Nov. 8, 1960 V. M. HEAZEL, JR., ET AL 2,958,930

RECEIVER INPUT TRANSFORMER AND METHOD OF MAKING THE SAME

Filed June 12, 1956

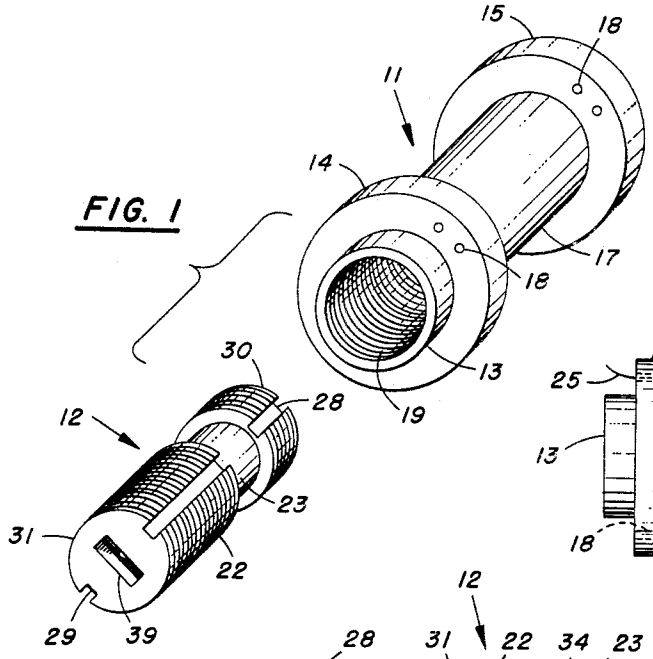


FIG. 1

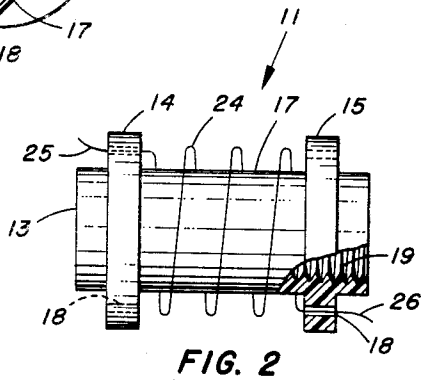


FIG. 2

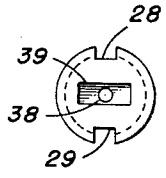


FIG. 4

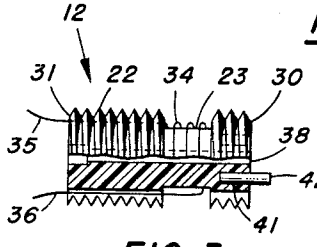


FIG. 3

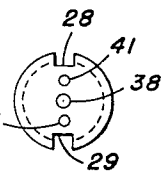


FIG. 5

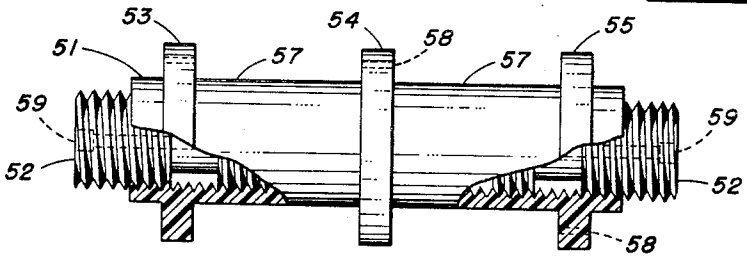


FIG. 6

INVENTORS
VINCENT M. HEAZEL, JR.
WILLIAM H. KUMM
BY
ATTORNEYS

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RECEIVER INPUT TRANSFORMER AND METHOD OF MAKING THE SAME

Vincent M. Heazel, Jr., Glen Burnie, and William H. Kumm, Baltimore, Md., assignors, by mesne assignments, to the United States of America as represented by the Secretary of the Navy

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4 Claims. (Cl. 29—155.58)

This invention relates to improvements in transformers and in the method of manufacturing transformers.

Although, relatively simple in appearance, the transformer unit is a very complex electrical unit. One of many possible uses of the transformer in the past has been as a receiver input transformer. To give the receiver a good noise figure, this type of transformer unit must resonate with the input and output capacities at the intermediate frequency, have a definite impedance matching function, and have a very wide bandpass characteristic. To accomplish these functions, the transformer must have definite primary and secondary inductances and a closely held coefficient of coupling. A required inductance can be established by proper winding characteristics, but previously the coefficient of coupling has depended on the proper mechanical tolerances of the individual pieces of the transformer unit and the placement of the primary and secondary windings on this unit. Thus, the electrical characteristics of the transformer depended on extremely close mechanical tolerances; consequently, in the past production of transformers, the manufacturing rejection rate has been extremely high, even as high as eighty percent. The high manufacturing rejection rate is directly responsible for a higher production cost.

In accordance with the present invention, the disadvantages stated are now overcome. There is provided a transformer unit that can be manufactured without extremely close mechanical tolerances and yet does not sacrifice the accuracy of the electrical characteristics, such as the coefficient of coupling. This is accomplished by manufacturing a transformer unit having two individual pieces wound with the primary and secondary windings of the transformer. The transformer piece having the primary winding wound thereon is adapted to be moved relative to the transformer piece having the secondary winding wound thereon. By adjusting the distance one winding is inserted into the other winding, a required coefficient of coupling for the transformer unit can be derived. This can be accurately set by the use of a "Q" measuring instrument. After the required coefficient of coupling for the transformer is set by means of a "Q" measuring instrument or any other equivalent means, the primary winding carrier is cemented to the secondary winding carrier.

Thus, the present invention contemplates a method of manufacture of a transformer where the electrical characteristics of the transformer, such as the coefficient of coupling, does not depend on extremely close mechanical tolerances, as required by past methods.

One of the principal objects of this invention is to provide a method of manufacture of transformers which lowers the manufacturing rejection rate.

Another object of the invention is to provide a method of manufacture of transformers wherein closer electrical tolerances can be obtained, without resorting to close mechanical tolerances.

A further object of the invention is the provision of

a cheaper, more accurate and simplified method of manufacturing transformers.

Yet another object of the invention is to provide a method for the manufacture of transformers of varied mechanical configurations.

A final object of the present invention is to provide a transformer which may be easily and cheaply manufactured.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 shows an exploded perspective view, of a preferred embodiment of the invention with the primary and secondary windings omitted for purposes of clarity.

Fig. 2 illustrates a side elevation of a tubular member, partly in section, having a coil wound thereon.

Fig. 3 shows a side elevation of a stud member, partly in section having a coil wound thereon.

Fig. 4 is a left-hand end view of the stud member shown in Fig. 3.

Fig. 5 is a right-hand end view of the stud member shown in Fig. 3.

Fig. 6 is an elevation, partly in section of another embodiment of the invention.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in Fig. 1 the tubular member **11** adapted to receive the cylindrical stud **12**. The tubular member **11** has an elongated body **13**, radial spaced flanges **14** and **15**, preferably integral with said body **13** and spaced from the ends of said body **13**. The two flanges **14** and **15** define a central portion **17** of the body **13**, which is adapted to receive the coil **24**. The coil leads **25** and **26**, see Fig. 2, are brought out through the holes **18** in flanges **14** and **15**. The inner surface **19** of the tubular body **13** is provided with screw threads that are adapted to mate with the screw threads provided on the stud **12**. The tubular member **11** is made of any suitable electric insulating material, such as plastic, rubber or the like, although other electric insulating materials may be used.

The stud **12** is also made of any suitable electric insulating material. The stud **12** is provided with screw threads **22** on its periphery. The screw threads **22** are interrupted by a recess or cut-away section **23**, thus forming two screw threaded sections **30** and **31**; recess **23** is adapted to receive a coil **34**. Elongated grooves **28** and **29** positioned 180° apart, are cut through the threads **22** of section **30** and **31** to provide lead out paths for the leads **35** and **36** of the coil **34** (see Fig. 3). A hole **38** is provided along the longitudinal axis of the stud **12**, and may be used as another path for the leads **35** and **36**. A slot **39** for receiving a screw-driver or the like is provided in one end of the stud **12**. In the other end of the stud **12**, relatively small pin holes **41** are provided to receive coupling pins **42**, one of which is shown in Figs. 3 and 5.

In assembling the present invention, the stud **12** is screwed into the tubular member **11** to give a required coefficient of coupling which is measured by a "Q" measuring instrument or the like. When the required coefficient of coupling is obtained, the stud **12** is cemented into place within the tubular member **11**. Any other suitable means may be employed to secure the stud **12** within the tubular member **11**. Thus, a transformer with a required coefficient of coupling is obtained without the high manufacturing rejection rate resulting from extremely close mechanical tolerances. It is to be noted that the above described method may be used with other than transformers having screw threaded parts as above described;

however, the screw threaded transformer is perhaps best suited to this method.

The stud 12 may be used as a single member or by the addition of pins 42 in holes 41, an additional stud 12 may be mechanically coupled to the first stud 12. Thus, two studs 12 having coils wound thereon may be adjusted as a single unit relative to the tubular member 11 having a coil wound thereon.

The assembled transformer described above may be manufactured by other methods than have been described herein. The obvious and most commonly used method in the past is to assemble the two coils relative to one another, rigidly secure the coils to prevent further movement between the coils and then test the assembled transformer to determine if the transformer has the required coefficient of coupling. This method has resulted in a very high manufacturing rejection rate, as above noted. Therefore, by using the disclosed method of manufacturing transformers, the disadvantages of the method used in the past can be overcome.

A further embodiment of the present invention is shown in Fig. 6 where a tubular member 51, very similar to the member 11, is provided with two central portions 57 corresponding to portion 17 of Fig. 1. The radial, spaced flanges 53, 54 and 55, correspond to flanges 14 and 15, and also have holes 58 therein. Separate coils are wound on the central portions 57 and the leads of said coils are brought out through the holes 58. The two studs 52 are identical with the stud 12. This embodiment enables the separate adjusting of the coils on members 52 in relation to the coils on member 51. By this means, closer electrical characteristics, such as the coefficient of coupling, may be obtained without regard to extremely close mechanical tolerances required in the manufacture of transformers in the past.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. The method of manufacturing a transformer comprising providing a first tubular support with spaced-apart flanges, providing a cylindrical stud member having a reduced diameter over a portion thereof, placing a first coil on the tubular support between the spaced-apart flanges, placing a second coil on said cylindrical stud member around the portion of reduced diameter, positioning the cylindrical stud member within the tubular member so that their longitudinal axes coincide, connecting a "Q" measuring means to said coils, adjusting said coils relative to one another along their longitudinal axes to obtain a desired coefficient of coupling, and then rigidly securing the coils from further movement with respect to each other.

2. The method of manufacturing a transformer comprising providing a tubular support with spaced-apart flanges thereon, providing a cylindrical stud member having a reduced diameter over a portion thereof and diametrically opposite slots in the periphery of the stud member running longitudinally the length of the stud, placing a first coil on the tubular support between the spaced-apart flanges, placing a second coil on the cylindrical stud member around the portion of reduced diameter, placing the lead-in wires to the second coil in the longitudinal slots in the stud member to provide an external connection to the second coil, assembling the transformer by inserting the stud member into the tubular support so that their longitudinal axes are parallel, connecting a "Q" measuring instrument to said coils, adjusting said coils relative to one another along their longitudinal axes to obtain a desired coefficient of coupling and rigidly securing the cylindrical stud member in place within the tubular support.

3. The method of manufacturing a transformer comprising providing an internally threaded tubular member of electric insulating material having spaced-apart flanges thereon, providing an externally threaded cylindrical stud member of electric insulating material having a reduced diameter over a portion thereof, providing diametrically opposite slots in the external threads of the stud member running longitudinally the length of the stud, placing a first coil on said tubular member between the spaced-apart flanges and a second coil on said stud member around the reduced diameter portion, providing holes in the flanges on the tubular member for lead-in wires to the first coil, placing the lead-in wires to the second coil in the longitudinal slots in the stud member to provide an external connection to the second coil, assembling the transformer by screwing the stud member into the tubular member so that their longitudinal axes are parallel, connecting a "Q" measuring means to the transformer, accurately setting the transformer to the required coefficient of coupling as determined by said means by screwing the stud member into or out of the tubular member so that the second coil moves longitudinally with respect to the first coil, and rigidly securing the stud member in place after the required coefficient of coupling has been obtained.

4. The method of manufacturing a transformer as set forth in claim 3, wherein the step of rigidly securing the stud member in place after the required coefficient of coupling has been obtained comprises cementing the stud member in place.

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