April 28, 1942. H. Z. BENTON ET AL 2,281,093

RADIO TUNING APPARATUS

Filed Dec. 4, 1939 2 Sheets-Sheet 1

Fig. 1.

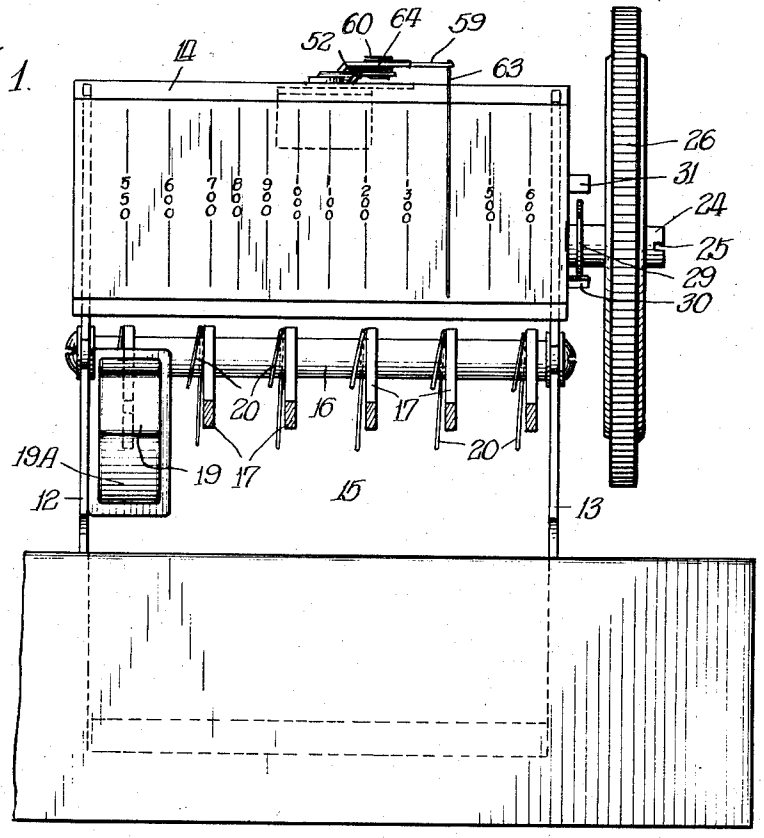
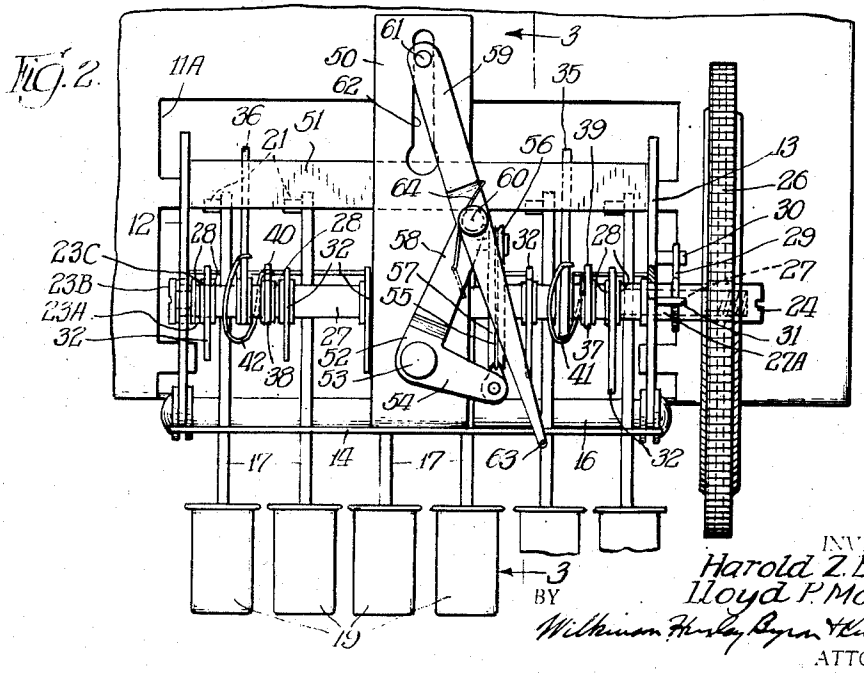


Fig. 2.



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Fig. 3.

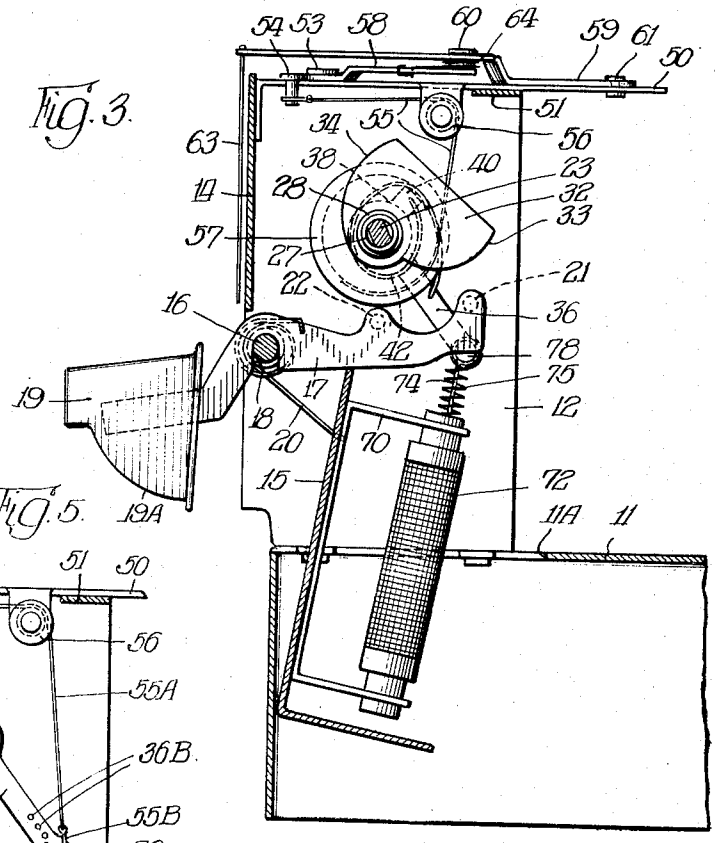


Fig. 5.

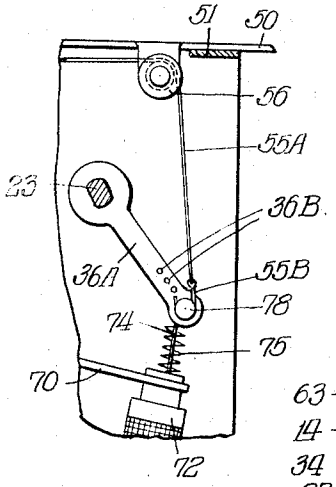
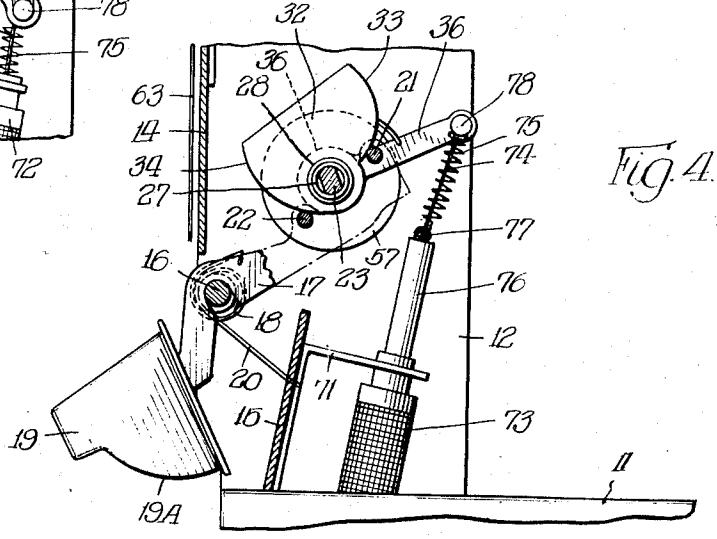


Fig. 4.



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2,281,093

RADIO TUNING APPARATUS

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Application December 4, 1939, Serial No. 307,362

6 Claims. (Cl. 74—10)

This application relates to a new and improved cam type push button tuner and more particularly to a radio tuner of this character adapted for use in connection with either permeability or capacity tuning continuously variable over a wide range of frequencies.

Present commercial practice requires a compact tuner adapted for push button tuning for a plurality of stations combined with continuous manual tuning over the frequency band. Horizontally slidable push buttons have the objection with smaller sets that pressure on the buttons may move the entire set rather than force the push button in to tune the set. In the present construction the major application of force to the push buttons is in the downward direction which obviates this difficulty.

The present construction includes a shaft having a plurality of cam units, as this type of construction has proven to give a much greater degree of accuracy for selection of stations. There has been shown and described herein a construction in which the cams and other parts are assembled on the shaft and locked in position by being forced together by means of a slotted nut on the end of the shaft. Other types of assembling and locking the units on the shaft may be used as, for example, the construction shown in the copending application of Harold Z. Benton, Serial No. 288,917, filed August 8, 1939. The construction shown herein is compact and rigid, the permeability coils being mounted in a vertical position below the cam shaft assembly so as to reduce the front to back space required by the assembly on a radio chassis. The coil mounting plate acts as a tie bar between the two end plates of the supporting frame end mechanism, which affords a compact and rigid structure.

Means are provided for canceling all back lash in either direction between the core moving arms and the cam shaft. This feature is important due to the fact that when the locking means holding the parts in position on the shaft is loosened for the purpose of setting the cams, there is a slight tendency due to the leverage of the core moving arms for these arms to take up whatever small amount of play there exists between the arms and the shaft upon which they are slidably fitted. The core moving arms are also connected to the cores by means which cancels all forms of back lash and at the same time allows flexible movement for any misalignment which may be present with respect to the cores and arms. The construction may be made with any number of buttons and the core moving arms can be placed anywhere desired along the line of the cam shaft to conform to any different spacing desired for the coils and cores. This is accomplished by changing the spacers and relocating the core arms in relation to the spacers and cams.

The construction provides U-shaped brackets for mounting the permeability tuned coils, which brackets are provided with slotted ends into which the coil forms fit loosely, so that they can be moved back and forth for tracking alignment and then cemented in place. This affords a very simple and cheap system of aligning the coils at the time of assembling the unit with the remainder of the radio set, and eliminates the use of more expensive threaded rods on cores and sliding brackets which are often fastened to a base with spring washers and are thus subject to the shifting out of alignment due to rough handling.

It is an object of the present invention to provide a new and improved tuning device especially adapted for use in continuously variable permeability tuning.

It is also an object to provide a construction which is compact and complete in itself as a radio frequency portion of a radio receiver.

It is a further object to provide a tuner which may be readily adjusted and aligned and in which the push button controls may be easily and rapidly set up to the desired stations.

It is another object to provide a structure which is simple and rigid and free from back lash so as to accurately maintain its adjustment and alignment.

It is also an object to provide a construction of this character composed of but few and simple parts and capable of commercial production and use at moderate cost.

Other and further objects will appear as the description proceeds.

Certain preferred embodiments of the invention have been shown in the accompanying drawings, in which—

Figure 1 is an elevation of the construction partly broken away;

Figure 2 is a plan view of the construction also partly broken away;

Figure 3 is a vertical transverse section taken on line 3—3 of Figure 2, showing a push button in inoperative position;

Figure 4 is a fragmentary view similar to a portion of Figure 3 and showing a push button lever in operative position; and

Figure 5 is a fragmentary section showing a modified form of dial drive connection.

The tuning apparatus frame is shown as supported on a chassis 11, and as comprising end plates 12 and 13 which are secured together at their upper forward edges by a dial plate carrying member 14. The chassis 11 has an opening 11A cut therein so that the tuning assembly may be mounted thereon as a unit. The end plates 12 and 13 are also secured together and braced by a coil carrying cross frame member 15. The push button lever shaft 16 is supported in the end plates 12 and 13 and is provided with circumferential grooves to receive the push button levers 17 and support them in spaced relation. These levers 17 are provided with notches 18 to fit in the grooves formed in the shaft 16 and their forward ends are provided with the enlarged buttons 19 for manual operation. The lower portions of the buttons 19 are formed with an arcuate forward face 19A, the arc having a center approximately at the axis of the shaft 16 upon which the levers 17 swing. These lower portions of the buttons serve, with the buttons in normal position, to fill the large openings in the panel or escutcheon which are required because of the swinging movement of the push button levers. The springs 20 hold the levers 17 in place on the supporting shaft 16. Each lever 17 is provided with the cam operating lugs 21 and 22.

The cam shaft 23 is pivotally supported in the end plates 12 and 13 and has a threaded end to receive the cup-shaped nut 24 shown in Figures 1 and 2, which nut is provided with the slot 25 so that it may be screwed on or off the end of shaft 23 or tightened or loosened upon the shaft by means of a screw driver or small coin. The shaft 23 is shown in cross-section in Figures 3 and 4 and has two opposite sides flattened to form what is commonly called a double D section. The manual operating disc 26 has a corresponding opening therein and is fitted upon the shaft 23 so as to rotate the shaft. The shaft 23 carries a plurality of tubular spacing washers 27 and a number of flat spacing washers 28. The tubular washers are free to rotate on the shaft while the flat washers have double D-shaped openings fitting the shaft so that they rotate with the shaft. The shaft 23 is provided with an enlarged portion 23A adjacent the frame member or end plate 12, this portion 23A serving to receive the end thrust when the members slidable on the shaft are clamped together. The portion 23A may be formed integrally with the shaft 23 or fixedly secured thereto. The shaft 23 has a reduced end fitting in a bearing in the end plate 12 and receiving the machine screw 23B which bears against the outer face of the end plate to hold the shaft in position. The washer 23C is fitted upon the shaft against the inner side of the end plate 12.

The shaft 23 carries a stop member 29 between two washers 27 outside of the end plate 13, this member 29 having an opening fitting the flattened portions of the shaft so that it rotates with the shaft. Stop lugs 30 and 31 are carried by the end plate 13 to cooperate with the stop 29 to limit rotation of the shaft 23 and the members carried by the shaft. The tubular washer 27A extends through the bearing opening in the end plate 13 so that the washers, spacers and other elements assembled on the shaft may be clamped or released without any end thrust against plate 13. The shaft 23 further carries a plurality of cams 32, each of which is held between two flat washers 28. The cam members 32 are provided with round openings fitted on the shaft so that they may be freely turned relative to the shaft when not clamped tightly between washers 28 by tightening up the nut 24. The cams 32 are shown in face view in Figures 3 and 4 and are provided with arcuate surfaces 33 and 34 which are adapted to be engaged by the cam operating lugs 21 and 22, respectively, on the push button arm 17 for moving the came to predetermined positions, which movement serves to rotate the shaft 23 when the cams are clamped in place.

The shaft 23 also carries a plurality of tuning arms 35 and 36 which are fitted between disc washers 28. These tuning arms are provided with openings closely approximating the shape of the shaft with its flattened sides so that they are rotated with the shaft at all times. Adjacent the tuning arms 35 and 36 are located armed washers 37 and 38 having arms 39 and 40 extending therefrom. The spring 41 connects the arm 39 on washer 37 with the tuning arm 35. The spring 42 similarly connects the arm 40 and tuning arm 36. The washers 37 and 38 are provided with openings similar to those in arms 35 and 36 so that they are constrained to rotate with shaft 23. The spring 41 tends to rotate the tuning arm 35 in the counterclockwise direction, as seen from the right of Figure 2, while it tends to rotate the washer 37 in the clockwise direction. This spring, therefore, serves to take up any slack or play between the tuning arm 35 and the shaft 23 and holds it at all times in a definite rotary relationship to the shaft regardless of the rotary position of the shaft. The spring 42 performs a similar function for the tuning arm 36.

The dial mechanism support 50 is a flat member extending rearwardly above the shaft 23, having its forward end secured to the dial plate 14 and its rear portion secured to a flat support member 51 extending transversely of the frame parallel to the dial front, this member being supported from the end plates 12 and 13. The bell crank lever 52 is pivotally supported at 53 upon the support 50. One arm 54 of the bell crank has connected thereto the cable 55 which, as best shown in Figure 3, passes over idler pulley 56 supported from the member 50, down over a cable drive drum 57 which is carried upon shaft 23 and which rotates with that shaft. The second arm 58 of the bell crank lever 52 has the lever 59 pivotally supported thereon at 60. One end of the lever 59 carries the guide member 61 which fits in an elongated slot 62 formed in the rear portion of member 50. The opposite end of the lever 59 carries an indicating member 63 which is moved back and forth in front of the dial plate 14 upon movement of the bell crank lever 52 caused by the cable 55 when shaft 23 is rotated. The coil spring 64, one end of which engages the bell crank lever 52 and the other end of which engages the lever 59, is carried in pivot 60 and serves to maintain tension on the drive cable 55. This spring 64 also has the important function of taking up play in the pointer assembly and preventing back lash between the pivot 60 and levers 52 and 59, between the guide member 61 and slot 62, between the bell crank lever 52 and its pivot 53, as well as in the cord coupling unit at the end of arm 54 of lever 52. The parts are so proportioned that a rectilinear movement is imparted to the indicating means 63, which moves parallel to and closely adjacent

the dial plate 14. This plate bears indicia, as shown in Figure 1.

The coil supporting cross frame member 15 carries the U-shaped members 70 and 71 with slotted tensioning legs, into which are adjustably fitted the coils 72 and 73, as shown in Figures 3 and 4. These coils may be moved in their U-shaped supports during the alignment of the receiver, and then secured in place by wax or cement or by any suitable means. As shown in Figure 4, the tuning arm 36 is connected by means of the link and spring 74 and 75 to the core 76. The spring 75 holds the thrust link 74 firmly against the eye 77 in the core 76 and the pin 78 carried by the tuning arm 36 so that there is no play or lost motion between the arm and core.

The modified form of construction shown in Figure 5 reduces the number of parts required to drive the dial indicator. The cable 55A is provided with a hook 55B which may be hooked around the pin 78 as shown, or which may be selectively hooked through one of the holes 36B in the core actuating arm 36A. This construction gives an indicator travel which may be adjusted in amount due to the several possible points of connection of the cable to the swinging arm with consequent different amounts of travel of the cable 55A. This construction eliminates the cable drum and connections of the form of construction shown in Figures 1 to 4. A further modification may comprise a second bell crank lever suitably supported by the frame with one leg operatively connected to the arm 36 or 36A and with the other leg in operative association with the bell crank 52.

In assembling the device, the various tubular and flat spacing washers, cam members, tuning arms and armed washers 37 and 38 are placed upon the shaft 23 in proper order and relationship and the shaft is assembled in the end frame members 12 and 13. The members to the right of the frame member 13, as shown in Figures 1 and 2, are then assembled on the shaft, whereupon tightening up the cup-shaped nut 24 serves to retain all of the parts carried by the shaft in the rotary relationship which they have at the time. As has been previously described, the tubular washers 27 are freely slidable and rotatable on the shaft 23. The flat washers 28 and armed washers 37 and 38 and tuning arms 35 and 36 are not freely rotatable on the shaft but are slidable thereon. The cam members 32 are rotatable upon the shaft. The push button arms 17 are assembled upon their shaft 16 by being placed in the grooves formed therein, and are held in place by their respective springs 20. The tuning arms 35 and 36 are connected to their respective cores by the push rods and coil springs, the cores being fitted in their coils 72 and 73. The bell crank 52 is assembled with its lever 59 upon the support 58, the guide member 61 passing into the large slotted end of the elongated slot 62. The cable 55 is connected to the bell crank and passed around pulley 56 and around the drum 57 to which it is secured. The spring 64, by its thrust against lever 59, urges the bell crank 52 in the clockwise direction, as seen in Figure 2, so as to normally maintain tension upon the cable 55.

In setting up the cams for particular stations, the cup nut 24 is loosened by means of a screw driver, which releases the clamping action upon all of the members loosely carried upon shaft 23. The selected push button is swung downwardly to its limit of movement, as shown in Figure 4, so as to engage the corresponding cam member 32. Then by means of the manual tuning disc 26, shaft 23 is rotated to swing the tuning arms and their associated cores to tune the set to the desired station. When this position has been reached, the push button is released and the nut 24 is screwed on tightly, which clamps the cam member 23 firmly in the desired position. It is necessary to release the push button before tightening nut 24 as turning the nut will turn the shaft and disturb the cam setting if the cam is held against turning by means of the push button lever assembly. This method of setting up may be repeated with the other cam members and may be used at any time to change the adjustment of any particular cam. Due to the plurality of interposed tubular and disc washers, there is no tendency for cams, once set, to be disturbed in their setting by the setting up of an adjacent cam. The springs connecting the tuning arms and the armed washers serve to hold the tuning arms in fixed rotary relationship to the shaft without play during any period when the shaft assembly is unclamped so that the arms will always be uniformly located when clamped in position.

The construction shown and described affords a compact and efficient radio tuner and dial combination with provision for both push button tuning and continuous manual tuning. The device may be supplied as a complete unit to be installed upon a radio chassis. The mechanism for moving the dial indicator is compact and is located at the top of the device so that it will not interfere with other parts mounted upon the chassis adjacent the tuning unit. All parts and coils may be readily aligned and adjusted and the structure will retain them in adjusted position.

While we have shown preferred embodiments of our invention, these are to be understood to be illustrative only as it is capable of variation and change to meet differing conditions and requirements, and we contemplate such modifications as come within the spirit and scope of the appended claims.

What is claimed is:

1. In a device for adjusting radio tuning apparatus, a frame, a transverse shaft rotatably supported in the frame, means for rotating the shaft, the shaft having a portion non-circular in cross-section, an arm loosely fitted on the non-circular section of the shaft to rotate therewith, an operative connection from said arm for actuating tuning means, and means for taking up slack between the arm and shaft.

2. In a device for adjusting radio tuning apparatus, a frame, a transverse shaft rotatably supported in the frame, means for rotating the shaft, the shaft having a portion non-circular in cross-section, an arm loosely fitted on the non-circular section of the shaft to rotate therewith, an operative connection from said arm for actuating tuning means, and means for taking up slack between the arm and shaft, said means comprising a washer loosely fitted on the non-circular portion, and spring means connecting the arm and washer and tending to rotate the arm and washer in opposite directions relative to the shaft.

3. In a device for adjusting radio apparatus, a frame, a transverse shaft rotatably mounted in said frame, and having a portion non-circular in cross section, an arm loosely fitted on the non-circular section of the shaft so as to rotate there-

with, a connection from said loosely fitted arm for effecting adjustments of radio tuning apparatus, means for taking up the lost motion between the arm and shaft, said last mentioned means comprising a washer loosely fitted to the non-circular portion of the shaft, and means to connect the washer and the arm tending to rotate the arm and washer in opposite directions relatively to the shaft, a dial mechanism support secured to the frame and comprising a flat member section fastened to the frame and extending from the front of the frame to the rear above the shaft, a bell crank pivotally mounted on the support and parallel thereto, a flexible connection between one leg of the bell crank and the shaft to swing the bell crank about its pivot upon rotation of the shaft, a lever pivotally mounted on the second leg of the bell crank, a guide means in one end of the lever engaging the dial mechanism support and moving in a slot therein, and an indicator carried in the other end of the lever and adapted to move over a dial plate supported upon the frame.

4. In a device for adjusting radio tuning apparatus, a frame, a transverse shaft rotatably supported in the frame, means for rotating the shaft, the shaft having a portion non-circular in cross-section, an arm loosely fitted on the non-circular section of the shaft to rotate therewith, an operative connection from said arm for actuating tuning means, means for taking up slack between the arm and shaft, indicator mechanism and operating connections from said arm to said indicator mechanism.

5. In a device of the character disclosed, a frame, a shaft rotatably mounted in said frame, a push button shaft in said frame forwardly of said rotatably mounted shaft, push button levers pivotally mounted on said push button lever shaft, inter-engaging means on the rearward portions of said push button levers and the rotatably mounted shaft for effecting rotary adjustments of said shaft by operation of said push button levers, downwardly and rearwardly projecting arms on said rotatably mounted shaft and operative connections from said arms for actuating tuning means below the rotatably mounted shaft.

6. In a device of the character disclosed, a frame, a shaft rotatably mounted in said frame, a push button shaft in said frame forwardly of said rotatably mounted shaft, push button levers pivotally mounted on said push button lever shaft, inter-engaging means on the rearward portions of said push button levers and the rotatably mounted shaft for effecting rotary adjustments of said shaft by operation of said push button levers, downwardly and rearwardly projecting arms on said rotatably mounted shaft and operative connections from said arms for actuating tuning means below the rotatably mounted shaft, said arms being loosely held on the rotatably mounted shaft and means for taking up slack between said arms and the shaft on which they are so mounted.

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