

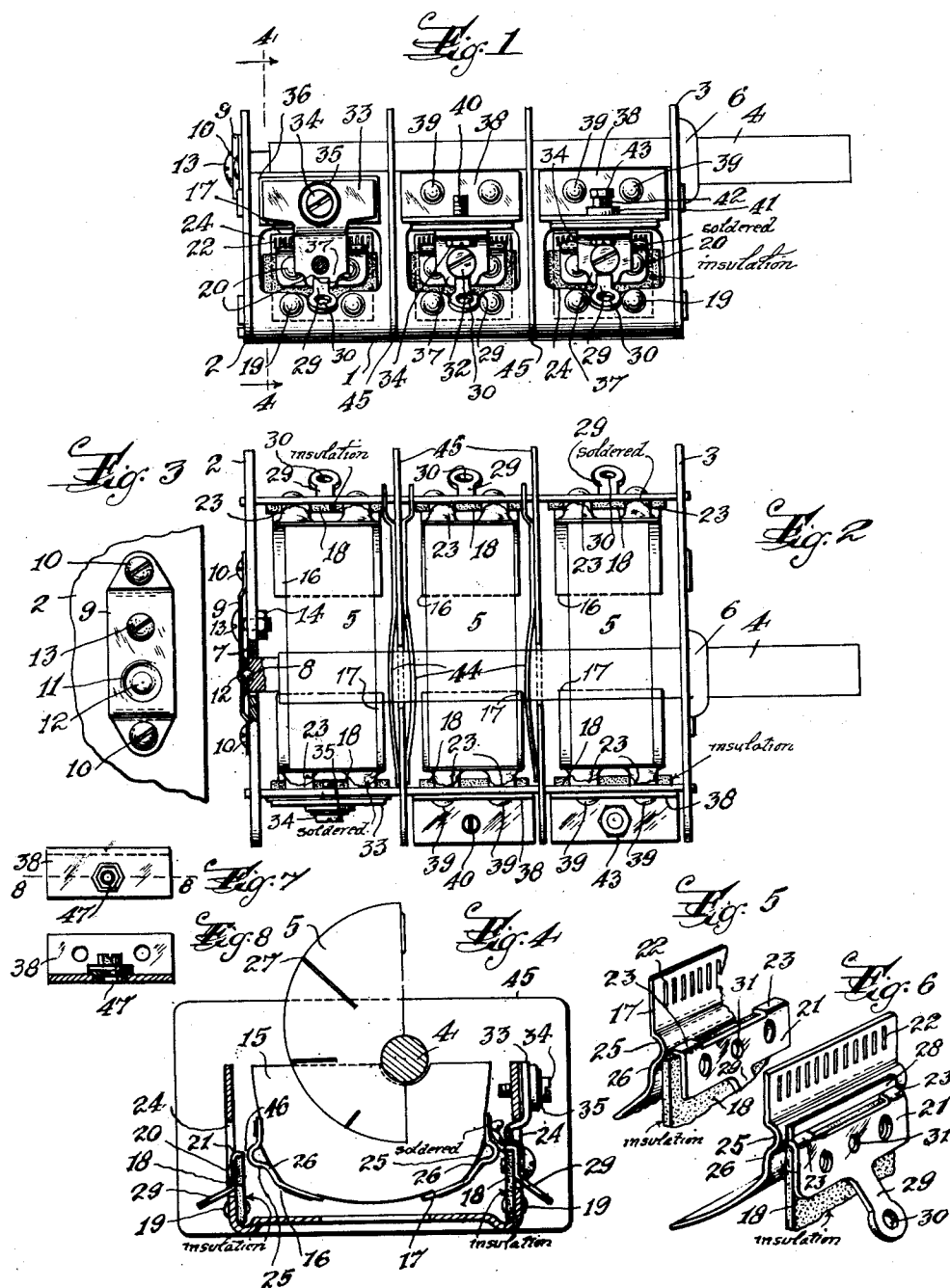
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R. E. CRAMER

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ELECTRICAL CONDENSER AND PROCESS OF ASSEMBLY

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INVENTOR
Russell E. Cramer
BY
A. D. T. Libby
ATTORNEY

UNITED STATES PATENT OFFICE

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ELECTRICAL CONDENSER AND PROCESS OF ASSEMBLY

Russell E. Cramer, Haddon Heights, N. J., assignor to Radio Condenser Company, Camden, N. J.

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This invention relates to improvements in a variable electrical condenser such as used in radio tunable circuits.

The trend of present-day practice is toward smaller radio receiving sets, and consequently, smaller units must be used in their construction. In order to get the tuning condensers reduced in size, the plates may be brought closer together, but in so doing great care must be exercised in the assembly of the rotor and stator plates, otherwise the warping stresses produced in manufacture will prevent accurate centering of the rotor plates between the stator plates, and much time must then be spent in accurately centering these plates. The importance of accurate centering of all units of a gang condenser can be realized by considering a condenser such as is being commercially produced today. For example, in this condenser the normal maximum capacity, which is the capacity when the plates are completely meshed, is, for example, 360 mmfd., which does not take into consideration the stray capacities introduced by the frame, trimmers, etc., as we are concerned only with the capacity produced by the plates themselves. Now if the rotor plates are displaced from equal spacing by only .003", the maximum capacity is increased to 378 mmfd., a change of 18 mmfd.

Present commercial tolerances of error in "tracking" one section of a variable gang condenser to another section of the same gang, are in the order of 1 to 1.5 mmfd. It will be realized that if one section of the gang has plates properly centered, and another section has plates out of center only .003", it will be very difficult to make these sections track to present requirements. Flexing of outside rotor plates offers some control in this respect, but the range of this control is limited to approximately 5 mmfd. from the normal maximum capacity. It is therefore extremely important that accurate centering of plates be made to meet present electrical specifications, particularly in the smaller and more compact units.

My invention is therefore directed to improvements in the construction and process of assembly of a variable electrical condenser.

One of the objects of my invention is to provide an improved means and process of mounting the stator plates in the frame so as to eliminate all stresses which might be set up therein by the usual screw or bolt attachment means; that is to say, when the ordinary screws are used for attaching the stator to the frame or parts carried by the frame, a twisting strain is ap-

plied to the stator, and strains of this character are highly detrimental in a condenser having plates closely spaced apart.

Another object of my invention is to provide an improved manner of mounting a trimmer plate on such a condenser.

A further object of my invention is to provide a special type of bearing for at least one of the bearings of the rotor shaft.

These and other objects will be clear to one familiar with the construction of such condensers, on reading the specification taken in connection with the annexed drawing, wherein:

Figure 1 is a side elevation of a three-gang condenser showing three different forms of trimmer plates.

Figure 2 is a plan view of Figure 1, the stator and rotor plates being shown merely in outline.

Figure 3 is a partial view of the left-hand end bearing shown in Figure 2.

Figure 4 is a section on the line 4—4 of Figure 1, but with the rotor plates turned 90 degrees.

Figure 5 is a fragmentary perspective view showing certain of the details of my improved form of stator mounting.

Figure 6 is a view similar to Figure 5, but showing a slight modification thereof.

Figure 7 is a bottom view of the trimmer condenser bracket shown in the right-hand unit of Figure 1.

Figure 8 is a section on line 8—8 of Figure 7, but with the bracket in the position of Figure 1.

In the various views, wherein like numbers refer to corresponding parts, 1 is a frame of a three-gang condenser having end bearing plates 2 and 3 supporting a shaft 4. The rotor plates 5 of each unit condenser are carried on the shaft 4 which is supported in the bearing plate or frame member 3 on balls or anti-friction bearing members positioned in the race 6 in a manner such as disclosed in Cramer Patent 1,800,719, issued April 14, 1931.

The opposite end of the shaft 4 is positioned within a clearance hole 7 in the end bearing plate 2. This end of the shaft 4 has a recess in which a ball 8 is positioned, the depth of the recess at its axial center being approximately the radius of the ball. Carried by the end bearing member 2 is a plate 9, the same being fastened to the plate 2 in any satisfactory manner as by means of screws 10. The plate 9 has a formation 11 made by pressing the metal inwardly around a central portion 12 which forms the bottom of a recess similar to that in the shaft end 2, whereby the ball 8 is positioned in these two recesses. By

punching the metal 11 inwardly around the portion 12, the metal of the plate 9 is materially stiffened at this point so as to provide a more positive seat for the ball 8. A screw 13 passes through the plate 9 and is preferably threaded in the plate 2. This screw is used for tensioning the member 9 so as to produce a certain amount of friction on the ball 8, and in order that this may be maintained, a lock nut 14 is provided on the screw to lock it in its adjusted position.

The stator group of plates 15 of each unit condenser is attached to tie bars 16 and 17 in any satisfactory manner; for example, as by staking over the lines on the plates which pass through slots 22 in the tie bars, somewhat as illustrated in Cramer et al. Patent 1,757,357, issued May 6, 1930.

After the stator units are completed as above, they are ready for assembly in the frame, but before this is done, a pair of insulators 18, one on each side of the frame for each unit condenser, are first securely fastened to the sides of the frame in any satisfactory manner as by rivets 19. At the opposite end of each insulator 18, there is securely fastened, as by rivets 20, a metallic supporting means which may be termed a bracket 21. The bracket 21 has, as shown in Figure 5, a pair of intumed fingers or portions 23 which extend inwardly over the top of the insulator 18 to a position closely adjacent to the position which one of the tie bars, for example 16 (see Figure 4), will occupy when the stator is put in position in the frame. It is to be understood that the bracket 21 may be fastened to the insulator 18 before the insulator 18 is fastened to the frame, instead of the reverse order as has been described.

It is to be noted that the insulators 18 extend upwardly from the bottom of the frame 1 into or over the openings 24 in the side members of the frame, so that the bracket 21 will not touch any part of the frame, as is clearly indicated in Figure 1.

After the insulators and brackets have been assembled on each side of the frame for each unit condenser, the rotor group of plates, carried by the shaft 4, is put into position in the frame, and the bearing plate 9 is put in place and the bearing adjusted as has been already described. The stator groups of plates are then put in position by placing each unit group in upside-down position over and in mesh with its rotor plates, the rotor plates being at that time in the position they would occupy for minimum capacity in normal operation. Then the rotor plates are turned, carrying the stator units arcuately along to their normal position as shown in Figure 4, it being understood that the side clearance at 46 (see left-hand side of Figure 4) is such that the stators can be so assembled. A spacing fixture is then inserted between the rotor and stator plates for the purpose of symmetrically aligning them. The next step in the assembly may now be taken, which consists in soldering the projecting portions 23 to the tie bars 16 and 17 of the stator plates, one soldering operation at 46 being omitted in the drawing of Figure 4 to show the relative position of the parts before soldering.

It will be noted from Figures 4, 5 and 6 that the tie bars 16 and 17 are bent outwardly at 25 to provide a ledge adjacent the bent ends or portions 23 of the brackets 21, thereby facilitating the soldering operation. In addition to strengthening the tie bar at this point, a transverse rib 26 is preferably provided therein closely adjacent the ledge 25. By soldering the brackets 21 in the

manner described to opposite tie bars of the stator plates, the stators are thus attached to the frame without any strain being applied thereto, so that when the spacing tool or fixture is removed from between the plates, they are all left in perfect alignment, and the usual bending or adjusting operation heretofore required is substantially eliminated, the only bending thereafter required being on the outside compensating plates of the rotor, this bending being facilitated by the slots 10 27.

In Figure 6, I have shown a modified form of bracket 21 in which the two arms 23, as shown in Figure 5, are joined by a cross-member 28 along which solder may be readily caused to flow in contact with its associated tie bar. In Figures 5 and 6, the rivets 20 for fastening the bracket 21 to the insulator 18 are not shown.

Coming now to another feature of my invention, each of the brackets 21 is provided with a lug 29 having a hole 30 therein to which a conductor may be attached for completing connection to the stator group of plates. The bracket 21 is provided with a threaded hole 31 to receive screw 32 which is omitted in the left-hand unit of Figure 1. It is to be understood that the insulator 18 has a clearance hole in alignment with the hole 31 for the passage of the screw 32 which is used for attaching a trimmer plate 33 to the main condenser unit.

As shown in the left-hand unit of Figure 1, the trimmer plate 33 has a portion extending upwardly and overlapping a part of the frame above the opening 24, and this trimmer plate is adjusted by means of adjusting screw 34 which is kept from contacting with the plate 33 by an insulator 35, while the plate 33 is kept from contacting with the frame by a suitable insulator 36, preferably of mica. The lower portion of the trimmer plate 33 has a forked end 37, which spans the lug 29 on the bracket 21, thereby assisting in positioning the trimmer plate in position. Preferably the metal of the trimmer plate 33 around the mounting hole for screw 32 is pressed inwardly to fit around the edge of hole 31 which also assists in positioning the trimmer plate 33.

In the form of trimmer plate shown in the central condenser unit of Figure 1, the trimmer plate 33 is bent at right angles to that portion which is attached by the screw 32 to the bracket 21, and to cooperate with this bent portion of the trimmer plate, an L-shaped metallic member 38 is fastened as by rivets 39 to one side of the frame, one arm of the L-shaped member extending in the same general direction as the bent portion 33 of the trimmer plate. The adjusting screw 34, however, in this case extends through the free arm of the L-shaped member 38 and is provided with a slotted end 40, whereby the screw may be operated either from the bottom or the top to adjust the position of the trimmer plate 33.

In the form of trimmer shown in the right-hand condenser unit of Figure 1, the same L-shaped metallic member 38 is used as has been described with respect to the centrally located condenser, but in this form of trimmer the free side of the member 38 has fastened thereto, a nut 41 having an upwardly extending split stem 42 for gripping the screw 34 to hold the trimmer plate in adjusted position. The nut 41 has a shank 47 which passes through a hole in the free side of the bracket 38. The metal around this hole on the trimmer plate side is depressed in some polygonal form as shown in Figure 7, and the shank is upset into this space, thereby locking the nut 41 se-

curely to the bracket 38. The adjusting screw 34, however, has a head at both ends, the one at the upper end being numbered 43, and is preferably soldered to the screw after the trimmer assembly has been made, whereby the trimmer plate may be adjusted from the top by a socket wrench, or from the bottom by a screw driver. By reason of this construction, the trimmer cannot unintentionally be disassembled, as by one inadvertently over-adjusting the screw 34. However by touching a soldering iron to the nut 43 and melting the solder, the nut may be removed so the screw 34 can be removed to replace a broken insulator. In either form of trimmer plate, it will be seen that the trimmer plate may be removed or added to such unit condenser without disturbing the setting of the stator group of plates.

Furthermore, each trimmer plate has an inwardly projecting fold extending into the space above and back of the insulator 18, and the trimmer insulator 36 may rest on the upper part of this fold. Heretofore the usual practice has been to make an outward fold in the trimmer with the insulator 35 resting on the bottom part of the fold, but the inward fold really narrows the width of the insulator to be used by approximately the width of the fold. Besides, the inward fold makes a better operating trimmer plate; i. e., one that will cause the trimmer plate to follow the adjusting screw 34 better than a plate with the outward fold, especially in the arrangements shown in the central and right-hand units of Figure 1.

In passing, it may be noted that forked grounding springs 44 may be used as indicated in Figure 2, these being mounted on the brace and shield plates 45 which are cut away to receive the shaft 4.

From what has been said, it will be seen that certain of the details may be varied considerably without departing from the spirit of my invention or the scope of the appended claims.

What I claim is:

1. In a variable condenser including rotor and stator plates and a frame, said stator plates being attached to tie bars and said tie bars being fastened to insulators carried by the frame, the fastening means between the tie bars and insulators including metallic supporting means for each side of the condenser extending between the insulator and a tie bar, the union for completing the supporting connection to the tie bar being made by soldering, thereby providing a strain-free stator mounting; characterized in that the metallic supporting means has a lug for making electrical connection to the stator plates, said lug also serving as a positioning means for a trimmer plate mounted on said insulator.

2. In a variable condenser including rotor and stator plates and a frame, said stator plates being attached to tie bars and said tie bars being fastened to insulators carried by the frame, the fastening means between the tie bars and insulators including metallic supporting means for each side of the condenser extending between the insulator and a tie bar, the union for completing the supporting connection to the tie bar being made by soldering, thereby providing a strain-free stator mounting; characterized in that each metallic supporting means has a flat transverse

portion which is fastened to its insulator and two spaced portions bent inwardly over the top of the insulator toward the tie bar.

3. In a variable condenser including rotor and stator plates and a frame, said stator plates being attached to tie bars and said tie bars being fastened to insulators carried by the frame, the fastening means between the tie bars and insulators including metallic supporting means for each side of the condenser extending between the insulator and a tie bar, the union for completing the supporting connection to the tie bar being made by soldering, thereby providing a strain-free stator mounting; characterized in that each metallic supporting means has a flat transverse portion which is fastened to its insulator and two spaced portions bent inwardly over the top of the insulator toward the tie bar, and a cross-piece joining the extremity of said spaced portions and extending longitudinally of the tie bar to which it is soldered.

4. In a variable condenser; the process of assembly of the rotor and stator in the frame thereof, which consists in first assembling the rotor plates to the shaft and the stator plates to tie bars, then mounting metallic supporting means on insulators and assembling the insulators to the frame, then placing the rotor with its shaft within the frame and aligning the shaft by at least one of its bearings, then swinging the stator plates into position by dropping them in upside-down position in mesh with the rotor plates and then turning both approximately 180° about the shaft center, passing a suitable fixture between the rotor and stator plates for the purpose described, and then soldering the metallic supporting means to the stator tie bars on opposite sides of the frame.

5. In a variable condenser including rotor and stator plates and a frame, said stator plates being attached to tie bars and said tie bars being fastened by non-warping means to insulators carried by the frame; characterized in that the fastening means between the tie bars and insulators includes a metallic supporting means for each side of the condenser securely anchored to its insulator and having parts extending to and soldered to said tie bar, said metallic supporting means having a projecting lug which may be used for making electrical connection to the stator plates and a trimmer plate independently mounted on one of said brackets, said trimmer plate having a forked end spanning said bracket lug for the purpose described.

6. The process of assembly of the stator group of plates of a variable condenser in a frame so as to prevent warping of the stator plates which consists in first assembling to the frame, stator support means on opposite sides of the frame and spaced a distance apart, also first assembling the rotor plates to the shaft then placing the shaft with rotor plates in operative position in the frame with the stator plates in upside-down position in mesh with the rotor plates, then rotating both sets of plates until the stator is in substantially operative position, then spacing by suitable means the rotor and stator plates, then soldering the group of stator plates to said support means and finally withdrawing said spacing means.

RUSSELL E. CRAMER.