

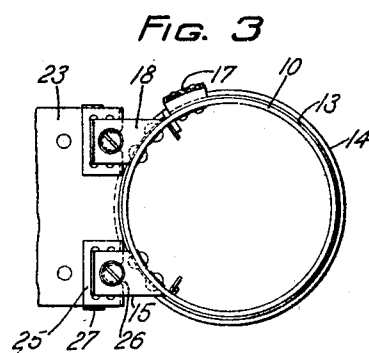
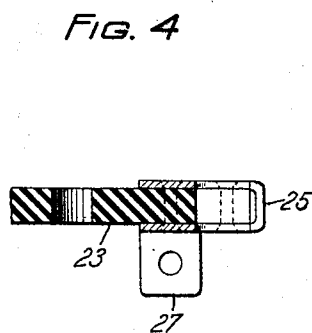
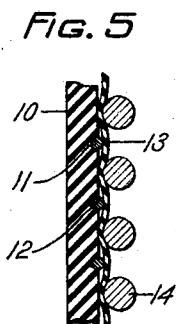
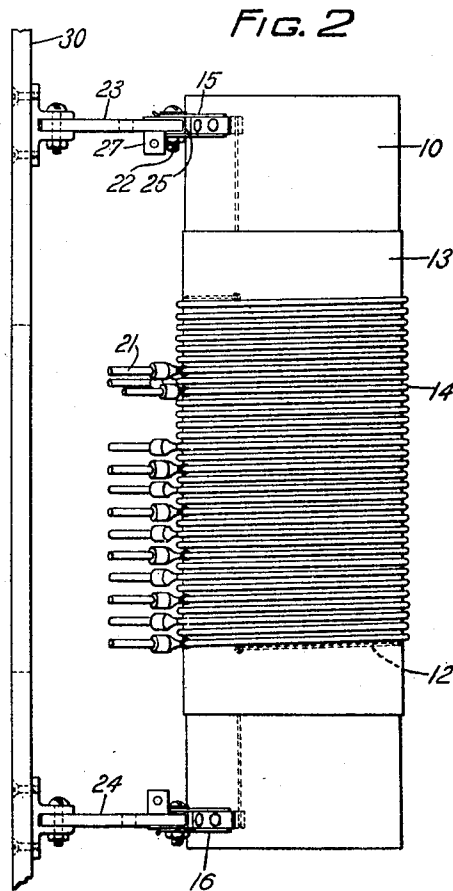
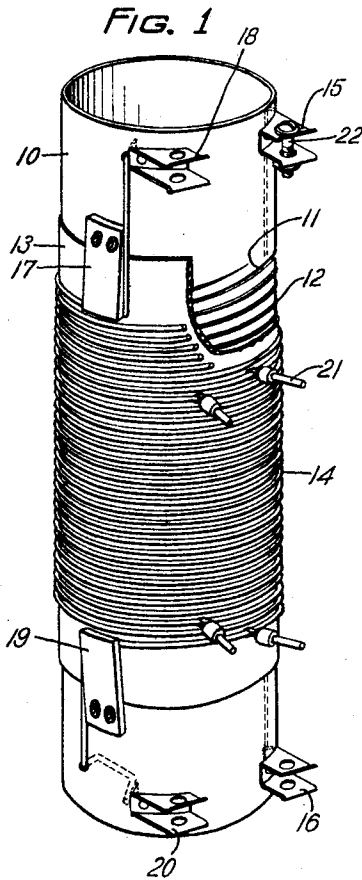
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INDUCTANCE DEVICE

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INDUCTANCE DEVICE

Application filed January 11, 1930. Serial No. 420,111.

This invention relates to inductive couplers and more particularly to a coupler adapted for transferring relatively large amounts of electrical power between meshes of a radio circuit.

5 An example of a specific application of the invention is found in an inductive coupler used between a space discharge device adapted to control relatively powerful electric currents and an antenna for radiating this power in the form of electromagnetic waves.

10 In a coupler of this sort the essential properties desired are close magnetic coupling and at the same time low distributed capacity and good insulation between the windings.

15 The desired characteristics are conveniently provided by the inductive coupler of the present invention. The construction of the coupler involves two windings, the inner one of which is laid in a groove in the surface of a winding form of insulating material. The groove and the wire are so proportioned that the wire projects above the surface of the winding form. A wrapping of insulating material is applied over the inner winding and then an outer winding is wound over the wrapping, the turns of the outer winding being positioned between the adjacent turns of the inner winding.

20 An object of the invention is to provide an inductive coupler having a close coupling between its windings.

25 Another object is to provide a coupler having a relatively low value of distributed capacity between turns of the windings thereof, thereby to minimize the shunting effect of such capacity upon the operation of associated circuits.

30 A further object of the invention is to provide a coupler comprising a plurality of windings which are effectually insulated from each other for direct current potentials as high as 1000 volts or more.

35 A feature of the invention is a mounting arrangement for the coupling coil, of such design that the coil may be readily removed and replaced by another coil of similar character, but having different electrical constants. When the coil has been secured in place it is effectually protected from becoming

loosened by vibration such as is encountered in use, for example, in an airplane.

The invention is fully described herein after with reference to the accompanying drawings in which Fig. 1 is a perspective view of a completed coupler partially cut away to show the method of winding. Fig. 2 is a side elevation of the assembled coupler as attached to a metal panel or framework by means of insulating brackets. Fig. 3 is a plan view of the coupler in engagement with an associated mounting bracket. Fig. 4 is a cross-sectional view of one of the brackets. Fig. 5 is a fragmentary cross-sectional view of the coupler.

40 In Fig. 1 there is shown a supporting form 10 of insulating material upon which the windings of the coupler are assembled. In the cut-away portion of this figure is shown a groove 11 which is cut into the surface of the form 10. The inner winding 12 of the coupler is laid in the groove 11 as is also shown in the cut-away portion of the figure. Over the winding 12 is placed an insulating wrapping 13 which is tightly drawn over the winding and outer surface of the supporting form. The inner winding 12 is wound with a wire of sufficiently large diameter that it partially projects from the groove 11 above the surface of the supporting form 10. The wrapping 13 conforms somewhat to the shape of the form 10 and projecting winding 12, as a result of which ridges are formed in the wrapping 13 where it is supported by winding 12 and slight hollows where the wrapping fits in between adjacent turns of the winding. An outer winding 14 is laid in the channel formed by the ridges and hollows in the surface of the wrapping 13 between adjacent turns of the winding 12.

45 The ends of the inner winding 12 are passed through small holes in the supporting form 10 and connected respectively to the upper right hand pair of spring connecting jaws 15 and the lower right hand pair of spring connecting jaws 16. The upper end of the outer winding is secured in position by a clamping block 17 in the manner shown and the free end is connected to the upper left hand pair of spring connecting jaws 18.

The lower end of the outer winding 14 is similarly secured by block 19 and is connected to the lower left hand pair of spring connecting jaws 20.

During the process of applying the outer winding 14, a number of connecting taps, such as the one shown at 21, may be applied to the wire in the manner described in a co-pending sole application of W. C. Tinus, Serial No. 418,892 filed January 6, 1930.

A clamping screw, such as is shown at 22, is provided in each pair of spring connecting jaws 15, 16, 18 and 20. The screw 22 passes through a hole in the upper jaw of pair 15 and engages in a thread in the lower jaw of the pair. The threads at the end of the clamping screw 22 are deformed or headed over so as to prevent the removal of the screw from the jaws.

Fig. 2 shows a side elevation of the coupler and illustrates one manner in which the coupler may be secured in place upon a metal panel by means of insulating brackets.

A portion of a metal panel is shown in sectional view at 30. Attached to panel 30 by any suitable means are upper and lower mounting brackets 23 and 24 respectively. Each bracket is formed from a block of insulatory material and has terminal plates of conducting material attached to it in the proper position to engage the corresponding spring connecting jaws. The upper terminal plate for the inner winding is shown at 25, engaging the upper spring connecting jaws 15.

Fig. 3 shows a plan view of the coupler with its upper jaws 15 and 18 in engagement with the terminal plates on the upper mounting bracket 23.

Fig. 4 shows the mounting bracket 23 and terminal plate 25 in a cross-sectional view. The terminal plate 25 is provided with a slot 26 for engaging the clamping screw 22. A lug 27 is provided for convenience in making connections to the terminal plate 25.

Fig. 5 shows an enlarged fragmentary view of a portion of the coupler. This shows the supporting form 10, groove 11, inner winding 12, insulatory wrapping 13 and outer winding 14 in a typical cross-section.

When the coupler is placed in position with the clamping screws, such as 22, engaged in the respective slots, such as 26, the coupler may be securely fastened in place by tightening the clamping screws. The spring jaw, such as 15 acts as a lock washer permitting a secure mechanical connection to be obtained which will withstand a great amount of vibration, such as is encountered in an airplane. A good electrical connection is secured over the relatively broad contact surfaces of the connecting jaws and the terminal plates. The coupler is, however, readily removed from the mounting brackets with the aid of a screw driver and may be replaced by another cou-

pler of similar construction but having different electrical constants, as for example, a different number of turns in the windings.

The following specifications are illustrative of a coupler constructed in accordance with this invention. The coupler was designed for use in the frequency range between 2000 and 6000 kilocycles, in connection with a tuning condenser having a maximum capacity value of 133 mmf., and with a direct current potential difference of 1000 volts between the windings of the coupler.

The supporting form 10 consists of a hollow cylinder having an outside diameter of $2\frac{1}{2}$ inches and a length of $8\frac{1}{4}$ inches. The groove 11 consists of a V-shaped helical thread having a pitch of 8 turns to the inch. The inner winding consists of 32 turns of number 20 B. & S. gauge bare tinned copper wire. The insulating wrapping 13 consists of a sheet of oiled silk fabric having a thickness of approximately 0.005 inch, wrapped seven times about the form, to make a total thickness of insulation of approximately 0.035 inches. The outer winding 14 consists of 32 turns of wire similar to that used in the inner winding, but of larger diameter, namely number 12 B. & S. gauge. A plurality of taps are provided.

The insulation provided between the inner and outer windings by means of the oiled silk wrapping was calculated to be sufficient to safely withstand a difference of potential of well over 1000 volts between the windings. Additional insulation may be provided by using insulated wire instead of bare wire.

The lower pair of spring connecting jaws 16 of this coil was connected to the plate electrode of a space discharge tube and during operation of the tube was charged to a potential of 1000 volts. The lower spring connecting jaw 20 was connected to the antenna and also to one terminal of a neutralizing condenser associated with the space discharge tube. Due to the close coupling between the windings of the coupler, the high frequency potentials of the jaws 16 and 20 were found to be substantially equal and in phase at all times during the operation of the space discharge device, so that the neutralizing condenser functioned as if directly connected to the plate electrode. In addition to the close coupling provided by the interleaving of the windings and the use of a flexible insulating layer, low distributed capacity in each winding is obtained by virtue of the longitudinal spacing of the turns, thus giving a coupling coil well adapted for use in a very wide range of frequencies.

While the invention has been illustrated by means of a coupling coil of a particular shape and design it is evident that many different arrangements may be used without departing from the spirit of this invention.

What is claimed is:

1. An inductive coupler comprising a supporting form of insulatory material having a groove encircling its outer surface in a plurality of turns, an inner winding consisting of a conductor lying within said groove and projecting therefrom, a sheet of insulatory material lying over said inner winding and said supporting form, and an outer winding lying over said insulatory sheet and interposed between adjacent turns of said inner winding.

2. An inductive coupler comprising a cylindrical form of insulatory material having a helical groove in its outer surface, an inner winding consisting of a conductor lying in said groove and having a sufficiently large diameter to project beyond the surface of the form, a wrapping of flexible insulatory material lying over said inner winding and said supporting form whereby an insulated helical channel is formed between adjacent turns of said inner winding, and an outer winding lying within said insulated channel.

3. An inductive coupler comprising a hollow cylindrical form of insulatory material having a helical groove in its outer surface, an inner winding consisting of a conductor lying within said groove and having a sufficiently large diameter to project beyond the surface of said form, a sheet of insulatory material wound over said inner winding and supporting form in a plurality of layers whereby an insulated helical channel is formed between adjacent turns of said inner winding, and an outer winding consisting of a conductor lying within said insulated channel.

4. An inductive coupler in accordance with claim 3 in which the insulatory material comprising the sheet specified therein is oiled silk.

5. A demountable assembly of electrical apparatus comprising a unitary electrical device, a pair of spring connecting jaws attached to said device, a clamping screw for closing said jaws, an electrical connection from said jaws to a component part of said device, a mounting bracket of insulatory material and a terminal plate covering a portion of the surface of said bracket, the bracket and plate having a slot cut therein for engaging said clamping screw in such position that operation of said screw is effective to bring said jaws into contact with said terminal plate.

6. A demountable assembly of electrical apparatus for use in the presence of mechanical vibrations comprising a unitary electrical device, a pair of spring connecting jaws mounted upon said device, a clamping screw for closing said jaws, an electrical connection from said jaws to a component part of said device, a mounting bracket of insulatory material, a terminal plate covering a portion of the surface of said bracket, the bracket and

plate having a slot cut therein for engaging said clamping screw in such position that operation of said screw is effective to bring said jaws into contact with said terminal plate, and means for preventing the escape of said clamping screw from said jaws.

7. An inductive coupler comprising a supporting form of insulating material, an inner winding composed of a plurality of turns of wire in a single layer lying on the surface of said form, the turns being spaced apart a distance at least equal to the diameter of the wire, a sheet of flexible insulating material wrapped over said inner winding and said form, and an outer winding having its turns wound over the insulating sheet and in the spaces between the turns of said inner winding.

8. An inductive coupler comprising a supporting form of insulating material, an inner winding composed of a plurality of turns of wire disposed in a single layer lying on the surface of said form, the turns being spaced apart a distance at least equal to the diameter of the wire, an outer winding having its turns wound in the spaces between the turns of said inner winding and a layer of flexible insulating material between said windings, said flexible insulating material being formed in corrugations over said inner winding and under said outer winding.

In witness whereof, we hereunto subscribe our names this 10th day of January, 1930.

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