

May 29, 1956

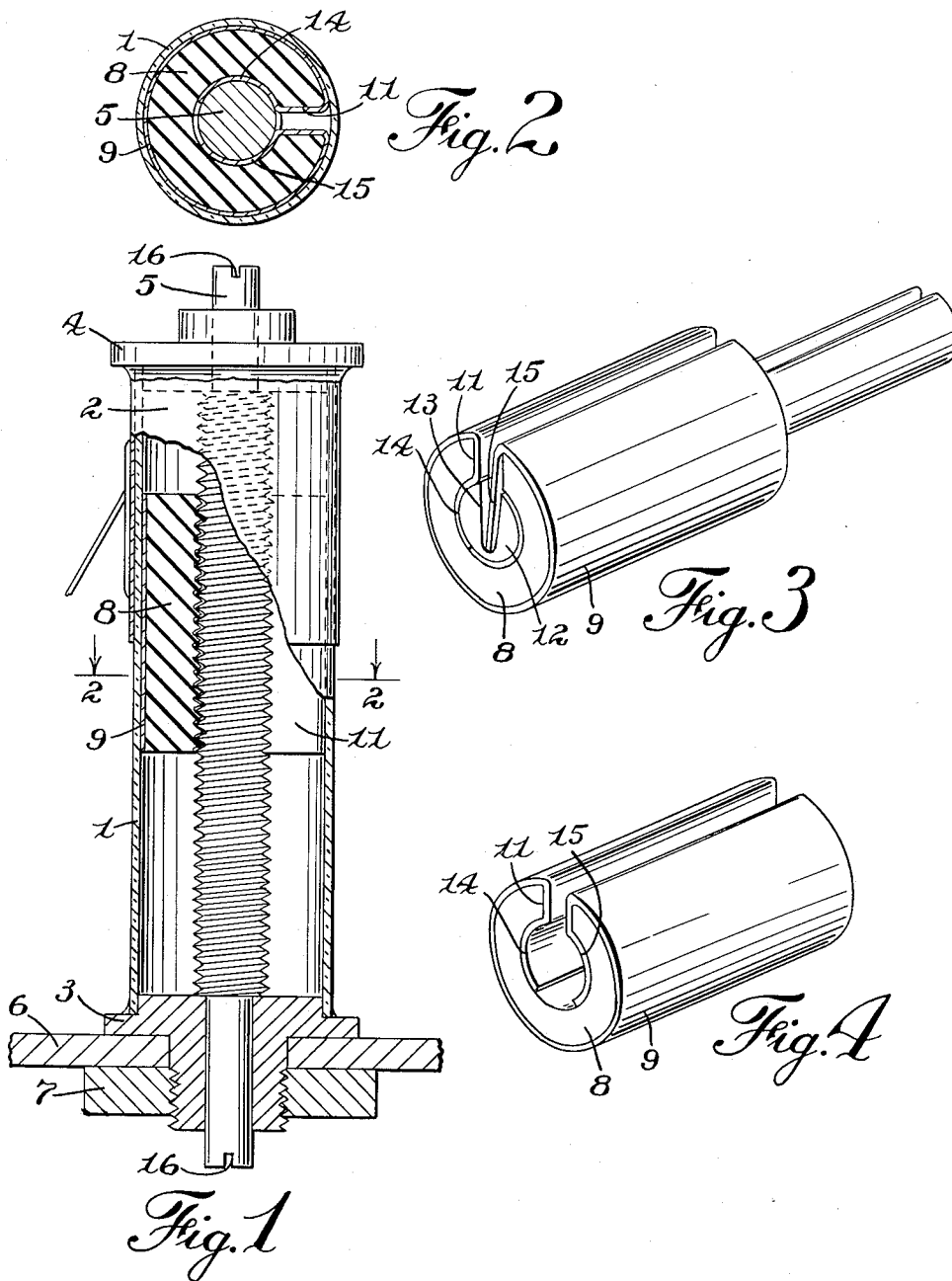
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TRIMMER CONDENSER

Filed Nov. 23, 1953

2 Sheets-Sheet 1



WITNESS:

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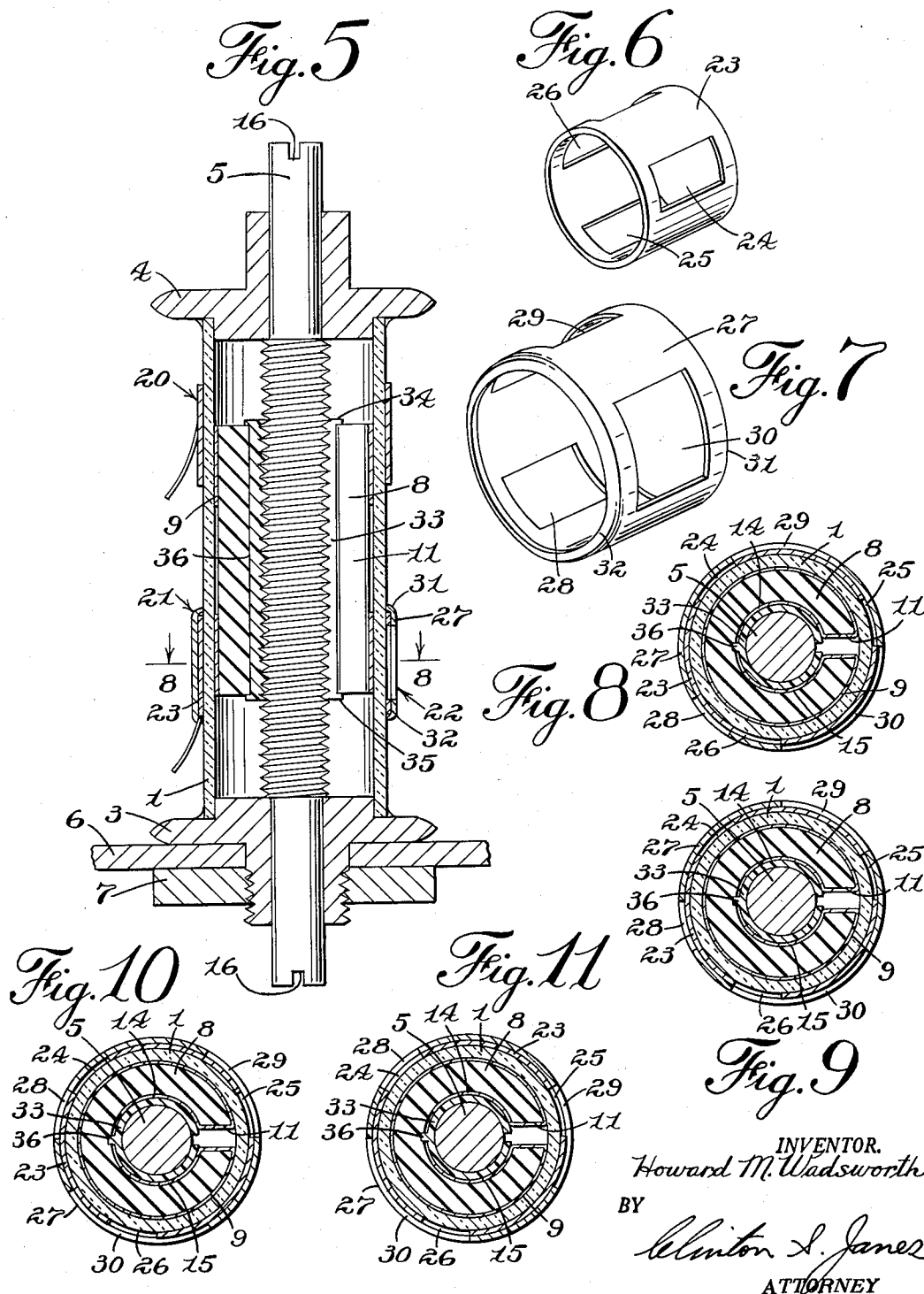
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TRIMMER CONDENSER

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Application November 23, 1953, Serial No. 393,605

6 Claims. (Cl. 317—249)

The present invention relates to a trimmer condenser for high frequency oscillating circuits and more particularly to an adjustable tubular type of miniature condenser.

It is an object of the present invention to provide a novel condenser of this type which is efficient in operation, economical in construction, and of small dimensions in relation to its electrical capacity.

It is another object to provide such a device which is so constructed as to lend itself to a simple and rapid method of construction and assembly.

It is another object to provide a novel and effective method of constructing and assembling the trimmer condenser.

It is another object to provide a gang-tuned multiple unit of the above type.

It is another object to provide such a multiple unit in which one of the units is readily adjustable to independently vary its capacity.

Further objects and advantages will be apparent from the following description taken in connection with the accompanying drawing, in which:

Fig. 1 is a side elevation, partly broken away and in section, of a preferred embodiment of the invention;

Fig. 2 is a section taken substantially on the line 2—2 of Fig. 1;

Fig. 3 is a detail in perspective of the inner electrode of the condenser as partially assembled;

Fig. 4 is a detail similar to Fig. 3 showing the inner electrode in its completed form;

Fig. 5 is a view similar to Fig. 1 showing a twin, gang-tuned trimmer constructed in accordance with the present invention;

Fig. 6 is a detail in perspective of the inner metallic band forming part of the outer electrode of the independently adjustable condenser;

Fig. 7 is a similar view of the outer metal sleeve of the same;

Fig. 8 is a section on the line 8—8 of Fig. 5; and

Figs. 9, 10 and 11 are semi-diagrammatic developments of the parts of the independently adjustable outer electrode showing steps in the progressive reduction in the effective area of the electrode.

In Fig. 1 of the drawing there is illustrated a tube 1 of suitable dielectric material having a cylindrical metallic band 2 fixedly mounted thereon to constitute the outer electrode of the condenser. Bushings 3 and 4 are rigidly mounted in the ends of the tube 1 in any suitable manner and serve to rotatably support at its ends a screw shaft 5 in coaxial relation with the tube 1. The bushing 3 is adapted to be mounted in a panel 6 to which it is affixed by a clamp nut 7 or other suitable means.

As best shown in Fig. 4 the inner electrode comprises a slotted hollow cylinder 8 of elastically deformable material such as rubber, around which a band 9 of sheet metal is wrapped, with its ends traversing the slot 11 of the rubber tube and conformed to the interior of the tube.

Applicant's novel method of constructing this inner electrode comprises the steps of inserting one end of a suitably proportioned metallic sheet or heavy foil through the slot 11 until it bottoms on the interior of the cylinder 8, then pressing through the slot 11 a cylindrical mandrel 12 having a diameter approximately the same as the interior diameter of the cylinder 8 and having a slot 13 which is arranged to register with the slot 11 in the rubber tube. When the mandrel is so inserted, the rubber tube 8 is forced open sufficiently to receive the mandrel, and as the tube springs back to its original shape the inserted end of the metallic sheet 9 is caused to conform itself to the interior of the cylinder 8 as shown at 14 in Fig. 3.

The said metallic sheet 9 is then wrapped around the cylinder 8 and its other end inserted through the slot 11 of the cylinder into the registering slot 13 of the mandrel 12 as shown at 15 in Fig. 3. The mandrel is then rotated in a clockwise direction whereby the sheet is tightly contracted around the cylinder 8 and then the end 15 of the sheet is rolled into contact with the interior of the cylinder as shown in Fig. 4.

The inner electrode so formed is mounted on the screw shaft 5 by introducing the screw shaft endwise while rotating the screw shaft and simultaneously withdrawing the mandrel as the screw shaft advances. The threads of the screw shaft thus form corresponding threads in the end portions 14 and 15 of the sheet 9 within the cylinder 8. If the sheet 9 is of metal which is sufficiently softer than that of the screw shaft, the threads are scored in the portions 14 and 15, but if a harder metal is used such as a thin sheet of stainless steel, the material conforms elastically to the threads of the screw shaft as permitted by the resiliency of the rubber tube, so that a threaded relationship of the inner electrode on the screw shaft is established.

The screw shaft with the inner electrode threaded thereon is then inserted in the dielectric tube 1, the dimensions of the parts being so proportioned that a suitable degree of compression is required to insert the electrode, whereby the threaded connection of the electrode on the screw shaft is firmly maintained, and the metallic sleeve 9 is elastically pressed against the interior of the tube 1. The assembly of the unit is completed by permanently attaching the bushings 3 and 4 to the tube 1.

The screw shaft 5 is preferably provided with means such as a screw driver slot 16 at both ends to facilitate adjustment at either end. It will be understood that rotation of the inner electrode will be prevented by its frictional engagement with the interior of the tube 1 since the radius of its engaging surface is much larger than the radius of the screw shaft whereby rotation of the screw shaft will cause traversal of the inner electrode to bring it more or less into registry with the outer electrode and consequently vary the capacity of the condenser.

In Fig. 5 of the drawing there is illustrated an adaptation of applicant's invention to produce a gang type trimmer condenser; that is, a unit comprising a plurality of condensers which are capable of being tuned simultaneously in step. As there illustrated two such units are provided, one of the units which is indicated generally by numeral 20 being of the same construction as the embodiment of the invention above described, the parts being similarly numbered.

The inner electrode of the second unit 21 is constructed in the same manner as previously described, and in fact may, as illustrated, be formed as a unit with the inner electrode of the unit 20, both being mounted on the same hollow rubber cylinder 8. The outer electrode of the second unit, which is indicated generally by the numeral 22, is so constructed as to be adjustable independ-

ently of the first unit in order to secure the proper relationship between the circuits to be simultaneously tuned. For this purpose, the outer electrode comprises a stationary metallic band 23 (Fig. 6) which is provided with a series of openings 24, 25 and 26, and a metallic sleeve 27 (Fig. 7) also having a series of openings 28, 29 and 30 therein is rotatably mounted on the band 23 being kept from longitudinal movement by spinning over the ends of the sleeve 27 as indicated at 31 and 32.

The openings in the band 23 and sleeve 27 are arranged to be brought progressively into registry by rotary adjustment of the sleeve on the band, thereby varying the effective area of these members functioning together as the outer electrode of the unit 21. One suitable arrangement for securing a progressive variation in the effective area of the outer electrode 23, 27 is shown in section in Fig. 8, and three progressive steps in such adjustment are illustrated in Figs. 9, 10 and 11. In Fig. 8 the three openings 24, 25 and 26 in the band 23 are shown as occupying an arc of 30°, separated by arcs of 90°. The openings in the outer sleeve are of graduated width and spacing, the opening 28 occupying an arc of 30° and being separated from the opening 29 by an arc of 90°. The opening 29 has a width of 60° and is separated from the opening 30 by an arc of 60°. The opening 30 has a width of 90° and is separated from the opening 28 by an arc of 30°. It will thus be seen by examination of Figs. 9, 10 and 11 that rotation of the outer sleeve from the position shown in Fig. 8 wherein all the openings in the band 23 are covered will progressively uncover openings 24, 25 and 26, thus correspondingly reducing the effective area of the electrode to a minimum as shown in Fig. 11.

In some cases, it may be found desirable to insulate the inner electrodes of one or both of the units 20, 21 from the screw shaft and provide individual flexible electrical connections to each electrode. This is conveniently accomplished by introducing a flexible split sleeve of suitable dielectric material such as nylon as indicated at 33 in Figs. 5 and 8. In such case, the nylon sleeve may perform the function of the slotted mandrel 12 of Fig. 3 in the assembly of the electrode, the nylon being of course left in place and the screw shaft threaded therein prior to assembly in the dielectric tube. If found desirable, the nylon sleeve may be formed with terminal flanges 34 and 35, and one or more longitudinal ribs 36 in order to positively prevent relative movement between the sleeve and rubber cylinder.

While certain structure has been shown and described in detail it will be understood that other embodiments are possible and that changes may be made in the design and arrangement of the parts without departing from the spirit of the invention.

I claim:

1. In a tubular trimmer condenser a dielectric tube having an outer metal envelop constituting one electrode, a screw shaft rotatably mounted coaxially in said tube, and an inner electrode mounted on the screw shaft com-

prising a slotted hollow cylinder of elastically deformable rubber-like material and a sheet of electrically conductive material wrapped around said cylinder and pressed into full surface contact with the interior of the dielectric tube by the expansion of the elastically deformable material, and with its end portions entering the cylinder through the slot and embracing the screw shaft, said end portions being expanded into conformity with the interior surface of the elastic cylinder to serve as anchorages maintaining said conductive sheet under tension around the exterior of said cylinder.

2. A trimmer condenser as set forth in claim 1 in which the inner electrode is compressed within the dielectric tube sufficiently to cause the threads of the screw shaft to form corresponding threads in the embracing ends of the conductive material.

3. A trimmer condenser as set forth in claim 1 including further a split sleeve of dielectric material interposed between the electrically conductive material and the screw shaft to insulate the inner electrode from the shaft while serving to impart longitudinal movement to the inner electrode responsive to rotation of the screw shaft.

4. A trimmer condenser as set forth in claim 3 in which the sleeve of dielectric material is provided with means for positively imparting longitudinal movement to the inner electrode and preventing relative rotary movement.

5. In a method of constructing and assembling a tubular trimmer condenser, the steps of forming an inner electrode by inserting one end of a thin sheet of metal into a hollow slotted cylinder of rubber or the like, forcing a slotted mandrel into the cylinder to press said end into conformity with the interior of the cylinder, wrapping the metallic sheet around the rubber cylinder, inserting the other end of said sheet through the slot of the cylinder and into the registering slot of the mandrel, and then rotating the mandrel in the cylinder to draw the sheet tightly around the cylinder and cause said other end of the sheet to also conform to the interior of the cylinder.

6. In the method set forth in claim 5 the additional steps of forming and assembling the inner electrode including withdrawing the mandrel endwise from the cylinder while threading a screw shaft after it, and then inserting this sub-assembly in a dielectric tube which carries the outer electrode of the condenser.

References Cited in the file of this patent

UNITED STATES PATENTS

2,541,897	Wadsworth	Feb. 13, 1951
2,544,550	Bird	Mar. 6, 1951
2,589,092	Kihn	Mar. 11, 1952

FOREIGN PATENTS

458,710	Great Britain	Dec. 24, 1936
541,712	Great Britain	Dec. 8, 1941
608,084	Germany	Jan. 15, 1935
628,499	Germany	Apr. 6, 1936