March 27, 1934. C. A. WISTRUP 1,952,108

VARIABLE RADIO TUNING CONTROL

Filed Jan. 30, 1932

Fig. 1.

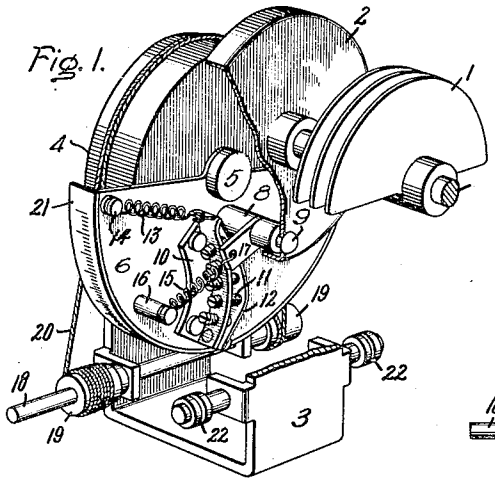


Fig. 2.

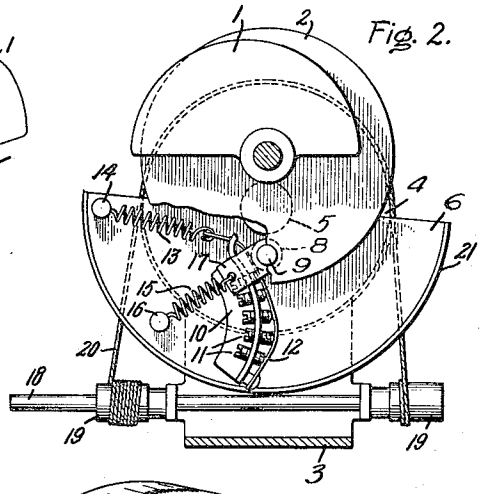


Fig. 3.

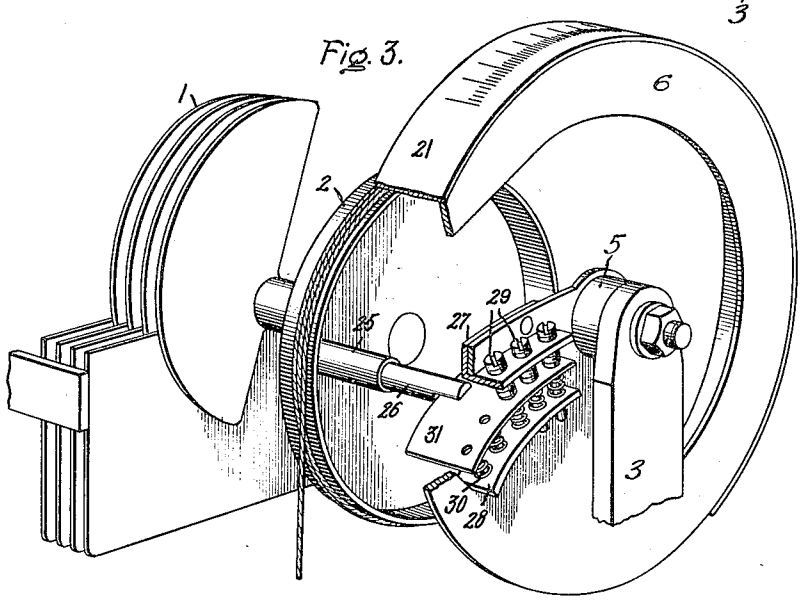
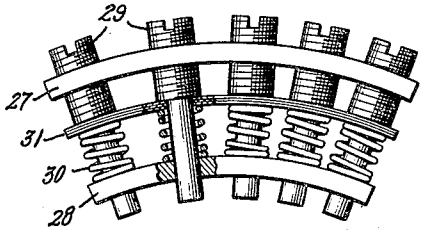


Fig. 4.



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VARIABLE RADIO TUNING CONTROL

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Application January 30, 1932, Serial No. 589,921

5 Claims. (Cl. 74—7)

My invention relates to control means for use in connection with high frequency apparatus, and more particularly for use in connection with radio receivers, whereby the adjustments necessary to obtain the desired resonant frequency may be conveniently and accurately effected notwithstanding manufacturing variations which occur in the elements comprising the circuits to be tuned.

In mass production of receivers, it has been found that manufacturing variations occur in the elements comprising the tuning arrangement with the result that the indicia provided on the dials usually displayed on the escutcheon of the receiver do not provide accurate indication of the frequency to which a receiver is tuned. In addition, these indicia are not spaced equally but are crowded at the high frequency end of the dial. This crowding of the indicia, together with the inaccurate indication, render it difficult for the operator of a radio receiver readily to tune the receiver to the desired frequency.

My invention has for one of its objects to provide means whereby the indicia on the dial of the radio receiver may be equally spaced along the dial and whereby accurate indication of the frequency at which the receiver is tuned are produced thereby, notwithstanding manufacturing variations in the elements comprising the tuned circuits of the receiver. A further object is to provide means whereby these results are accomplished notwithstanding that the tuning element is of such design that the frequency to which the circuit containing this element is tuned varies nonlinearly with the displacement of the tuning element.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing in which Fig. 1 represents a perspective view of a preferred embodiment of my invention; Fig. 2 is an end view thereof; Fig. 3 represents another embodiment, and Fig. 4 represents a detail thereof.

Referring to Fig. 1, I have illustrated therein a portion of a tuning element 1. This tuning element is shown as the movable member of a variable capacitor but may of course comprise any suitable type of tuning device. A cable drum 2 is attached to the shaft of the tuning element 1 to provide a means for rotating the tuning element. The drum 2 and the tuning element 1 are supported by a suitable frame (not shown). Attached to the frame of the tuning element is a U-shaped frame 3 which supports an assembly of a driving means and a dial scale support 6. A second cable drum 4 is supported on the U-frame 3 by means of a shaft 5. The dial scale support 6 is arranged to rotate with the cable drum 4.

Between the cable drum 2 which serves to rotate the tuning element 1, and the dial scale support 6, I have arranged means which provide the proper relation between the rotation of the tuning dial scale support 6 and the rotation of the tuning element 1. This means comprises an arcuate bracket 10 supported by the dial scale support 6, and which is provided with a plurality of adjustable screws 11. This arcuate bracket 10 is so shaped and placed as to provide a straight line frequency relation between the angular displacement of the dial scale support 6 and the changes in frequency effected by the tuning element 1. One or more flexible flat metal strips 12, which, for example, may be of bronze or copper, are fastened at one end to the arcuate bracket 10 and stretched over the points of the screws 11 to form an adjustable cam surface. A spring 13 fastened to the other extremity of the strips 12 and to a stud 14 on the dial scale support 6 serves to provide the proper tension for these strips. The cable drum 2 is provided with a cam roller 4 supported by a stud 5 which cooperates with the cam surface strips 12. The cam roller 8 is held in contact with the cam surface strips 12 by a spring 15 connected to a stud 16 on the dial scale support 6 and a link 17 on the cam roller stud 9.

A control shaft 18, journaled in the U-frame 3 directly beneath the cable drum 4, is provided with two small cable drums 19 upon which the cable 20 winds and unwinds. If the cable 20 is arranged to drive cable drum 4 directly as shown in Fig. 1, the angular rotation of the control shaft 18 will be directly proportional to an angular motion of the cable drum and dial 21. The indicating dial 21 is graduated to provide equal spacing of the frequency indications. This arrangement provides a relation between the control shaft 18, and the dial 21 and tuning element 1 which may be expressed as straight line frequency tuning and straight line frequency indication.

At a point directly beneath the cable drum 2 which is attached to the shaft of the tuning element 1, there are arranged two idler pulleys 22. As an alternative arrangement the cable 20

may be passed over these idler pulleys 22 and around the cable drum 2. This arrangement will provide straight line frequency indication, but the relation between the rotation of the control shaft 18 and that of the tuning element 1 will be one which is not a straight line frequency relation. In some instances this form of drive may be desirable.

To obtain accurate indication of the resonant frequency of the radio receiver, the screws 11 must be properly adjusted. This is accomplished by energizing the receiver with a wave of known frequency and tuning the receiver to resonance. The screw which is directly beneath the cam roller 8 at that time is then adjusted until the frequency indication is correct. This procedure is followed for different frequencies until each of the screws 11 is properly adjusted.

The operation of this form of invention is as follows: When the driving cable 20 is on the driving drum 4 which supports the dial scale, rotation of the driving drum 4 from the high frequency position toward the low frequency position, will cause the cam arrangement 10, 11, 12 to move in a clockwise direction. The tension spring 15 will maintain contact between the cam surface 12 and the cam roller 8. This spring will cause the tuning element 1 and the drum 2 to rotate in the same direction, but the amount of rotation will be determined by the shape of the cam surface 12. When the driving drum 4 is rotated in the opposite direction the pressure of the cam surface 12 against the cam roller 8 will cause the tuning element 1 and the drum 2 to rotate in accordance with the shape of the cam. The cam surface imparts the proper movement to the tuning element so that the resonant frequency of the radio receiver is that indicated by the scale.

If the cable 20 is arranged to drive the drum 2 which is attached to the tuning element 1, the cooperation of the spring 15, the cam roller 8 and the cam surface 12 will be such that the dial 21 will be moved to give the correct frequency indication.

In the modification illustrated in Fig. 3, I have indicated the parts corresponding to those in Figs. 1 and 2 with similar reference characters. In this arrangement the dial support 6 may be provided with a cable drum corresponding to the drum 4 shown in Fig. 1, but this has been omitted from the figure for the sake of clearness. The cable drum 2 is provided with a sleeve bearing 25 which supports the cam follower 26. The cam follower 26, which is in the form of a bifurcated rod, is free to rotate in the sleeve 25. The dial support carries two brackets 27 and 28 which act as supports for a plurality of adjusting screws 29 and compression springs 30. An adjustable cam surface 31 is supported by the adjusting screws 29 and the springs 30. An opening is provided in the dial scale support 6 through which the cam surface 31 extends. The cam surface 31 is of sufficient width so that it fits between the bifurcated portions of the cam follower rod 26.

A more detail view of the brackets 27 and the assembled cam structure is shown in Fig. 4. The upper bracket 27 has a series of holes threaded to receive the screws 29. The lower portion of each of the adjustable screws 29 is in the form of a rod of smaller diameter which extends through a guide hole in the lower bracket. The adjustable cam surface 31 preferably is composed of a plurality of flexible metal strips which, for example, may be of bronze. The cam surface is held in position against the shoulder of the adjusting screws 29 by the compression springs 30 which surround the rod portion of the adjusting screws.

In preparing this arrangement for proper operation, the screws 29 are adjusted to provide accurate indication in accordance with the method described for the arrangement shown in Figs. 1 and 2. The cooperation of the bifurcated cam follower with the cam surface, eliminates the need for tension springs, as the pressure exerted between the flat surfaces of the bifurcated portion against the cam surface transmits the rotary motion from the drum 2 to the dial support 6, or vice versa depending upon which member is the driving member.

My invention in combination with radio apparatus has the advantage of providing an indicating scale with equal spacings of the frequencies for a tuning element having a characteristic other than a straight line frequency characteristic, and an automatic correction for variations in the tuning elements to provide accurate indication of the resonant frequency.

While I have shown and described my invention in connection with certain specific embodiments it will, of course, be understood that I do not wish to be limited thereto, since it is apparent that the principles herein disclosed are susceptible of numerous other applications, and modifications may be made in the circuit arrangements and in the instrumentalities employed without departing from the spirit and scope of my invention as set forth in the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is,—

1. An apparatus for indicating the frequency to which an electrical circuit is resonant including a tuning element, means for rotating said tuning element, a rotatable frequency indicating member provided with a cam surface shaped in accordance with the indications to be produced, and means mounted upon said means for rotating said tuning element for cooperating with said cam surface to provide substantially accurate indication of the resonant frequency.

2. An indicating apparatus for a rotatable tuning element included in an electrical circuit, said apparatus comprising means for rotating said tuning element, rotatable means for indicating the resonant frequency of said electrical circuit, a cam mounted upon said indicating means, a cam follower mounted upon said means for rotating the tuning element, said cam and follower cooperating with said indicating and said rotating means, said cam having an adjustable surface for imparting a corrective motion to said indicating means whereby a substantially accurate indication of the resonant frequency is obtained.

3. An indicating device for radio apparatus including a rotatable indicating element having indicia thereon corresponding to equal angular displacements of said element, a rotatable tuning element included in an electrical circuit to be tuned, a member for rotating said tuning element, said rotatable tuning element having a characteristic in which the angular displacement varies non-linearly with the change in the frequency to which said circuit is tuned, an adjustable surface cam mounted upon said indicating element, a cam follower mounted upon said member for rotating said tuning element, said adjustable surface cam and cam follower being arranged between said indicating element and said

tuning element member to transmit motion from one of said elements to the other of said elements in such ratio that the indicia on said indicating element correspond to the resonant frequencies of the electrical circuit.

4. In an indicating apparatus for resonant electrical circuits, the combination of a rotatable tuning element, a drum for rotating said element, rotatable drum means for indicating the resonant frequency of said electrical circuit, a cam mounted upon said indicating drum, a cam follower mounted upon said tuning element drum, said cam and follower cooperating with said tuning element and said indicating means, said cam having an adjustable surface for imparting a corrective motion to said tuning means, whereby the resonant frequency obtained is substantially that indicated by the indicating means.

5. In an indicator for radio apparatus, the combination of a rotatable frequency indicating member, a cam attached to said member, said cam having an adjustable surface, a rotatable tuning element for a resonant circuit, said element being provided with a shaft, a drum attached to said shaft, said drum having a member cooperating with said cam, means for rotating said tuning member and drum whereby the member cooperating with said adjustable cam will rotate said frequency indicating member at a rate to indicate correctly the resonant frequency of the circuit tuned by said tuning element.

CARL A. WISTRUP.