April 17, 1928. 1,666,120

H. D. CURRIER

COIL

Filed Oct. 18, 1924

Fig. 4.

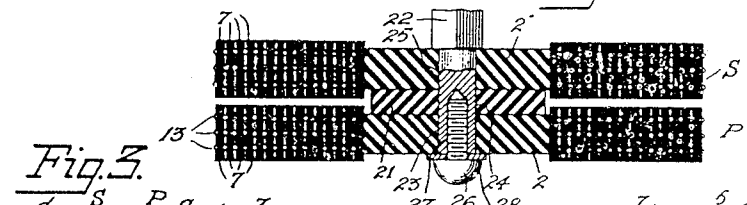


Fig. 3.

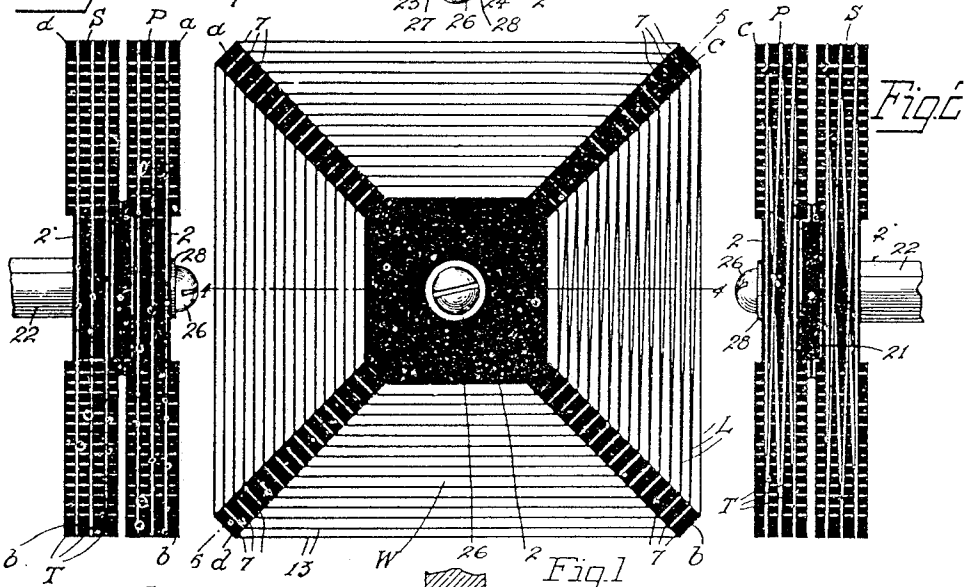


Fig. 1

Fig. 5.

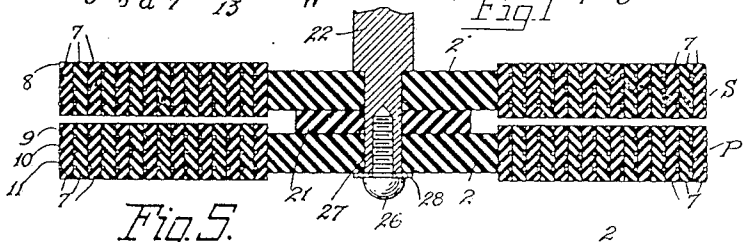


Fig. 7.

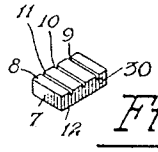
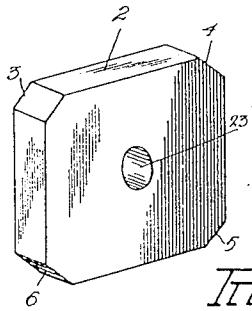


Fig. 6.



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UNITED STATES PATENT OFFICE.

HIRAM D. CURRIER, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

COIL.

Application filed October 18, 1924. Serial No. 744,465.

My invention relates to coils or transformers, and has to do more particularly with transformers of the air core type, which in the art of wireless or radio art, are known as radio frequency transformers and are used in circuits of radio receiving sets.

In transformers of the above type, the primary and secondary windings comprise a plurality of convolutions or turns of wire wound upon tubes of insulation material, or a plurality of turns of wire are wound upon moulded members of insulating material. It has been found that large losses occur, due to leakage drainage of the coils and material capacity, owing to the fact that the convolutions of wire are in contact with their supporting tubes or form and with each other, and an object of my invention is to construct a coil which will obviate a large percentage of the loss found in coils of the prior art.

A feature of my invention is the provision of an improved coil of the above type, in which each individual convolution of the coils is equally spaced from its adjacent convolution, and in which each layer of convolutions is spaced from the adjacent layers of convolutions.

Another feature of my invention is the provision of an improved coil construction, in which tiers of insulation strips are built up to form arms which are equally spaced apart, and at right angles to each other, and which strips are provided with means for spacing the convolutions of a layer equally and in which the strips also equally space the layers of convolutions.

Another feature of my invention is the construction or building up of these arms to form a spider upon which the convolutions are supported, so as to present a small contacting surface for each convolution of wire of the windings, so that only a small percent of the winding actually contacts with the supporting member or spider.

A further feature of my invention is the means the convolutions of the windings play in securing the individual strips in relation to each other, and the way it secures the arms which forms the spider in position against movement to form a substantial winding.

A still further feature of my invention is the production of a coil in which the turns of wire are spaced from each other and the layers of wire are spaced from each other to form a unitary self supporting structure without the use of any substance such as shellac or the like for holding the turns of wire in position.

The features just mentioned, as well as others, relating to the details of construction and combination of parts will be hereinafter more particularly pointed out in the ensuing specification and appended claims.

For a better understanding of my invention reference may be had to the accompanying drawing in which like reference characters in the several views denote like parts, and in which:

Fig. 1 is a plan view of the transformer of my invention;

Fig. 2 is a right side view of Fig. 1;

Fig. 3 is a left side view of Fig. 1;

Fig. 4 is a sectional view along the line 4—4 of Fig. 1;

Fig. 5 is a sectional view along the line 5—5 of Fig. 1;

Fig. 6 is a perspective view of the block or core about which the coil or transformer is wound, and

Fig . 7 is a perspective view of one of the combined separator and spacer members.

Referring now more in detail to my invention as illustrated in the accompanying drawings the transformer of my invention comprises a primary winding P and a secondary winding S, and as the two windings P and S are similar in construction, a detailed description of the primary winding will suffice.

The primary winding P of the transformer of my invention which is typical of both windings, comprises a plurality of convolutions T of wire in layers L, in which each adjacent turn T of a layer L is equally spaced apart and each layer L of convolutions of the winding is also separated an equal distance. To accomplish this, I have devised a novel method of construction in which the primary winding P of the transformer comprises a core 2 of suitable insulation material, such as hard rubber. The core 2 is square in shape with its corners chamfered to present angular faces 3, 4, 5 and 6, for purposes as will presently be described.

The winding is built up of a plurality of layers L of convolutions T and to equally space adjacent turns in a layer L and space the successive layers L, I provide separate strips 7, and to construct a transformer of

this type, a suitable fixture is provided. The fixture is of suitable construction comprising two sections, each of which is provided with a body portion and four integrally formed extending arms at right angles to each other. The sections when placed together in matched relation to clamp the core 2 between the body portions of the fixture sections also places the extending arms in matched relation to form channels of a size to permit the insertion of the rectangular separator strips 7. The separator strips 7, one of which is illustrated in perspective in Fig. 7, is made of a rectangular strip of insulation material, such as hard rubber, the face 8 of which is provided with parallel slots 9, 10 and 11. The assembly fixture, as before described, clamps the core 2 in position, and with the core 2 thus clamped a separator strip 7, as illustrated, is positioned in the channel of an arm of the fixture with its bottom face 12 resting against the angular face 3 of the core 2. The inside terminal of the winding W is secured to the strip 7 by threading the end through an orifice 30 in the strip 7 to secure the same in position. The wire 13 is now laid in the slot 9 of the strip 7, and with this strip 7 in position with the wire 13 in the slot 9, the fixture is turned to present the other three arms of the fixture in succession to permit separator strips 7 to be positioned in the channels of the arms with their bottom faces 12 resting against the angular faces 4, 5 and 6 of the core 2. The wire 13 is laid in the slots 9 of these three strips 7 that are placed in succession in the remaining three arms of the fixture, and the continued turning of the fixture will permit the wire 13 to be laid in the slots 10 and 11 of the four strips 7, which rest against the respective angular faces 3, 4, 5 and 6 of the core 2.

Thus far described, the first layer L has been placed on the core 2 which consists of three turns or convolutions T. To place the next layer L of convolutions T on the core 2, a strip 7 is positioned in the channel of the arm of the fixture that received the strip 7, to which the inner terminal of the winding W is secured, the second strip 7 resting in position with its bottom face 12 resting against the face 8 of the first strip 7. The wire 13 is now laid in the slot 11 of the second strip 7, and the fixture is then turned to present the other three arms of the fixture in succession to permit the other three strips 7 to be positioned in the channels with their bottom faces 12 resting against the faces 8 of the strips 7 already in position which support the first layer L of convolutions T. The wire 13 is now laid in the slots 11, 10 and 9 of this second tier of strips 7, to complete the second layer L of the convolutions T.

From the above description, it is readily apparent the successive tiers of strips 7 are positioned in the channels of the arms of the fixture and the wire 13 laid in the slots 9, 10 and 11, from left to right, and vice versa, for the required number of turns T which are to be placed upon the supporting core 2. When the required number of turns has been completed, the outside end of the winding is threaded through an orifice 30 in the strip 7 of the last tier, thus securing it against movement.

The above method of construction in which four arms, *a*, *b*, *c* and *d* are built up of superimposed strips 7, will form a spider in which the arms *a* and *b* extend outward from the supporting core 2, at right angles to the outwardly extending arms *c* and *d*. The wire 13 as it is placed in the slots of the strips 7 in layers L is held taut by suitable means during the winding operation of the coil, thus producing a clamping effect upon each strip 7, as it is superimposed on a strip already in position, thus each arm is self-supporting, each being built up of tiers of strips 7, and the lateral movement of the strips 7 in relation to each other is prevented by means of the pressure exerted by the convolutions T of a layer L upon its supporting strips 7. This pressure exerted by the convolutions T of the layers L also prevents tilting or movement of the arms *a*, *b*, *c* and *d*, as a whole, on the cores. With the convolutions of the winding of each layer L resting in the slots 9, 10 and 11 of the strips 7, it is impossible to displace the convolutions from their fixed spaced relation with each other, as each succeeding strip 7 as it is placed above the other prevents any movement of the individual convolution. From the foregoing it will be noted that the primary winding P is square in form and the convolutions T only engage the supporting arms *a*, *b*, *c* and *d*, which are built up of tiers of strips 7 at these four points of contact which points of contact are the slots 9, 10 and 11 in the strip 7. I have also produced a coil in which each convolution T is equally spaced from its adjacent convolution T by means of the separation between the slots 9, 10 and 11 of the strips 7 and in which the successive layers L are also equally spaced apart by means of the separator strips 7.

While I have illustrated the strips 7 with the slots to permit each layer of convolutions T to have three turns I do not wish to be limited to the exact number as a larger strip 7 may be employed with a greater number of slots to accommodate a greater number of convolutions per layer to increase the number of turns without departing from the spirit of the invention. It may also be seen that I have constructed a coil which is substantially built and which may be handled without disarranging the winding or shifting of the arms or spider as a whole

due to the binding effect of the convolutions on the individual strips 7 and the arms *a*, *b*, *c* and *d* which are built up of a plurality of strips 7.

As I have described in detail the construction of the primary winding P a detailed description of the secondary winding S is not necessary only in so far as to say that the secondary winding S is also supported on a core 2′ and wound in a similar manner to produce a square coil winding *s*. To associate the primary winding P and the secondary winding S with each other, a suitable spacer member 21 is placed between the cores 2 and 2′ of the primary and secondary windings P and S, and a stud 22 passing through orifices 23, 24 and 25 in the core 2; spacer member 21 and core 2′ clamp the two coils P and S together by means of a screw 26 which has screw-threaded engagement with a tapped orifice 27 in the end of the stud 22, a suitable washer 28 being placed between the head of the screw 26 and the face of the core 2. The other end of the stud 22 is provided with a tapped orifice and may be secured to the supporting panel by a suitable screw, which has screw-threaded engagement with the tapped orifice in that end of the stud.

By this method of construction I eliminate the large leakage or drainage of the prior coils in which the turns of wire were in direct contact with the supporting tube or member with each other throughout the entire length thereof, and I also reduce the mutual capacity of the coil.

It is readily apparent that I may regulate the coupling of the coils by separating them any desired amount, and the means to accomplish this end may be made adjustable if desired. Further it is obvious that I may use just one coil for an inductance instead of using two coils for a transformer.

While I have described a particular form of coil it is to be understood that changes and modifications will readily suggest themselves to those skilled in the art and I therefore, do not wish to be limited to the exact structure as shown but aim to cover all such changes and modifications as come within the spirit and scope of the appended claims.

Having described my invention what I claim as new and desire to secure by United States Letters Patent is:

1. In a device of the character described including a rectangular shaped core provided with chamfered edges to form angular faces diametrically opposite, strips superimposed upon said diametrically opposite chamfered edges of said core to form arms, said arms being at right angles to the adjacent arms and lying in the same plane as the diametrically opposite arm, slots in said strips, and a winding rectangular in form supported upon said strips in said slots to maintain said winding in spaced relation, said winding being effective to bind said strips in position to form a self-supporting structure whereby said winding maintains said strips and said strips support said winding to form a coil.

2. In a device of the character described including a rectangular core provided with chamfered edges to form angular faces diametrically opposite, strips superimposed upon said diametrically opposite angular faces of said rectangular core to form arms at right angles to adjacent arms and parallel to the opposite arm, slots in each of the superimposed strips in which is wound a plurality of turns of wire to form a rectangular shaped winding, said slots maintaining said turns in spaced relation and said strips maintaining the layers in spaced relation to each other and said winding being adapted to bind said strips to form a self-supporting structure.

3. In a device of the character described including a pair of rectangular shaped cores having orifices and each provided with chamfered edges to form angular faces, strips superimposed upon said angular faces of each rectangular core to form arms at right angles to adjacent arms and parallel to the opposite arm, slots in said strips, a winding angular in form supported in said slots in spaced relation, said winding having a binding effect for maintaining said strips in fixed relation to each other against movement and for maintaining said arm at right angles to each other, a spacing member having a central orifice, adapted to be secured between said rectangular cores, a stud adapted to enter said orifices and a screw member having screw threaded engagement with an orifice in said stud for securing said cores and their supported windings in position whereby the windings supported on one of said cores are parallel to the windings supported on the other of said cores.

Signed by me at Chicago, county of Cook and State of Illinois, this 16th day of October, 1924.

HIRAM D. CURRIER.