May 12, 1942. J. A. FLANZER 2,282,858

ELECTRICAL CONDENSER

Filed Nov. 7, 1940 2 Sheets-Sheet 1

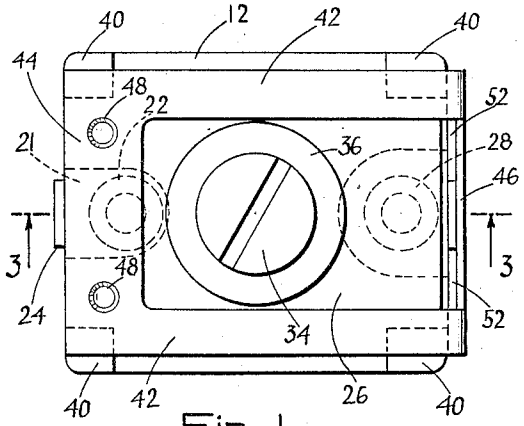


Fig. 1

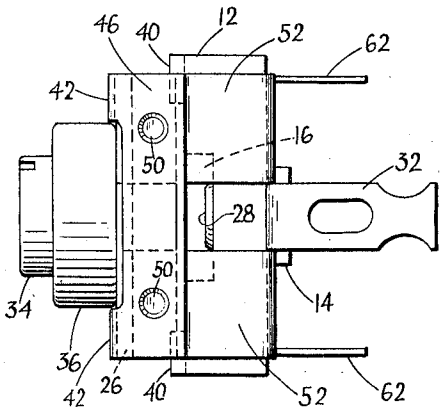


Fig. 2

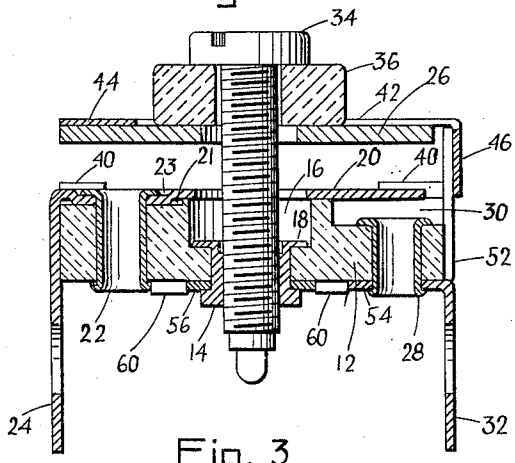
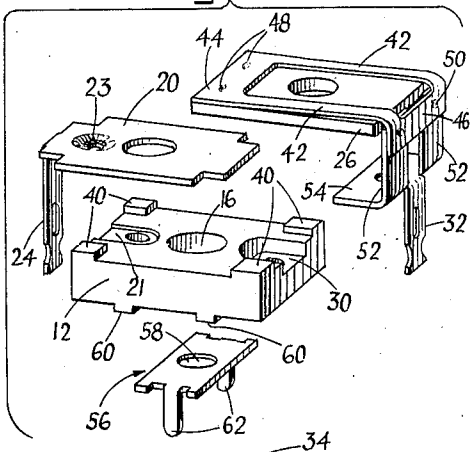


Fig. 3

Fig. 4



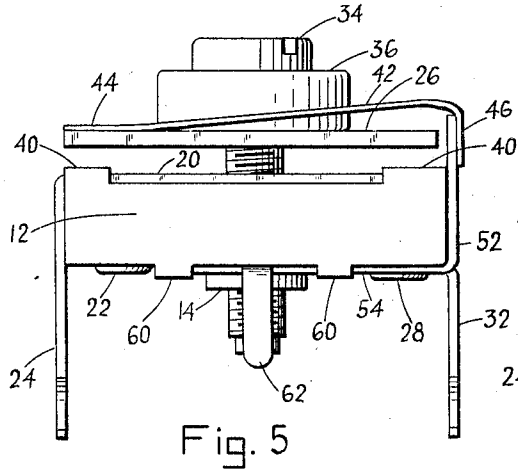


Fig. 5

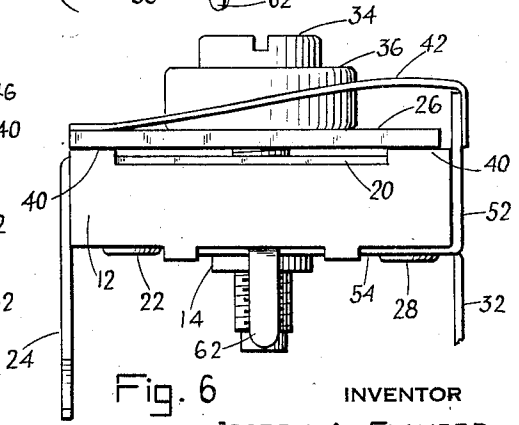


Fig. 6

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ELECTRICAL CONDENSER

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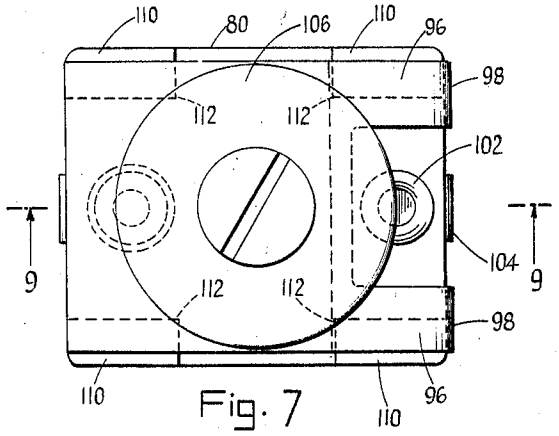


Fig. 7

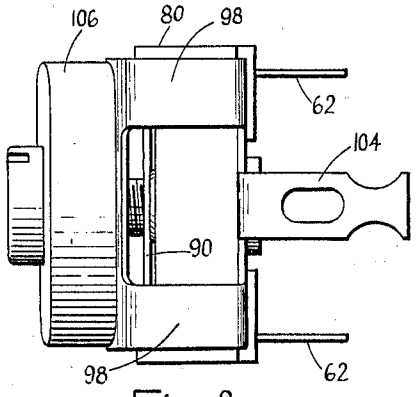


Fig. 8

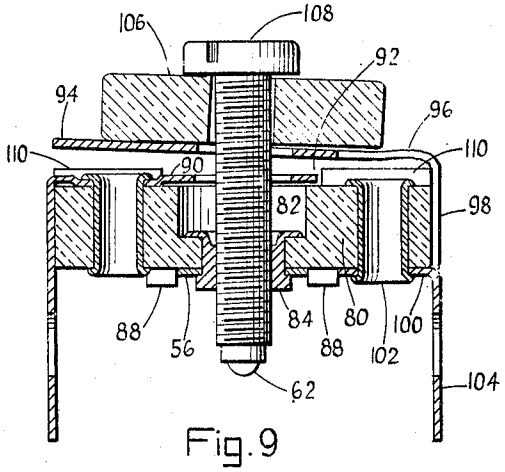


Fig. 9

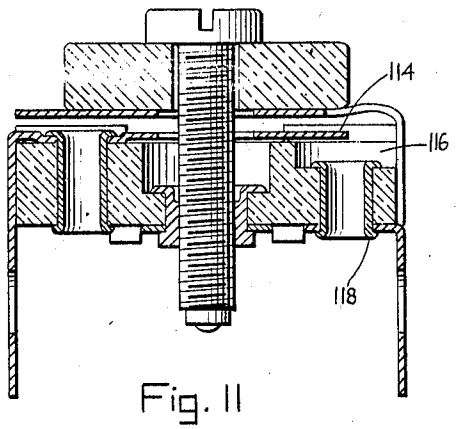


Fig. 11

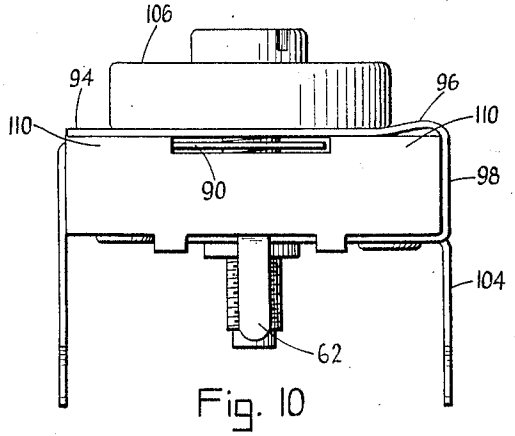


Fig. 10

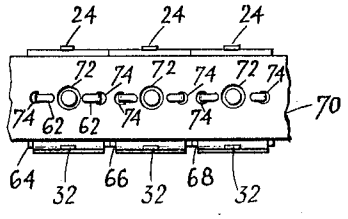


Fig. 12

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ELECTRICAL CONDENSER

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Application November 7, 1940, Serial No. 364,629

14 Claims. (Cl. 175—41.5)

This invention relates to electrical condensers, and more particularly to trimmer condensers for high frequency work.

The primary object of my invention is to generally improve trimmer condensers. A more particular object is to provide a small variable trimmer condenser having an exceedingly stable capacitance or frequency characteristic. Such condensers are important for high frequency work as, for example, in frequency modulation receivers and television receivers. It has been found that the most stable dielectric available is air, for even mica is not comparable in this respect, and from this viewpoint the object of my invention is to provide a generally improved air trimmer condenser.

Air trimmer condensers are not new, but those heretofore used have been characterized by varied and complex structures which are expensive to manufacture and relatively cumbersome to handle. They have proved to be difficult to mount when building the receiver, and difficult to regulate when adjusting the receiver. Further objects of my invention are to overcome these difficulties and to provide a simple, efficient, inexpensive air trimmer condenser which may be conveniently mounted and readily adjusted.

More specific objects of the invention are to provide a small minimum capacitance; to provide stops for preventing direct contact between the plates when the plates are brought together for maximum capacitance; and to provide means for keeping the plates in substantially parallel relation over a relatively large range of movement.

To the accomplishment of the foregoing and such other objects as will hereinafter appear, my invention consists in the condenser elements and their relation one to the other as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by drawings, in which :

Fig 1 is a plan view of an air trimmer condenser embodying features of my invention;

Fig. 2 is an end elevation thereof;

Fig. 3 is a section taken in the plane of the line 3—3 of Fig. 1;

Fig. 4 is a perspective view showing the parts of the condenser in disassembled relation;

Fig. 5 is a front elevation, looking in the same direction as in Fig. 3, but with the upper plate moved partially toward the lower plate;

Fig. 6 is a similar elevation with the condenser closed for maximum capacitance;

Fig. 7 is a plan view of a modified form of air trimmer condenser embodying features of my invention;

Fig. 8 is an end elevation thereof;

Fig. 9 is a section taken in the plane of the line 9—9 in Fig. 7;

Fig. 10 is a front elevation of the condenser looking in the same direction as Fig. 9, but with the condenser closed for maximum capacitance;

Fig. 11 is a section similar to Fig. 9 through a condenser slightly modified for higher capacitance; and

Fig. 12 is explanatory of the method of mounting the condensers in gang formation, this figure being a bottom plan view.

Referring to the drawings, and more particularly to Figs. 1 through 6, the condenser comprises a thick insulation base 12 preferably made of molded ceramic material. The base is provided with an internally threaded center bushing 14. It will be noted that the upper side of the base is deeply recessed at the bushing as is indicated by the numeral 16, thus spacing the top flange 18 of the bushing a substantial distance from the stationary plate 20 of the condenser, thus minimizing the minimum capacitance of the condenser. The stationary or bottom plate 20 rests directly on the top of the ceramic base 12 and is secured thereto by means of an eyelet 22 located at one end of the condenser. The base 12 is preferably recessed slightly as indicated at 21, and plate 20 is depressed at 23 an amount sufficient to prevent the riveted upper end of eyelet 22 from projecting above the plane of plate 20.

A soldering lug 24 projects from the same end of the condenser and is most conveniently formed integrally with the bottom plate 20. The movable top plate 26 is secured to the opposite end of the base, as by means of an eyelet 28, and at this point the base is preferably deeply recessed as is indicated at 30. A soldering lug 32 for the upper plate projects from this end of the base.

The condenser is adjusted by means of a screw 34 threadedly received in bushing 14. An insulation washer 36 is disposed between the head of the screw and the top plate 26. This washer is preferably made thick and of large area and is most conveniently made of molded ceramic material, such as is used for the base 12. Washer 36, acting on movable plate 26, helps maintain

the same in parallel relation to the stationary plate 20 during adjustment of the condenser.

The base is provided with upward projections 40 at its corners, these projections acting as stops to limit the downward movement of the top plate to prevent contact with the bottom plate when the condenser is closed for maximum capacitance, as indicated in Fig. 6. It will be noted, particularly in Fig. 4, that the corners of the bottom plate 20 are notched or cut away to receive the corner stops 40.

In the particular form of the condenser here shown, the top plate 26 is preferably made of thick rigid stock, such that it will not bend or flex appreciably upon tightening of the adjustment screw 34. Thus the plate 26 may be supported solely at its corners by means of the stops 40. This is desirable because it makes it possible to minimize the size of the stops and to locate the same as far as possible from one another so as to prevent danger of short-circuiting.

The rigid plate 26 is movably mounted by means of a pair of spring arms 42 disposed thereabove, said arms being secured to plate 26 at one end and to the condenser base at the opposite end, thus facilitating parallel movement of plate 26, as will be evident by comparison of Figs. 3, 5, and 6 of the drawings. In fact, the plate tends to follow a parallel movement even without the aid of the large area washer 36, and the latter insures the desired parallel movement. In practice the spring arms 42 are preferably stamped from sheet material with integral cross connections 44 and 46 at their ends. Phosphor bronze or other suitable resilient material may be employed. The cross connection 44 is secured to plate 26 by spot-welding the same, as is indicated at the points 48. The cross connection 46 is spot-welded at 50 to the upstanding arms 52 of a bracket, the horizontal part 54 of which is eyeletted to the bottom of base 12 by means of the eyelet 28 previously referred to. The soldering lug 32 is formed integrally with the bracket, it being formed by material struck out from between the upstanding arms 52, as will be clearly seen in Fig. 4.

The washer 36 has a diameter slightly less than the spacing between the spring arms 42, so that the washer moves between the arms during adjustment of the condenser.

To mount the condenser on a suitable support, it is preferably provided with a staple-like member 56, best shown in Fig. 4. The top or bridge portion of the staple has a hole 58 through which the bushing 14 is passed when riveting the bushing to the base. Thus the staple 56 is secured to the bottom of the base by means of the bushing 14. The base is preferably provided with projections or beads 60 between which the staple is received to lock it against rotation. It will be understood that the depending legs 62 of the staple may be used to mount the condenser on a suitable support strip. This mounting is adapted for either a single condenser or a gang of condensers. Fig. 12 illustrates three condensers 64, 66, and 68, which may form a part of a larger gang of condensers, mounted on a strip 70, only a part of which is shown. The strip has holes 72 which receive the lower ends of bushings 14 and additional pairs of holes 74 which receive the legs of the staples, the latter being bent over as is indicated at 62 to lock the condenser on the strip. The strip is narrower than the condensers, so that the soldering lugs 24 and 32 do not contact the strip 70, but are freely accessible below the strip for the connection of necessary wiring.

A modified form of the air trimmer condenser is illustrated in Figs. 7 through 10 of the drawings. This modified condenser employs a bendable top plate, instead of a rigid but spring-mounted top plate. The modified condenser is less expensive to manufacture, but does not have as big a capacitance range.

The base 80 is a ceramic base substantially like the base 12 previously described, it being deeply recessed at 82 to receive the threaded bushing 84, and the latter holding a mounting staple 56 which is additionally locked in position by projections 88. The bottom plate 90 is much like that previously described, except that it is cut short at the point 92 in order to provide a desired low minimum capacitance, this being necessary because the upper plate 94 oscillates about its bent connection 96, instead of moving parallel to the bottom plate. By shortening the bottom plate the less movable part 96 of the top plate is made ineffective.

The top plate is formed out of a single piece of sheet metal which is bent downwardly at 98 and inwardly at 100 beneath the base where it is eyeletted to the base by means of eyelet 102. Inasmuch as the lower plate 90 is too short to reach the upper end of eyelet 102, there is no need in this case to recess the base at the upper end of the eyelet, although such a recess will not do any harm, if provided. A part of the plate is cut away to form spaced arms or strips at 96 and 98, thereby increasing the flexibility of the plate. Some of the waste metal may be turned downwardly to form the soldering lug 104.

A thick large-area ceramic washer 106 is provided between the head of screw 108 and top plate 94. This washer is of considerably larger diameter than that previously described. In the first place there is no need for the washer 106 to fit between spring arms, and it may instead be co-extensive with the plate against which it bears. In the second place there is greater need to promote parallel movement of plate 94, although admittedly a strict parallel movement is not obtained with this form of the invention. In the third place it is desired to make the washer 106 so large in area, relative to the location of the corner stops 110, that the washer will at least slightly overlie the corner stops. This is so because the top plate 94, unlike the thick rigid plate 26 previously described, is bendable, and tightening of the screw 108 would tend to bend or flex the top plate with the possibility of contacting the bottom plate. When, however, the washer 106 overlies the corner stops, as is indicated at the points 112 in Fig. 7, the adjustment is brought to a positive stop while maintaining the desired minimum space between the plates. To attain the desired result the corner stops 110 are enlarged, in addition to increasing the area of the washer 106. In the present case the stops 110 have been extended longitudinally until they reach, and preferably pass the periphery of the washer, thus forming a positive stop. The change from open to closed position of the condenser will be apparent by comparison of Figs. 9 and 10, the latter figure showing the plate 94 resting directly on the stops 110. The condenser of Figs. 1 through 6 has an advantage over the condenser of Figs. 7 through 10, in providing a bigger range of capacitance. For example, using a base having a dimension of five-eighths by three-fourths inches, the first con-

denser may provide a capacitance range of, say, two to ten mmf. The modified condenser will provide a capacitance range of only, say two to six mmf.

Of course, a higher capacitance value may be provided, but not a large capacitance range. Thus in Fig. 11, I show a slightly modified condenser in which the bottom plate 114 is of full length, and the base is recessed at 116 to drop the upper end of eyelet 118. Otherwise the condenser of Fig. 11 is the same as the condenser of Fig. 9. By this change the maximum capacitance may be raised to, say, ten mmf., but the minimum is also raised to, say, five mmf.

It will be understood that while I have mentioned some examples of quanitative dimension and numerical capacitance values, these are given merely by way of exemplification and not in limitation of the invention.

The condensers of Figs. 9 and 11 are provided with a mounting staple exactly like that previously described, and any of the condensers may be mounted either singly or in gang formation in the manner described in connection with Fig. 12.

It is believed that the construction and operating characteristics, as well as the many advantages of my improved air trimmer condenser, will be apparent from the foregoing detailed description thereof. While I have referred to the stops as corner stops it will be understood that it is not essential to locate them at the corners of the base, although that is a convenient location. For example, looking at Fig. 7, a single elongated stop such as 110 may be located at the middle of each of the longer sides, between the ends of two stops now shown. The bottom plate would then be notched at the center instead of at the ends. Or all three stops might be used, producing a continuous ledge at each side, in which case the bottom plate would not be notched, but would be smaller in area, with some reduction in capacitance. It will therefore be apparent that while I have shown and described my invention in two preferred forms, other changes and modifications may be made in the structures disclosed without departing from the spirit of the invention as sought to be defined in the following claims.

I claim:

1. An air trimmer condenser comprising a thick insulation base having a threaded center bushing, the upper side of said base being recessed at said bushing, a bottom plate overlying said base, a movable top plate secured to said base, an adjusting screw passing through said plates and threadedly received in said bushing, said base being provided with upward projections at its corners acting as stops to limit the downward movement of the top plate to prevent contact with the bottom plate.

2. An air trimmer condenser comprising an insulation base having a threaded center bushing, a bottom plate overlying said base and eyeletted thereto at one end, a movable top plate secured to said base at the opposite end of the base, an adjusting screw passing through said plates and threadedly received in said bushing, a thick insulation washer of large area disposed between the head of the screw and the top plate, said base being provided with stop means to so limit the downward movement of the top plate as to prevent contact with the bottom plate, despite the absence of any sheet of solid dielectric material between said plates.

3. An air trimmer condenser comprising a thick ceramic base having a threaded center bushing, the upper side of said base being deeply recessed at said bushing, a bottom plate overlying said base, a movable top plate secured to said base, an adjusting screw passing through said plates and threadedly received in said bushing, a thick ceramic washer of large area disposed between the head of the screw and the top plate, said base being provided with upward projections acting as stops to limit the downward movement of the top plate to prevent contact with the bottom plate, mating parts of said bottom plate being cut away to clear said stops.

4. An air trimmer condenser comprising a thick insulation base having a threaded center bushing, the upper side of said base being deeply recessed at said bushing, a bottom plate overlying said base, a movable top plate secured to said base, an adjusting screw passing through said plates and threadedly received in said bushing, a washer of large area disposed between the head of the screw and the top plate, said base being provided with upward projections at its corners acting as stops to limit the downward movement of the top plate to prevent contact with the bottom plate.

5. An air trimmer condenser comprising a thick insulation base having a threaded center bushing, the upper side of said base being deeply recessed at said bushing, a bottom plate overlying said base and eyeletted thereto at one end, a soldering lug projecting from said end of the plate, a movable top plate secured to said base at the opposite end of the base and having a soldering lug projecting therefrom, an adjusting screw passing through said plates and threadedly received in said bushing, a thick insulation washer of large area disposed between the head of the screw and the top plate, said base being provided with upward projections at its corners acting as stops to limit the downward movement of the top plate to prevent contact with the bottom plate.

6. A condenser as specified in claim 1, in which the corner stops are small in area and remote from one another in location, and in which the top plate is a thick rigid plate sufficiently thick and rigid to withstand bending by the adjusting screw when said plate is supported with only its corners resting on the aforesaid stops.

7. A condenser as specified in claim 1, in which said top plate is movably mounted on the base by means of relatively long spring arms disposed above and secured to the plate at one end of the top plate and secured to the base at the opposite end of the top plate, whereby said top plate readily remains parallel to said bottom plate during movement toward or away from said bottom plate.

8. A condenser as specified in claim 1, in which the corner stops are small in area and remote from one another, and in which the top plate is a thick rigid plate sufficiently thick and rigid as to withstand bending by the adjusting screw when said plate is supported with only its corners resting on the aforesaid stops, and in which said top plate is movably mounted on the base by means of relatively long spring arms disposed above and secured to the top plate at one end of the top plate and secured to the base at the opposite end of the top plate, whereby said top plate readily remains parallel to said bottom plate during movement toward or away from said bottom plate.

9. A condenser as specified is claim 2, in which said top plate is movably mounted on the base by

means of a spring plate disposed above and secured to the top plate at one end of the top plate and secured to the base at the opposite end of the top plate, whereby said top plate readily remains parallel to said bottom plate during movement toward or away from said bottom plate.

10. A condenser as specified in claim 4, in which said top plate is movably mounted on the base by means of relatively long spring arms disposed outside the washer above the top plate secured to the top plate at one end of the top plate and secured to the base at the opposite end of the top plate, whereby said top plate readily remains parallel to said bottom plate during movement toward or away from said bottom plate.

11. A condenser as defined in claim 2, in which the top plate is relatively thin and yieldable, and in which the stops are so located and the top washer is so large in area that the washer overlies at least a part of said stops, whereby bending of the center of said plate against the bottom plate by the adjusting screw is prevented.

12. A condenser as defined in claim 3, in which the top plate is relatively thin and yieldable, and in which the stops are so located and the top washer is so large in area that the washer overlies at least a part of each of said stops, whereby bending of the center of said plate against the bottom plate by the adjusting screw is prevented.

13. A condenser as defined in claim 4, in which the top plate is relatively thin and yieldable for movement toward or away from the bottom plate, and in which the corner stops are so located and the top washer is so large in area that the washer overlies at least a part of said stops, whereby bending of the center of said plate against the bottom plate by the adjusting screw is prevented.

14. A condenser as defined in claim 5, in which the top plate is relatively thin and yieldable for movement toward or away from the bottom plate, and in which the corner stops are so located and the top washer is so large in area that the washer overlies at least a part of each of said stops, whereby bending of the center of said plate against the bottom plate by the adjusting screw is prevented.

JOSEPH A. FLANZER.