and carries on its shaft 113 a cup 114 having a lining 115 of friction material, such as cork. The resilient brake member 116 is pivotally supported at 117 upon a rear extension of the frame 112. This brake member 116 is provided with an operating extension 118 extending around to the rear of the frame 112. A push button slide 119 is carired in the frame 112, the screw 120 being so short that it will at no time interfere with the movement of the paddle bar 111. This slide 119 has a rear extension 121 which, when the push button slide 119 is pushed inwardly and latched in its inner position, serves to thrust positively against the extension 118 on the brake member 116, thus forcing that member firmly against the braking surface 115 on the paddle bar. This braking effect can be adequate to overcome the force of the spring 122, which normally swings the paddle bar 111 in the counterclockwise direction. It will be understood that the push button 123 on slide 119 will be designated manual tuning, and pushing this button in will both release any push button previously pushed in and apply the brake as described above. When it is desired to go back to push button tuning, pressure on any other button will release the manual tuning button and tune the device in the usual manner.

Figure 11 shows a different type of construction for applying a brake to the swinging paddle bar so as to permit continuous manual tuning without interference from the spring normally swinging the bar against the push button screws. The paddle bar 130 is pivoted in the frame 131 at 132 and is provided with the cup-shaped member 133 carrying the friction brake disc 134. The brake member 135 is pivoted at 136 on lug 137 extending from the frame 131. The push button slide 138 passes through the front frame member 139 and through latch bar 144 which is connected to operate the brake 135 when the cam point 142 on the push button slide travels inwardly to per-

mit shifting of the latch bar by spring 146. The adjustable screw 140 is short so as not to engage the bar 130. The slide 138 is provided with the latch cam 141, the high point 142 of which serves to unlatch any slide being held in. The front end 143 of the slide serves to latch this slide in.

The latch slide 144 is movable against the inner face of frame member 139 and is provided with an opening through which passes the reduced end 145 of the brake member 135. The spring 146 extends around the pivot 136 of brake member 135, one end being hooked under the reduced portion 145 of the brake member and the other end being hooked around the lug 137. This spring tends to slide the latch bar 141 upwardly, as seen in Figure 11, and also tends to swing the brake surface 147 carried by brake member 135 against the brake disc 134. The spring 148 tends to swing the upper edge of bar 130 to the left, as seen in Figure 11.

A push button slide 149 is shown adjacent the slide 138, this slide being similar to slide 138, with the exception that a latch slide stop lug 150 is provided at the end of the struckup cam 151. This stop lug 150 prevents the latch slide from moving far enough to apply the brake when tuning push button slide 149 is latched in.

In Figures 13 and 14 is shown a modified form of connection between the flapper bar and the pull rods connected to the cores. In these figures the flapper bar 160 is pivoted at 161 and is provided with upwardly extending portions 162 which are reversely bent at 163 to support a cross bar 164. As shown in Figure 14, the cross bar 164 is provided with the downturned end 165 to limit longitudinal movement. The coil support 166 carries the coil 167 and the cylindrical core 168 is slidable within the member 166. The flexible and resilient pull rod 169 has one end molded in the core or otherwise positively and permanently connected thereto. The connecting member 170 is soldered, brazed or welded permanently to the bar 164. The free end 171 of the pull rod 169 is soldered or otherwise secured to the member 170 in the assembly of the parts. The flapper bar 160 is provided with struckup portions 172 which are adapted to receive and retain the spring 173, the upper portion of which bears against the cross bar 164, thus preventing any play between this bar and its support at 163.

In Figures 15 to 22, inclusive, various specific forms of means for connecting a movable core and core drive means are shown. In the form of construction shown in Figure 15, the flapper bar or other swinging member 180 is pivoted on an axis at 181. The tubular coil form 182 carries a coil 183, and a core 184 fits within the form 182 in such manner as to slide freely therein. The flexible resilient wire 185 has one end molded in the core 184 or otherwise positively connected to the core. Its free end 186 is soldered or welded or otherwise rigidly secured to the portion 187 of the movable member 180. This connection absolutely prevents any backlash or looseness between the driving elements and the driven core. It will be understood that the wire or similar member 185, which may be formed of steel, brass or bronze, is flexible and resilient so that it does not become bent or take any permanent set during operation.

In the form of construction shown in Figure 16, the core 201 has an eye 202 molded or otherwise permanently and fixedly secured to the core. The pull rod 203 has a hooked portion 204 passed through an opening in the eye 202. The compression coil spring 205 has one end bearing against the face of the core 201 adjacent the eye 202. The opposite end of the coil spring is reduced in diameter and engages deformed portions 206 formed in the pull rod 203. The spring, therefore, presses against the core and the pull rod and eliminates all play or looseness in the connection between the pull rod 203 and the eye 202.

In the form of construction shown in Figure 17, the core 210 has a pull rod 211 molded or otherwise fixedly secured therein. This pull rod 211 is provided with an end portion 212 turned at right angles to the body of the pull rod and fitting in an opening 213 formed in the flat drive arm 214. This opening 213 has a lower V-shaped portion 215. The drive arm 214 is provided with a pin or stud 216 about which is fitted one end of the coil spring 217. The opposite end of this spring is hooked around the portion 212 of the pull rod 211, holding that portion down in the V-notch in the lower portion of the opening 213. This spring connection, therefore, prevents play or looseness between the parts.

In the form of construction shown in Figures 18, 19, the pull rod 221 has one end molded or otherwise fixedly secured to the core 222. This rod 221 has a transversely extending portion 223 and a reversely bent portion 224. The driving member 225 is provided with an opening through which the transverse portion 223 of the pull rod passes. The member 225 also has an upturned end portion 226. The coil spring 227 is fitted around the extended portion 228, of the member 225 beyond the cross portion 223 of the pull rod, one end of it engaging this portion of the pull rod and the other end engaging the portion 226 of the member 225. This spring serves to hold the parts in relatively fixed position and eliminates play or backwash at this point.

In the form of construction shown in Figure 20, the supporting frame member 241 has pivoted thereto at 242 a bracket 243. This swinging bracket has an outturned portion 244 to which is secured a base 245 carrying a coil form 246 upon which is wound a coil 247. The core 248 is slidably fitted in the coil form 246 and this core has a rigid pull rod 249 molded therein or otherwise rigidly and permanently connected thereto. The pull rod 249 passes through an opening in the swinging flapper bar 250 and has a nut 251 secured on its outer end, this nut having a rounded inner face to engage the adjacent surface of the flapper bar 250 and limit relative movement between the parts. The intermediate portion of the rod 249 carries the nut 252 and the coil spring 253 is fitted between the nut 252 and the adjacent face of the flapper bar 250. This spring holds the rounded face of nut 251 at all times in engagement with the face of the bar 250 so that relative movement of the part is maintained uniform.

In the form of construction shown in Figure 21, there is provided a frame construction 260 having a rear transverse member 261 and a front transverse member 262. These members 261 and 262 have aligned slots to receive the push button slides 263. These slides 263 each carry a cam 264 pivoted thereto at 265. The slides are provided with slots 266 through which extend the clamping members 267 and 268. The slide has a transversely extended end portion 269 through which is threaded the clamping

screw 270. This screw extends through a threaded opening in the clamping member 268 and its end engages the clamping member 267, thus forcing it against the face of the cam 264. The outer end of the slide carries the push button 271. The swinging paddle bar 272 is pivoted at 272' in the frame 260 and is provided with slots 273 through which the reduced portions 274 of the slides 263 pass. The slides carry the coil springs 275, one end of each spring engaging the cross frame member 261 and the other end engaging the shoulder 276 on the slide. These springs normally maintain the slides at their outer limit of movement and return them to that position when pressure is removed from the push buttons. The paddle bar 272 has a core drive arm 277 secured thereto, this arm, as shown, being formed of a flat member having its upper portion 278 twisted at right angles to its lower portion which fits against the face of the paddle bar. The portion 278 is provided with a notched slot 279 to receive the end of the connecting wire or pull rod 280, which end is turned at right angles to the body of the wire. The wire 280 is positively connected to the core 281 fitting in the coil form 282. This coil form carries the coil 283 and is supported from the rear transverse member 261 by the rearwardly extending bracket 284. The paddle bar 272 is provided with the hand wheel 285 for continuous manual tuning.

The form of construction shown in Figure 22 comprises the frame member 290, the push button slides 291, and paddle bar 292 pivoted at 292'. The slides 291 are similar in construction to the slides 263 shown in Figure 21, and need not be described in further detail. The side brackets 293 are secured to the sides of the frame 290 and are provided with openings 294 into which fit lugs on the ends of a swinging support 295. This swinging support carries a base 296 to which is connected the coil form 297. The core 298 is slidably fitted in the coil form 297 and is provided with a flat connecting lug 299. This lug 299 has a non-circular opening formed therein with a V-notch 300 located approximately in line with the line of thrust of the connecting arm 301. This arm 301 has a reversely bent portion 302 secured to the paddle bar 292 so that the arm swings with movement of the paddle bar. It has a finger 303 extending through the opening in the lug 299 and fitting in the notch 300. The lug 299 is provided with a hooked portion or horn 304 over which is fitted one end of the coil spring 305. The other end of the coil spring is fitted about a lug 306 extending downwardly from the member 301. This coil spring serves to keep the finger 303 positively seated in the notch 300 and therefore eliminates play or looseness between the parts as the core is moved into and out of the coil upon rotary movement of the paddle bar 292.

In the use of the form of construction shown in Figures 1 to 5, in order to set up a push button for a desired station the selected push button is pushed in until the end 52 of the stop 51 engages the inner face of the latch slide 48. The rounded end 38 of the screw 36 will engage the front face of the flapper bar 26 and move that bar to an angular position, dependent on the adjustment of the screw 36 at the time.

It being assumed that this is not the desired adjustment, the hollow push button member 39 is withdrawn from the end of the slide to a position where the flattened end 37 of screw 36 fits between opposed pairs of flanges 40, as shown in Figure 4. The member 39 is then rotated and serves as a handle for rotation of the screw 36. Rotation of this screw 36 moves its inner end 38 inwardly or outwardly, depending upon the direction of rotation of the screw. The screw is rotated until the desired station is tuned in, it being apparent that this movement of the screw varies the angle of the flapper bar 26 and consequently moves the cores 68 and 69 inwardly or outwardly of their associated coils, depending upon the direction of movement.

The indications on the dial drum 41 are of assistance in making this adjustment since the dial moves with movement of the flapper bar 26, and it will therefore be readily apparent to the person setting up the push button as to which direction the tuning of the push button is going and the desired station can be identified by the indications on the dial. The exact tuning can then be accomplished by slight movement of the screw 36.

After the desired adjustment is obtained, the hollow push button member 39 is slipped back to its position, as shown in Figure 1, fitting firmly on the squared portion 28' of the slide. The guide flanges 40 engage the screw 36 and maintain the push button in proper alignment. It will be noted that at this time the flattened adjusting end 37 of the screw need not be in either a vertical or horizontal position as it is not located between the flanges 40. Other push buttons may be set up in the same manner. It will be noted that as a push button is forced inwardly or to the right as seen in Figure 1, the cam 50 engages the latch bar 48 and slides it laterally. This movement of the latch bar releases its engagement with the stop 52 of whatever push button slide has previously been forced inwardly. The previously used push button is thereupon released early in the travel of the push button being tuned and does not in any way interfere with the latching of the subsequently used push button slide.

It will be apparent that during the push button operation of the device the push button for the particular station being heard remains latched in its inner position. This gives an indication of the station being heard which, however, can also be ascertained by looking at the dial. If it is desired to tune continuously, it is necessary to release any push button slide which is latched in place. This is accomplished by pushing in button 75, as shown in Figure 2, and when this button is latched in the inner position the latch bar is moved as desired by rotating the button, the movement of the dial 41 serving to indicate the tuning adjustment.

The form of connection between the flapper bar 26 and the core 68 shown in Figures 1, 2 and 12 is efficient in preventing backlash or play between the parts, which is essential in this type of tuner. It will be understood, however, that any one of the various other forms of construction for making an efficient connection between such parts, which constructions are shown in the other figures of the drawing, may be incorporated in this type of push button tuner.

The method of assembly and operation of the different forms of connection shown in Figures 13 to 19, inclusive, are believed apparent from the drawings and the previous description of these types of construction.

In the form of construction shown in Figure

20, a rigid core pull rod 249 is used and the coil is permitted to have a rocking motion so as to prevent binding between the core and the coil form. Tilting of the coil will take place as the flapper bar 250 is swung back and forth, thus raising and lowering the free end of the pull rod 249.

In the form of construction shown in Figure 21, the push buttons are adjusted in the well-known manner by releasing the clamping action against the cam 264. This is accomplished by turning the screw 270 so as to release the thrust against the clamping member 267. The screw 270 is always located in substantially the same linear position when in clamping action, and its head therefore may be rigidly and permanently secured to the push button 271. Rotation of this push button serves to loosen and tighten the clamping action. The station is set up by loosening the clamping action, thrusting the push button in to its limit of movement so that the cam 264 engages the paddle bar 272, and then swinging the paddle bar to such a position as to tune in the desired station. With the parts in this position the cam 264 is clamped and held by screwing inwardly the screw 270. The push button may then be released and when thereafter pushed inwardly will always swing the paddle bar to the same position. It will be understood that in this form of construction the support of the paddle bar must have sufficient frictional drag so that it is held in adjusted position. The paddle bar may be manually tuned by means of the hand wheel 285. The connection between the drive arm 277 and the core pull rod 280 is adjustable and the core may be given a greater or lesser movement, depending on the length of lever arm utilized. It will be understood, however, that this adjustment will normally be made at the factory and will not thereafter be varied.

The form of construction shown in Figure 22 is adjusted in the same manner for setting up push buttons as has been described in connection with Figure 21. Here again the paddle bar 292 must be frictionally held so that it is maintained in adjusted position by friction regardless of any thrust upon it due to the weight of the core and coil, which thrust is transmitted through the arm 301. The paddle bar may be manually tuned by means of the hand wheel 307. The spring 305 serves to prevent any play or backlash between the parts and when once adjusted the parts will always be returned to the same position upon the same movement of the paddle bar 292.

It will be understood that in both of the constructions of Figures 21 and 22 a dial may be connected to the paddle bars 272 and 292, respectively, in any desired manner, such, for example, as the manner of dial connection used in the form of construction of Figure 1. It will thus be possible to tune these constructions manually by their hand wheels.

While the form of construction shown in Figure 22 may be used in the position in which it is shown with the push buttons extending through the front of a cabinet, it is particularly adapted for use with the push buttons projecting upwardly through the top of the cabinet in which case the core and coil are approximately horizontal. In this case the coils and cores may be located below the chassis, if desired. With units such as those of Figures 21 and 22 where the push button slides or screws do not remain latched against the bars, it is necessary to provide sufficient frictional or spring resistance to counterbalance any connected weight of coils and cores so that the movable bar will remain in any position to which it may be moved.

While we have shown certain preferred embodiments of our invention, it is capable of further change and variation to meet differing conditions and requirements and we contemplate such modifications as come within the spirit and scope of the appended claims. And while particularly adapted for and shown in conjunction with permeability tuning, it will be clear that the invention is adapted as well to other forms of tuning, such for example, as capacity and coaxial capacity tuning.

What is claimed is:

1. Radio tuning apparatus comprising a frame, a swinging bar pivoted in the frame, means normally swinging the bar in one direction, a plurality of means for selectively swinging the bar in the opposite direction, a tuner comprising fixed and movable members, means connecting the movable tuner member to the swinging bar, a rotary dial mechanism, and means connecting the swinging bar to the dial mechanism, said means comprising a gear on the rotary dial, a gear sector pivoted on the frame and meshing with the dial gear and a link connecting the swinging bar and the gear sector to rotate the sector upon swinging movement of the bar.

2. Apparatus for radio tuning, comprising a plurality of separately operable tuning slides, a pivotally mounted spring biased pivoted bar having openings therethrough for passage of said tuning slides, adjustable abutment screws on said tuning slides engageable with said pivoted bar at the sides of said openings therethrough for displacing said pivoted bar to the extent determined by the adjustment of said screws, a latch bar slidable over said tuning slides substantially at right angles thereto and provided with locking shoulders at the side of said tuning slides for holding the latter in advanced positions and tuning slide locking and releasing lugs in different positions on the sides of said tuning slides for operative coaction with said locking shoulders.

3. In apparatus for radio tuning, the combination with separately operable tuning slides, a latch bar slidably mounted for movement across said tuning slides substantially at right angles thereto and provided with shoulders adjacent the different tuning slides for holding a slide which has been advanced in the advanced position and tuning slide locking and releasing lugs in different positions on said tuning slides for operative coaction with said locking shoulders on said slidable latch bar.

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