June 14, 1932. E. G. DANIELSON 1,862,819

VARIABLE TUNING DEVICE

Filed July 22, 1929 2 Sheets-Sheet 1

FIG. 1.

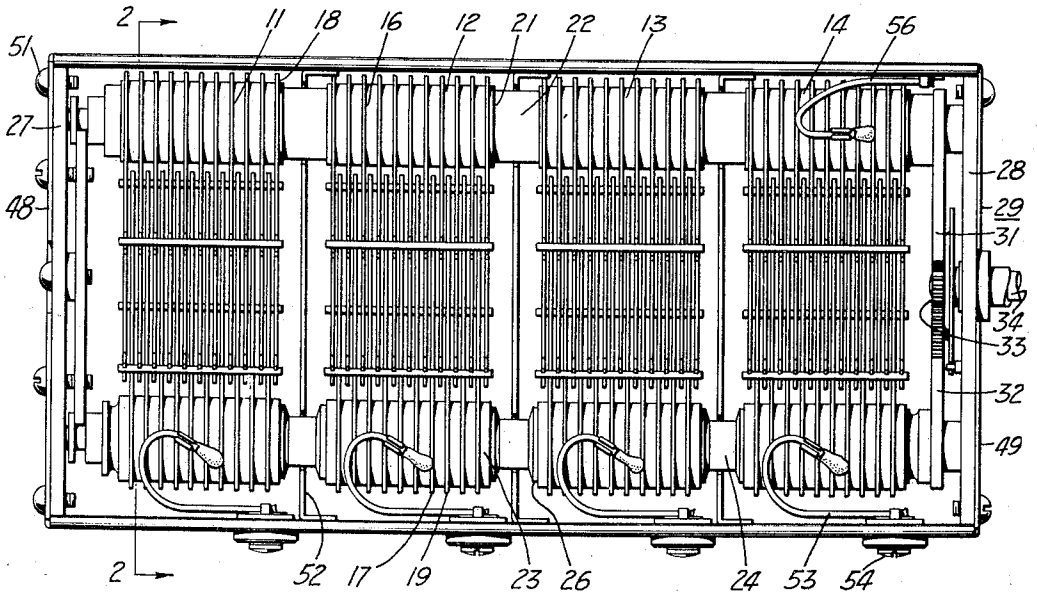
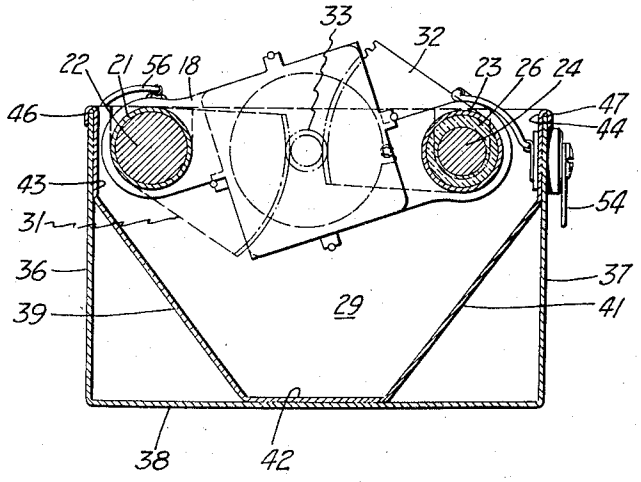


FIG. 2.



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FIG. 3.

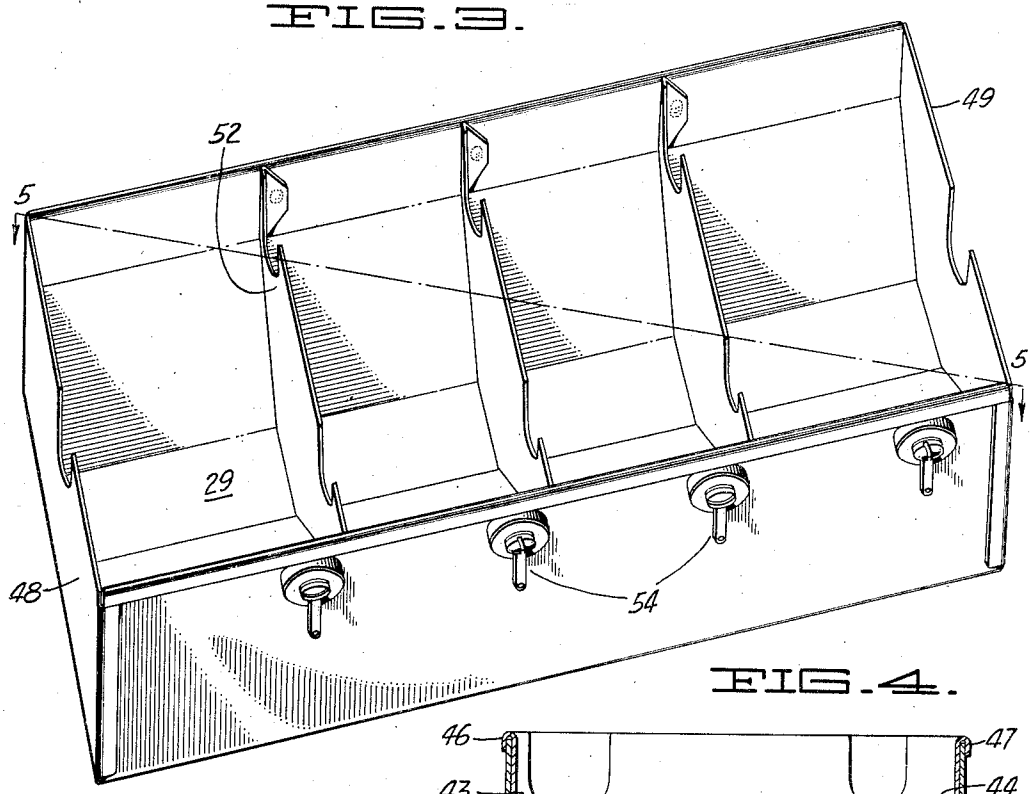


FIG. 4.

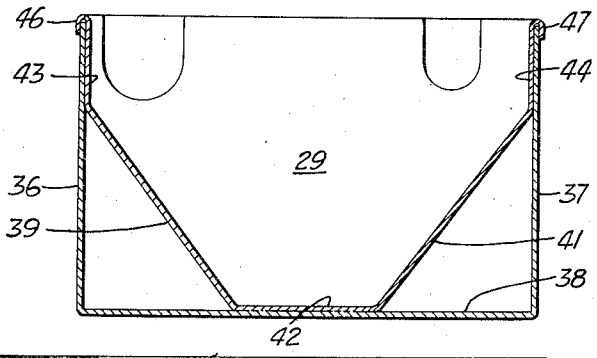
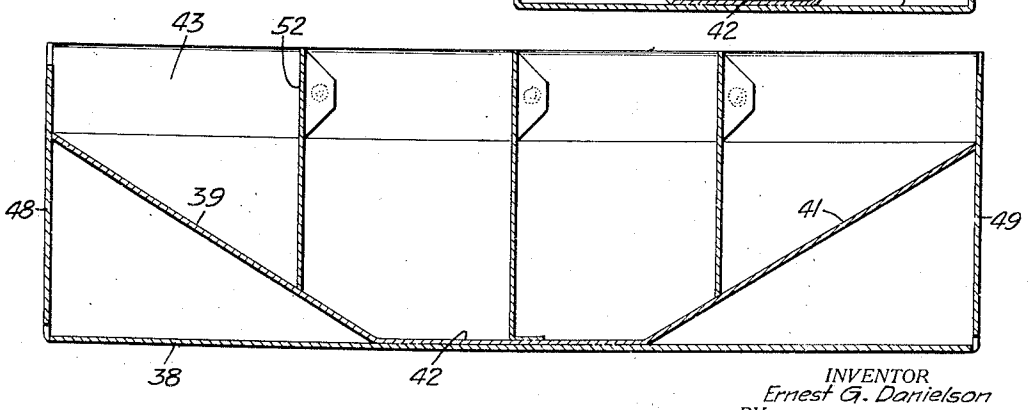


FIG. 5.



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UNITED STATES PATENT OFFICE

ERNEST G. DANIELSON, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO GRAY & DANIELSON MANUFACTURING COMPANY, OF SAN FRANCISCO, CALIFORNIA, A COPARTNERSHIP CONSISTING OF ERNEST G. DANIELSON AND THOMAS B. GRAY

VARIABLE TUNING DEVICE

Application filed July 22, 1929. Serial No. 379,916.

This invention relates generally to electrical control devices which include two or more electrical elements movable relative to each other, and which are retained in cooperative relationship by means of a supporting structure. It has particular application to devices for tuning electrical circuits, as for example variable electrical condensers for tuning radio apparatus.

It is a general object of this invention to devise novel and improved means for supporting the electrical elements of a device of the above character, whereby displacement or disalinement of the electrical elements will not occur thru distortion or deflection of the supporting means.

It is a further object of this invention to devise a supporting structure for a device of the above character which can be made of relatively light sheet material but will be of extreme strength and rigidity.

It is a further object of this invention to devise a supporting structure for a variable tuning device which will be inherently trussed to provide great strength and rigidity.

Further objects of the invention will appear from the following description in which I have set forth the preferred embodiment of my invention. It is to be understood that the appended claims are to be accorded a range of equivalents consistent with the state of the prior art.

Referring to the drawings:

Figure 1 is a plan view illustrating a device constructed in accordance with this invention.

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

Fig. 3 is a perspective view illustrating the supporting structure incorporated in the device of Figs. 1 and 2.

Fig. 4 is a transverse cross-sectional view of the structure shown in Fig. 3.

Fig. 5 is a diagonal cross-sectional view taken along the line 5—5 of Fig. 3.

In the construction of variable tuning devices, it has been common to utilize a metallic frame for supporting two or more relatively movable elements. For example in the construction of variable tuning condensers, condenser electrodes are carried by a suitable frame, and are movable relative to each other to vary their electrostatic relationship. A common construction is to mount one electrode upon a rotatable shaft, so that it can be moved relative to a stationary electrode or stator, or both electrodes may be mounted upon rotatable shafts as disclosed and claimed in Patent No. 1,618,399 granted February 22, 1927, to R. M. Wise and E. G. Danielson.

For radio receiving apparatus, where a plurality of electrical circuits must be tuned simultaneously, it is common practice to utilize a plurality of condenser units positioned in alinement and having their electrodes carried by a common shaft or shafts. The electrodes are generally formed of spaced metal plates which interleave a more or less amount depending upon the required capacitance, and since air is generally employed as a dielectric, it is evident that the supporting frame for the electrodes must be of extreme rigidity. A slight amount of warping of the supporting frame after the electrodes are assembled, or a slight amount of deflection due to stresses which may be applied to the frame, will cause a corresponding displacement between the electrodes, thus causing a detrimental change in the capacitance afforded. In a gang condenser, or a condenser employing a plurality of condenser units connected together to one control, such a change in capacitance due to distortion or deflection of the supporting frame, is particularly undesirable, since it may seriously affect the efficiency of the radio apparatus with which it is connected, or even render the apparatus inoperative.

In the past it has been common to construct supporting frames for variable condensers, by the use of metal which is cast to the desired form. While a cast frame may have considerable strength, the cast metal frequently warps many months after the condenser is assembled. Furthermore cast metal frames are comparatively expensive to manufacture, and they add materially to the cost of the completed condenser. In this invention I have dispensed with the use of cast

metal, and have utilized sheet metal which is used in such a way as to provide a trussed frame of extreme rigidity.

Referring to the drawings I have disclosed my invention as incorporated with a variable gang condenser consisting of a plurality of condenser units 11, 12, 13 and 14 which are positioned in alinement. In this particular instance, each condenser unit incorporates the invention disclosed and claimed in said Patent No. 1,618,399, in that the electrodes thereof are both mounted upon rotatable shafts. Thus each condenser unit is formed of electrodes 16 and 17, the electrode 16 comprising spaced metallic plates 18, and electrode 17 comprising similar spaced metallic plates 19. The plates 18 for each condenser unit are mounted upon metallic sleeves 21, which in turn are fixed upon a common shaft 22. Likewise the plate 19 of each condenser unit are shown mounted upon metallic sleeves 23 which in turn are mounted upon the rotatable shaft 24, by means of the insulating bushings 26.

The ends of shafts 22 and 24 are journaled in suitable members 27 and 28, which in turn are carried by the supporting frame 29, to be presently described in detail. For rotating shafts 22 and 24 in opposite directions in unison, gear segments 31 and 32 are shown fixed to corresponding ends of shafts 22 and 24 respectively, and these gear segments are arranged to cooperatively engage a common pinion 33. Pinion 33 is in turn secured to a rotatable control shaft 34, whereby upon rotation of this shaft, shafts 22 and 24 are rotated simultaneously in opposite directions to interleave the plates of the condenser units a more or less amount. Generally a suitable indicating device is connected to shaft 34 to enable an operator to set the device for any desired capacitance.

The frame 29 in its preferred form consists of side walls 36 and 37 connected to a bottom wall 38. These walls are preferably made of ordinary sheet metal, and for convenience can be formed of a single integral sheet, with the side walls 36 and 37 formed by bending the sheet at substantially right angles to the bottom wall 38. In addition to the side and bottom walls, walls 39 and 41 are provided which are also preferably of sheet metal construction. These walls 39 and 41 are preferably disposed at an angle to the side walls 36 and 37, and bottom wall 38. As shown in Figs. 2 and 4, in cross section they preferably form the hypotenuse of a triangle, the other sides of the triangle being formed by walls 36 and 38 for wall 39, and by walls 37 and 38 for wall 41. In practice walls 39 and 41 are preferably planar or substantially flat, and their lower edges are connected to the intermediate portion of bottom wall 38, while their upper edges are connected to the upper edge portions of the side walls 36 and 37. For convenience and simplicity, these walls 39 and 41 are preferably formed of the same sheet of metal, this sheet being bent angularly with respect to its medial portion 42, and having its upper edge portions 44 bent substantially at right angles to medial portion 42 and substantially parallel with the side walls 36 and 37. The edges of portions 43 and 44 can be crimped or bent over as indicated at 46 and 47, to overlock over the upper edges of walls 36 and 37. To securely anchor walls 39 and 41 in place, portions 43 and 44 are spot welded or otherwise rigidly connected to the upper edge portions of walls 36 and 37, while medial portion 42 is spot welded or otherwise fixed to the intermediate portion of bottom wall 38.

The completed supporting frame 29 described above forms what can be termed a box-like structure, which when assembled with the condenser units, has its side and bottom walls, and also the walls 39 and 41, extending substantially parallel or in the same general direction as the axes of shafts 22 and 24. At the ends of this supporting frame, it is preferable to provide end walls 48 and 49, which can also be formed of sheet metal, and which are welded or otherwise suitably secured to the corresponding edges of the frame walls. The end walls 48 and 49 provide convenient means for attaching and supporting the journal members 27 and 28, these members being shown connected to the end walls by suitable means such as screws 51. In order to avoid capacitative coupling between the condenser units, it is frequently desirable to provide metallic shielding walls 52, which can be welded, soldered or otherwise secured and grounded to the frame so as to be interposed between adjacent condenser units.

In the particular form of device shown, connections are made to the insulated condenser electrodes thru flexible conductors 53, which in turn can be connected to insulating binding posts or terminals 54. Likewise the condenser electrodes 16 of the different condenser units, can be grounded to the supporting frame, by means of flexible conductor 56.

The supporting frame described above is of extreme rigidity and strength, although it is relatively light in weight because of the use of sheet metal in its construction. Because of the disposition of walls 39 and 41 with respect to the side and bottom walls, the frame is trussed in such a manner that stresses applied to the frame which might tend to disaline shafts 22 and 24, are transmitted to the walls of the frame as compressional stresses. A frame of this character is most apt to be distorted by stresses tending to twist the frame about its longitudinal axis. My frame however is trussed against twisting of this character, this trussing effect being apparent from the diagonal cross section shown in Fig. 5. In this instance walls 39

and 41 likewise form truss sections together with the associated side and bottom walls of the frame, and this trussing effectively prevents any substantial deflection. My frame also possesses the desirable characteristic of retaining its form after being manufactured. In other words, after manufacture, it will not warp, as is frequently the case with frames formed of cast metal.

I claim:

1. In a combined support and housing for an electrical tuning instrument having a pair of relatively movable tuning elements, a sheet metal frame serving to support and maintain said elements in accurate alignment, said frame comprising sheet metal bottom and side walls, and sheet metal end walls forming a housing for said elements, a sheet metal channel member secured to said bottom and having portions extending between the bottom and side walls at an angle thereto, effective to brace said frame and provide space for said tuning elements.

2. In a support for an electrical tuning instrument having a pair of relatively movable tuning elements, a sheet metal frame serving to support and maintain said elements in accurate alignment, said frame comprising sheet metal bottom and side walls, and sheet metal end walls, forming a housing for said elements, a sheet metal member extending between the bottom and side wall at an angle thereto, said member being positioned within the frame and being secured to said bottom and to a side wall so as to contact with said side wall at a portion spaced from the top thereof whereby said frame is braced against distortion and space is provided for said tuning elements.

3. In a support for an electrical tuning instrument having a pair of relatively movable tuning elements, a frame serving to support and maintain said elements in accurate alignment, said frame comprising a metal bottom and side walls and metal end walls forming an open top rectangular container effective to shield said tuning elements from stray fields, a sheet metal member positioned within the frame and having portions extending between said bottom and side walls at an angle thereto, said member being secured to said bottom and side walls so as to abut said end walls thereby bracing said side walls and said end walls.

4. In a support for an electrical tuning instrument having a pair of relatively movable tuning elements, a frame serving to support and maintain said elements in accurate alignment, said frame comprising a metal bottom and side walls and metal end walls forming an open top rectangular container effective to shield said tuning elements from stray fields, a member positioned within the frame and having portions extending between said bottom and side walls at an angle thereto, said member being secured to said bottom and side walls whereby said frame is braced against distortion and a sheet metal division wall positioned within said frame transversely thereof and secured to said member effective to shield certain portions of said tuning elements from other portions thereof, said division walls also being effective to further brace said frame.

5. In a support for an electrical tuning instrument having a pair of relatively movable tuning elements, a frame serving to support and maintain said elements in accurate alignment, said frame comprising a metal bottom and side walls and metal end walls forming an open top rectangular container effective to shield said tuning elements from stray fields, a sheet metal bracing member positioned within said frame, said bracing member having a flat central portion extending longitudinally of said bottom and secured thereto, bracing portions extending upwardly at an angle to said central portions and edge portions extending longitudinally of said side walls and secured thereto, the extremities of said edge portions having a return bend enclosing the upper edge of said side walls.

In testimony whereof, I have hereunto set my hand.

ERNEST G. DANIELSON.