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H. D. CURRIER

COIL

Filed Oct. 25, 1924

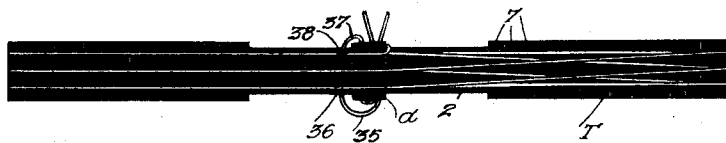


Fig. 3.

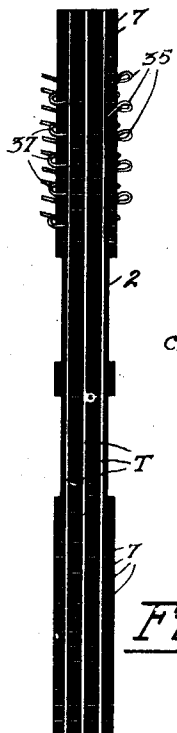


Fig. 2.

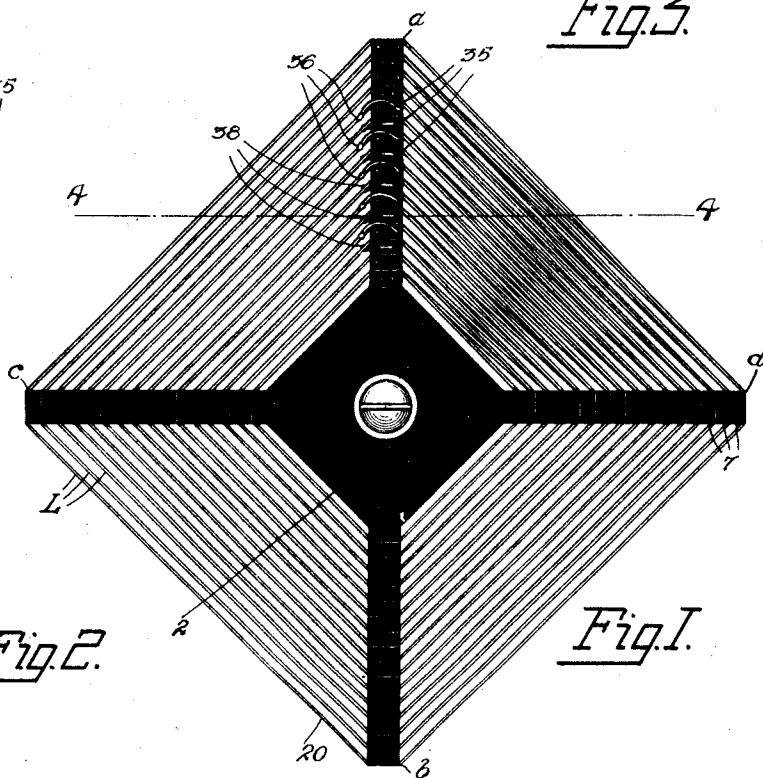


Fig. 1.

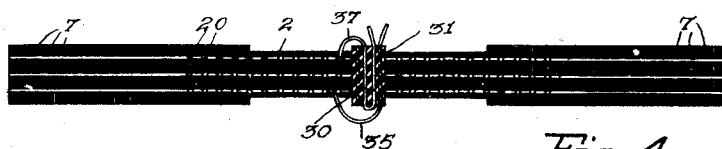


Fig. 4.

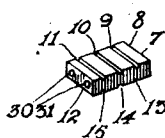


Fig. 6.

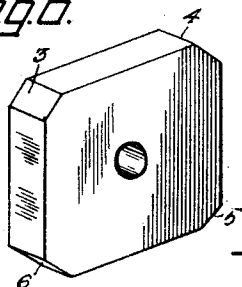


Fig. 5.

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UNITED STATES PATENT OFFICE.

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COIL.

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My invention relates to coils or transformers, and has to do more particularly with transformers of the air core type which are provided with a variable primary and secondary and which in the wireless or radio art are used in circuits of radio receiving sets.

In transformers of the above type, the primary and secondary each comprise a plurality of convolutions wound upon a tube support of a suitable insulating material. It has been found that large losses occur, due to leakage of the coils, owing to the fact that the convolutions of the wire are in contact with their supporting member and with each other and one of the features of my invention is the provision of an improved coil in which the supporting means presents only a small contacting surface for each convolution of the winding and in which the convolutions are in spaced relation with each other to thus reduce this leakage to a minimum.

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

Another feature of my invention is the provision of parallel slots in the two faces of the strips which register as the strips are superimposed one above the other to form the arms or spider for supporting the convolutions of the winding. The slots in the top and bottom face of the strips which register when stacked, form means for maintaining the convolutions of the layers in spaced relation with each other and prevent any movement of the individual convolutions.

Another feature of my invention is the provision of orifices in the strips which are adapted to receive the terminal ends of the taps of the tapped primary and secondary to permit these terminal ends to be led from the same side of the transformer face for convenience in connecting these terminal leads with apparatus in the circuit with which the transformer is associated. The features just mentioned, as well as others relating to details of construction and combination of parts will be hereinafter more particularly pointed out in the ensuing specification and appended claims.

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

Fig. 1 is a front elevation of the transformer of my invention;

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

Fig. 3 is a top view of Fig. 1;

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

Fig. 5 is a perspective view of the supporting core of the transformer, and

Fig. 6 is a perspective view of one of the separator strips for supporting the winding of the transformer.

Referring now more in detail to my invention as illustrated the transformer of my invention comprises a plurality of convolutions T of wire wound in layers L, in which each adjacent turn T of a layer L is equally spaced apart and each of the layers L of convolutions of the winding are also separated an equal distance. To accomplish this I have produced a novel method of construction in which the transformer comprises a core 2 of suitable insulating material, such as hard rubber, the said core 2 being 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 and space the successive layers L, I provide separator 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 arm 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. 6 is made of a rectangular strip of insulating material, such as hard rubber, the top face 8 of which is provided with parallel slots 9, 10 and 11 and the bottom face 12 of which is also provided with parallel slots 13, 14 and 15.

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 is secured to the strip 7 by threading its end through an orifice 30 in the strip 7 to secure the same in position and the wire 20 is now laid in the slot 9 of the strip 7. With the strip 7 in position with the wire 20 in the slot 9, the fixture is now 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 20 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 20 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.

The first layer L, which comprises three turns or convolutions T is thus supported on the core 2 the said turns or convolutions resting in the slots 9, 10 and 11 of the four strips 7. To place the next layer L of convolutions 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 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 slots 13, 14 and 15 in the bottom face 12 of this second strip 7 register with the slots 9, 10, and 11 of the strip 7 which received the convolutions of the first layer L, and the slots in the respective faces 8 and 12 of the strips 7 are so shaped and of such a size as to receive the wire and to permit a portion of its circumferential face to project above the face 8 of the first strips 7. Now when the second strips 7 are placed in position with their bottom faces 12 resting against the faces 8 in the strips 7 which are now supporting the convolutions of the first layer L, the projecting portions of these convolutions extend in the slots 13, 14 and 15 of the strips 7 resting in position between the two strips 7 to maintain the individual convolutions T of the layers L in spaced relation with each other and at the same time prevent any movement of the convolutions. With the second strip 7 in position as just described the wire 20 is 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. The slots 13, 14 and 15 in the respective faces 12 of these strips 7 register with the slots 9, 10 and 11 of the first strips 7 to receive pro-

jecting portions of the convolutions of wire in the slots 9, 10 and 11. The wire 20 is now laid in the slots 11, 10 and 9 of this second tier of strips 7, to complete the second layer L of convolutions T.

From the above description, it is readily apparent that the successive tiers of strips 7 are positioned in the channels of the arms of the fixture and the wire 20 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 and with the required number of turns thus supported the outside end of the winding is threaded through one of the orifices 30 in the strip 7 of the last tier, thus securing it against movement.

The above method of construction in which the 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 20 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 transformer, to produce a clamping effect upon each strip 7, as it is superimposed on a strip 7 already in position, thus each arm *a*, *b*, *c* and *d* 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 each layer upon its supporting strips 7 and this pressure exerted by the convolutions T of each layer L also prevents tilting or movement of the arms *a*, *b*, *c* and *d* as a whole, on the core 2. With the convolutions of the winding of each layer L resting in slots 9, 10 and 11 of its supporting strips 7 and the slots 13, 14 and 15 of the next tier of 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 of a layer. The clamping effect of the strips 7 due to the pressure exerted by the convolutions of each layer causes the strips to clamp the wire in the orifice formed by the slots 9, 10 and 11 in the face 8 of the strip 7 and the slots 13, 14 and 15 in the bottom face 12 of the next strip above to prevent the individual convolution from becoming loose, and also prevents the strips 7 from moving relative to each other.

The transformer of my invention as illustrated comprises a variable primary and a variable secondary. The windings are provided with a predetermined number of taps 35 which are soldered at the points 36 of a convolution T of certain layers L of the winding. The taps or terminal leads 35 are now threaded through suitable orifices 30 in the strips 7 which support the layers L. The transformer is also provided with a predetermined num-

ber of taps 37 which are soldered at the points 38 of a convolution of adjacent layers L to those which comprise the taps 35 of the transformer. These taps or terminal leads 37 are now threaded through orifices 30 in the strips 7 which support these convolutions of the layers and these terminal ends are then doubled back and threaded through a parallel orifice 31 in the strips 7 to permit these terminal leads 37 to extend from the same side of the transformer as the terminal leads 35. These terminal leads 37 and 35 are now secured to switch points of suitable variable switches for varying the inductance of the primary and secondary of the transformer. Through the agency of these two variable switches associated with the tapped primary and secondary, the inductance of either one may be varied for purposes as are readily understood in the art.

From the foregoing it will be noted that every other layer of coil is tapped from the same side of the coil; and that the other layers of the coil are tapped from the opposite side of the coil, thus providing taps for each three turns or for each layer of the coil. This method of tapping the coil is made necessary from the fact that the coil is wound back and forth. If it is desired the coil may be used as an auto-transformer and only one variable switch provided.

By tapping the coil in this method each tap lead thereof is threaded through strip 7 at least once, thereby preventing the soldered tap from pulling loose from the coil, the one set of taps being threaded through the blocks 7 once and the alternate set of taps being threaded through the blocks 7 twice so that all taps extend from the same side of the coil.

While I have illustrated the strips 7 with slots to permit each layer of convolutions to have three turns, I do not wish to be limited to the exact number of slots, 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 deranging the winding or shifting the arms of the spider, as a whole, due to the binding effect of the convolutions on the individual strips 7, of the arms *a*, *b*, *c* and *d*, which are built up of a plurality of strips 7. By this method of construction, I also eliminate the large leakage or drainage of the prior coils as the point of support of the convolutions is reduced to a minimum in the transformer of my invention, whereas, in prior coils, the turns of wire are in direct contact with the supporting member or tube and with each other, throughout the entire length thereof.

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 Letters Patent is:

1. A coil of the character described comprising spaced convolutions of wire wound in spaced layers, a core provided with diametrically opposite angular faces, strips superimposed upon said diametrically opposite angular faces of said core to form arms for supporting said convolutions, certain of said strips having longitudinal orifices for supporting taps from said convolutions of wire, slots in both faces of said superimposed strips in matched relation forming means for maintaining said convolutions in spaced relation, said convolutions producing a binding effect to make said superimposed strips which form said arms self-sustaining.

2. A coil of the character described comprising spaced convolutions of wire wound in spaced layers, a core provided with diametrically opposite angular faces, strips superimposed upon said diametrically opposite angular faces of said core to form arms for supporting said convolutions, certain of said strips having longitudinal orifices for supporting taps from said convolutions of wire, slots in both faces of said superimposed strips in matched relation to form means for encompassing portions of said winding for maintaining said convolutions in spaced relation, said convolutions producing a binding effect to make said superimposed strips which form said arms self-sustaining.

3. A coil of the character described comprising spaced convolutions of wire wound in spaced layers, a core provided with diametrically opposite angular faces, strips superimposed upon said diametrically opposite angular faces of said core to form arms for supporting said convolutions, certain of said strips having longitudinal orifices for supporting taps from said convolutions of wire, slots in both faces of said strips in matched relation when superimposed to form orifices which encompass and contact with the wire for substantially short distances for maintaining said convolutions in spaced relation, said convolutions producing a binding effect to make said superimposed strips which form said arms self-sustaining.

4. A coil of the character described comprising spaced convolutions of wire wound in spaced layers, a core provided with diametrically opposite angular faces, strips superimposed upon said diametrically opposite angular faces on said core to form arms for supporting said convolutions, cer-

tain of said strips having longitudinal orifices for supporting taps from said convolutions of wire, slots in both faces of said strips in matched relation when superimposed to form orifices which encompass and contact with the wire for substantially short distances, said matched slots in said strips forming means for maintaining said convolutions in spaced relation, said wire forming binding means for holding the coil in shape.

5. A coil of the character described comprising spaced convolutions of wire wound in spaced layers, a core provided with diametrically opposite angular faces, strips superimposed upon said diametrically opposite angular faces of said core to form arms for supporting said convolutions, and means in adjacent strips for maintaining said convolutions in spaced relation, said convolutions forming binding means for maintaining said superimposed strips which form said arms self-sustaining in position, taps leading from predetermined layers of said coil, said taps leading from said winding through longitudinal orifices in said strips and extending from the same side of said coil.

6. A device of the character described including a core provided with angular faces, strips superimposed upon said angular faces to form arms, slots in the opposite sides of said strips, a winding supported in said slots, taps leading from said winding, certain of said strips having longitudinal orifices for supporting said taps from said winding, said winding extending into the slots of adjacent strips for maintaining said strips in fixed relation to each other and forming binding means to make said superimposed strips which form said arms self-sustaining.

7. A coil of the character described includ-

ing layers of convolutions of wire, said convolutions being spaced from each other and said layers being spaced from each other, supporting means for said convolutions of wire, a core upon which said supporting means are positioned to form arms, the convolutions of wire extending through depressions in adjacent supporting means to prevent the movement of one supporting means relative to its adjacent supporting means, said convolutions of said layers forming binding means to make said supporting means self-sustaining, certain of said supporting means having pairs of longitudinal orifices, taps for said coil extending through said orifices in said supporting means, certain of said taps extending through one of said orifices and other of said taps extending through both of said pair of orifices.

8. A coil comprising spaced convolutions of wire wound in spaced layers, supporting means for the wire, and a core upon which said supporting means are positioned to form arms, said supporting means being in contact with the wire for substantially small distances, the said wire forming binding means to make said supporting means self-sustaining, taps for the different layers of the coil, certain of said supporting means having pairs of longitudinal orifices, part of the taps being connected on one side of the coil and extending through one of said pair of longitudinal orifices and the other taps being connected on the other side of the coil and extending through both of said pair of longitudinal orifices in the supporting means so that all taps are brought out on the same side of the coil.

Signed by me at Chicago, county of Cook, and State of Illinois, this 23d day of October, 1924.

HIRAM D. CURRIER.