

March 19, 1935.

R. M. HEINTZ

1,994,767

METHOD OF MAKING INDUCTANCES

Filed June 27, 1934

Fig. 1.

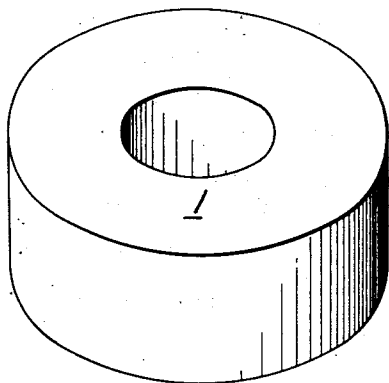


Fig. 2.

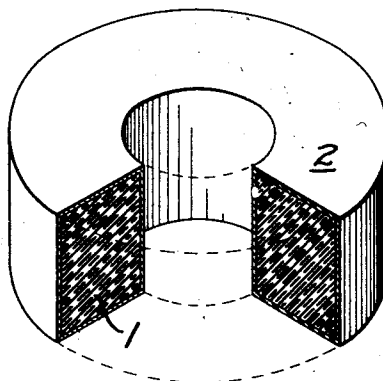


Fig. 3.

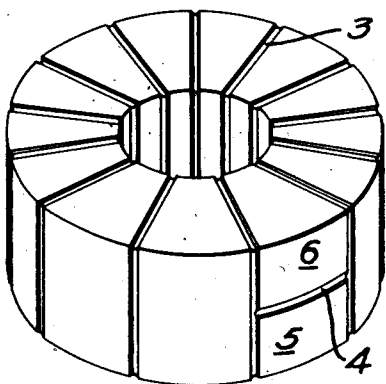


Fig. 4.

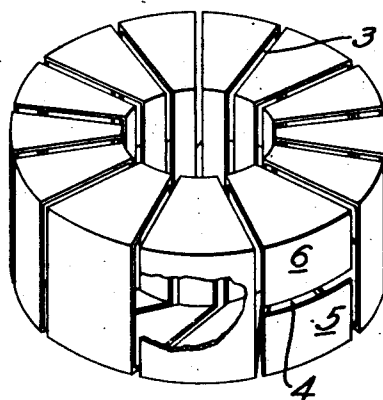


Fig. 5.

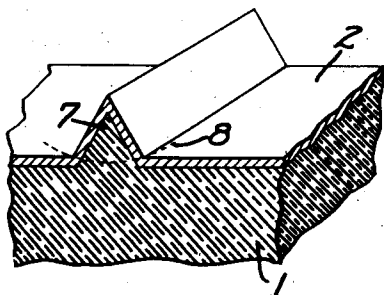


Fig. 6.

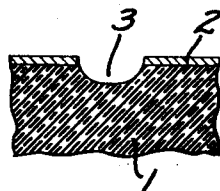
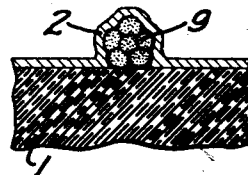


Fig. 7.



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1,994,767

METHOD OF MAKING INDUCTANCES

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Application June 27, 1934, Serial No. 732,649

7 Claims. (Cl. 175—359)

My invention refers to a method of making inductances, and more particularly to a method which is ideally adapted for the formation of toroidal coils.

5 Among the objects of my invention are: to provide a method of forming inductances from unstressed conductive material; to provide a method of forming inductances by electro-deposition of conductive material; to provide a method of forming a substantially self-supporting inductance; to provide a method of making an inductance in toroidal form; and to provide a simple and efficient method of making inductances by deposition of conductive material upon a form.

10 Other objects of my invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but I do not limit myself to the embodiment of the invention herein described, as various forms may be adopted within the scope of the claims.

Referring to the drawing:

Figure 1 is a perspective view of a meltable pattern to be used in making a toroidal coil.

Figure 2 is a perspective view of the pattern shown in Figure 1, having conductive material deposited on all surfaces thereof, a portion of the figure being cut away to show the plated pattern in section.

Figure 3 is a perspective view of the scoring step in the formation of the inductance.

Figure 4 is a perspective view of a completed toroid inductance.

Figure 5 is a view partly in section and partly in perspective, of a raised thread on a plated form.

Figure 6 is a sectional view taken through the plated form in the region of a scoring cut.

Figure 7 is a sectional view of an alternate step in the making of my inductance.

One of the most important advantages of the toroidal, or doughnut, form of inductance is that it has practically no external field, and so gives but little mutual induction with other circuits. A toroidal coil will, for similar reasons, not be affected by mutual induction from other sources. Used as a tuning coil in a receiving set, therefore, it will not pick up strays or other disturbing fields.

Heretofore, toroidal coils have not been applied to any great extent in short wave work because of the small amount of inductance desired, as it is obvious that when relatively few turns of an inductance are formed into a torus, that the spacing between turns on the periphery of the coil is too great either to create the required inductance or to properly confine the magnetic field.

Inasmuch as my invention is ideally adapted to produce a toroidal coil having a relatively small number of turns, I have chosen to describe my method as exemplified in the making of a toroidal coil, but it should be here noted that the same method may also be applied to the production of practically any type of coil in any of the well known shapes, and I do not desire to be limited in my application of the method to the production of toroidal coils alone.

The toroidal coil illustrated and described in this application is the subject of my application, Serial No. 732,648 filed June 27, 1934, contemporaneously with this application, and is therein claimed per se.

It is believed that the description of the method, as applied to the particular torus shown in the drawing, will enable anyone skilled in the art to practice the method to produce any desired form of inductance.

My invention comprises, broadly, a method of forming an inductance by depositing a layer of conductive material, preferably copper or silver, on a meltable form, spirally removing some of the deposited layer to create the turns of the inductance, and melting the form to leave the turns free of interior support.

I may prefer, particularly in the case of the toroidal inductance, to remove the deposited layer in a spiral path of substantially uniform width, whereby the device becomes almost completely self-shielding even though there are only a small number of turns.

I may also employ several different methods of removing the deposited layer; by cutting through the layer with a tool adapted for the purpose, placing a raised thread on the meltable form before plating, and then removing the thread after plating; or I may prefer to wind a filamentous body, such as string, around the form, plate, and then remove the string. By depositing a relatively heavy layer of conductive material on the pattern the completed inductance is substantially self-supporting.

My method may be more completely understood by reference to the drawing:

I first shape a meltable form or pattern 1 into the general conformation of the desired coil, in this case a torus, or doughnut shaped pattern. While the only requirement for this form, as far as the melting point is concerned, is that it shall be substantially less than that of the conductive material to be deposited thereon, I prefer to use a wax pattern as the wax is easily removed by melting. If, however, extreme accuracy is de-

sired in the dimensions of the completed coil, a meltable metal, such as lead or Wood's metal, may be substituted for the wax. In case wax is used, I prefer to employ the usual custom of graphiting the exterior surface of the form 1, and by electro-plating, deposit a layer of conductive material 2 on the pattern, as shown in Figure 2. This layer may be heavy or light in accordance with the requirements of the finished product.

The last step is shown in Figure 3. A scoring cut 3 is made through the plating following a helical path around the inductance to separate the deposited layer of conductive material into an inductance.

I also prefer to cut a separating path 4 in one of the turns in order to provide end plates 5 and 6 to which electrical connection to the coil may be made. It is obvious, however, that this separating path may be placed across any part of any turn to provide for the exigencies of particular cases.

I next prefer to place the plated and scored pattern in an oven, or similar device, and apply heat until the material of the pattern melts and runs out of the inductance, leaving the completed inductance free, as shown in Figure 4. This inductance, if heavy, is virtually self-supporting and may be mounted in any convenient manner. If it has been made of a light deposit of metal, various standards or other supporting arrangements may be applied to the device, such as a bar through the central aperture, for example, to support the coil. I prefer, however, to form the metal layer sufficiently thick that it may substantially support itself.

Instead of scoring the pattern, as shown in Figure 3 and in section in Figure 6, I may prefer to form the original pattern 1 with an external raised thread 7, as shown in Figure 5. The pattern is then plated, as in the original case, and the thread may then be removed, as indicated by the dotted line 8, to level the surface and provide the spacing between turns.

In Figure 7 I have shown an alternate method of separating the turns after plating, where a filamentous body 9, such as common string, is wound over the form 1. The pattern is then plated and the string removed, tearing and breaking the plating to form the open path between the turns.

Irrespective of the particular method step used to separate the continuous plating into a plurality of turns, the end result is substantially the same. The path provided between the turns has a substantially uniform width throughout which, in the case of a torus, leaves the outside of each turn considerably wider than the inside. This not only adds strength to the toroidal coil but also aids greatly in the shielding effect.

Furthermore, the inductance coils formed by my method are exceptionally stable as to shape,

as the metal deposited by electro-plating or similar process is deposited in an unstrained condition in its final shape. There has been no winding or bending of the conductive material, and therefore the material of the inductance does not have any tendency to change its shape due to strains set up in the metal.

It is also quite apparent that this method is also applicable to form coils wherein two dissimilar metals are deposited, one over the other, to form a bimetallic layer which, when cut into turns, can be made so that the coefficient of expansion, as to temperature, may be made substantially nil.

I claim:

1. The method of forming an inductance which comprises depositing a layer of conductive material on a meltable form, spirally removing some of the deposited layer to create the turns of the inductance, and melting the form to leave said turns.

2. The method of forming an inductance which comprises electro-plating a layer of conductive material on a meltable form, spirally removing some of the deposited layer to create the turns of the inductance, and melting the form to leave said turns.

3. The method of forming a toroid inductance which comprises depositing a layer of conductive material on a meltable form of toroid shape, cutting through the deposited layer in a helical path of substantially uniform width, and melting said form to free the inductance turns.

4. The method of forming a toroid inductance which comprises depositing a layer of conductive material on a wax form of toroid shape, cutting the deposited layer in a helical path of substantially uniform width, and melting said form to free the inductance turns.

5. The method of forming an inductance which comprises providing a form with a raised helical thread on the exterior surface thereof, depositing conductive material on said surface, and removing all material projecting above said surface to level said surface and create said inductance by the removal of said thread.

6. The method of forming an inductance which comprises providing a form having an exterior surface of the shape desired, winding said form with a filamentous material to form a spiral thereon, electro-plating said form, and removing said filament to separate the electro-plating into inductance turns.

7. The method of forming an inductance which comprises providing a meltable form having an exterior surface of the shape desired, winding said form with a filamentous material to form a spiral thereon, electro-plating said form, removing said filament to separate the electro-plating into inductance turns, and melting said form to release said inductance.

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