

Aug. 6, 1929.

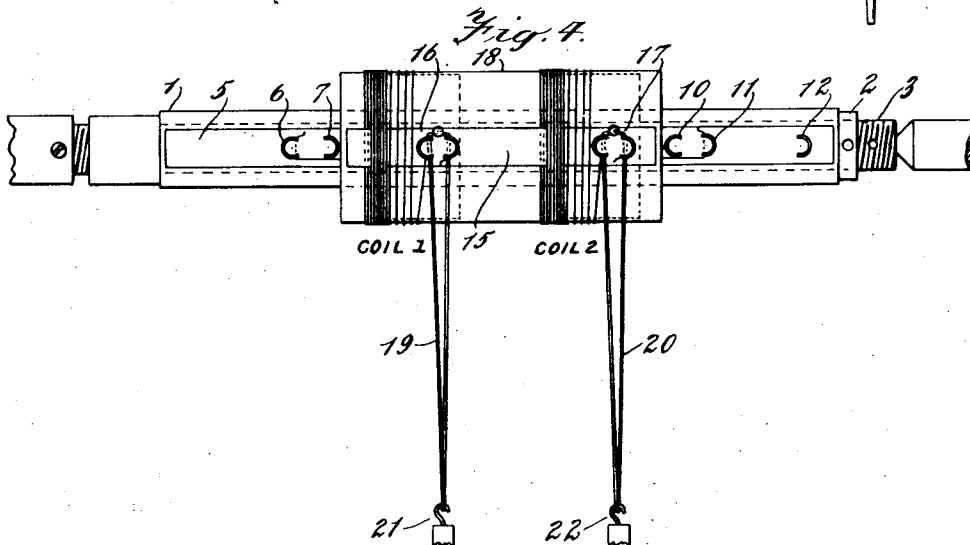
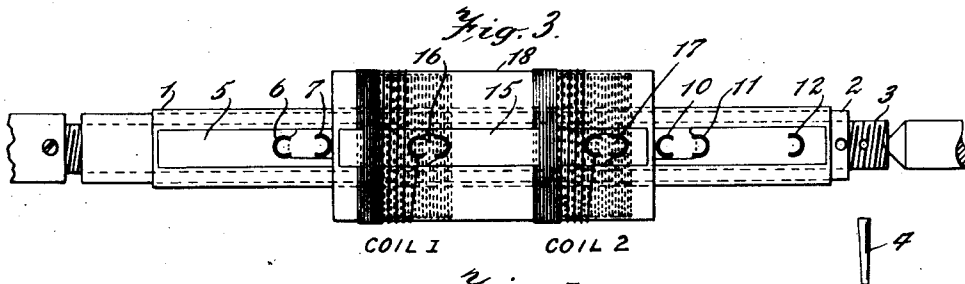
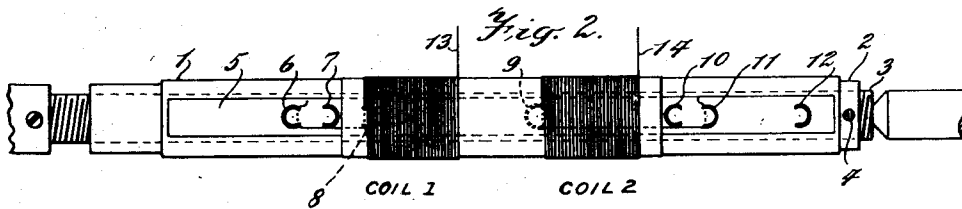
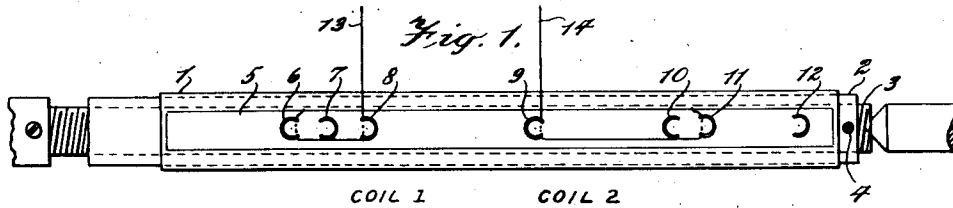
R. VARLEY

1,723,261

COIL AND METHOD OF WINDING THE SAME

Filed June 10, 1926

4 Sheets-Sheet 1



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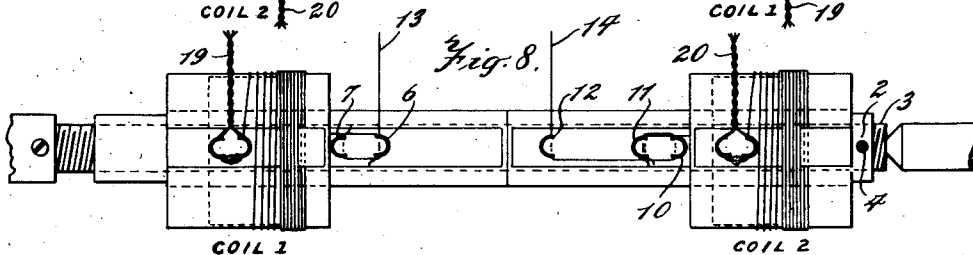
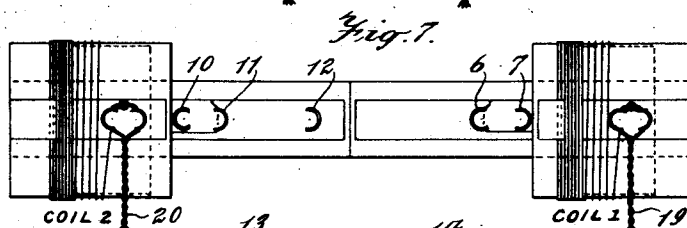
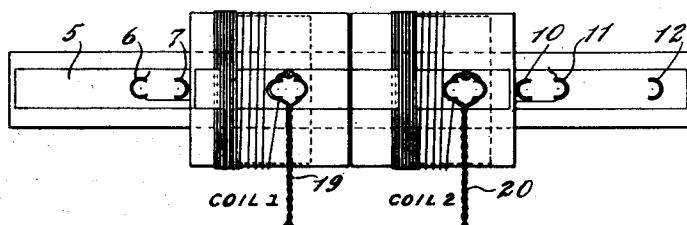
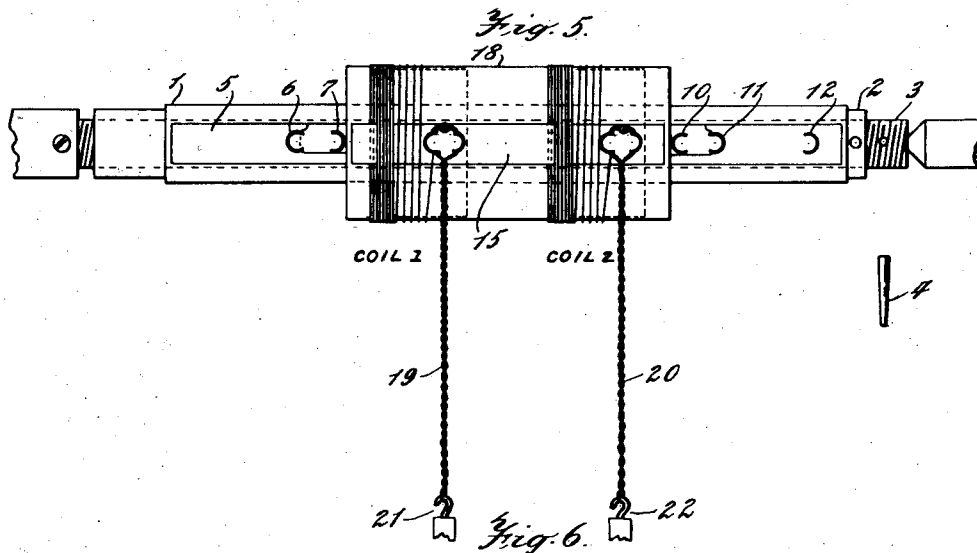
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1,723,261

COIL AND METHOD OF WINDING THE SAME

Filed June 10, 1926

4 Sheets-Sheet 2



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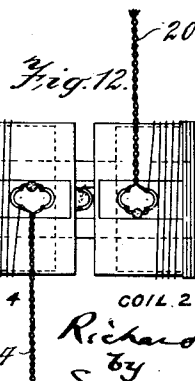
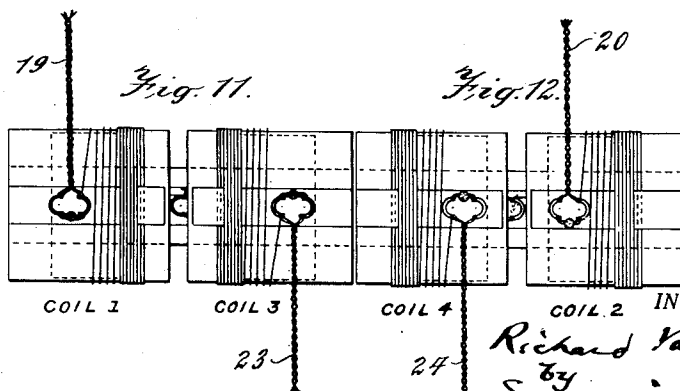
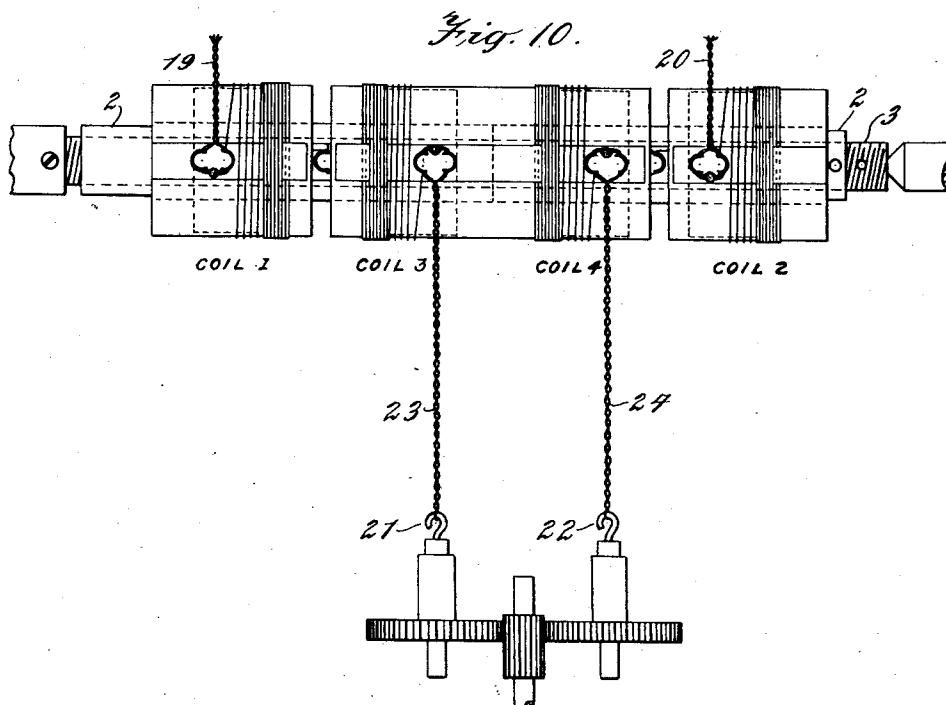
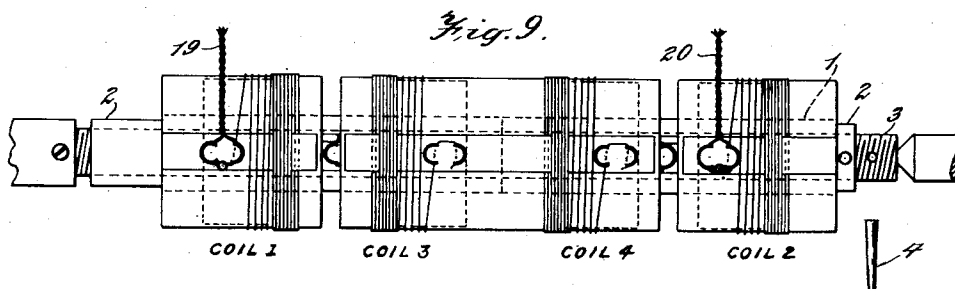
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1,723,261

COIL AND METHOD OF WINDING THE SAME

Filed June 10, 1926

4 Sheets-Sheet 3



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1,723,261

COIL AND METHOD OF WINDING THE SAME

Filed June 10, 1926

4 Sheets-Sheet 4

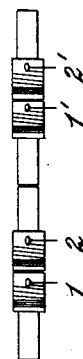
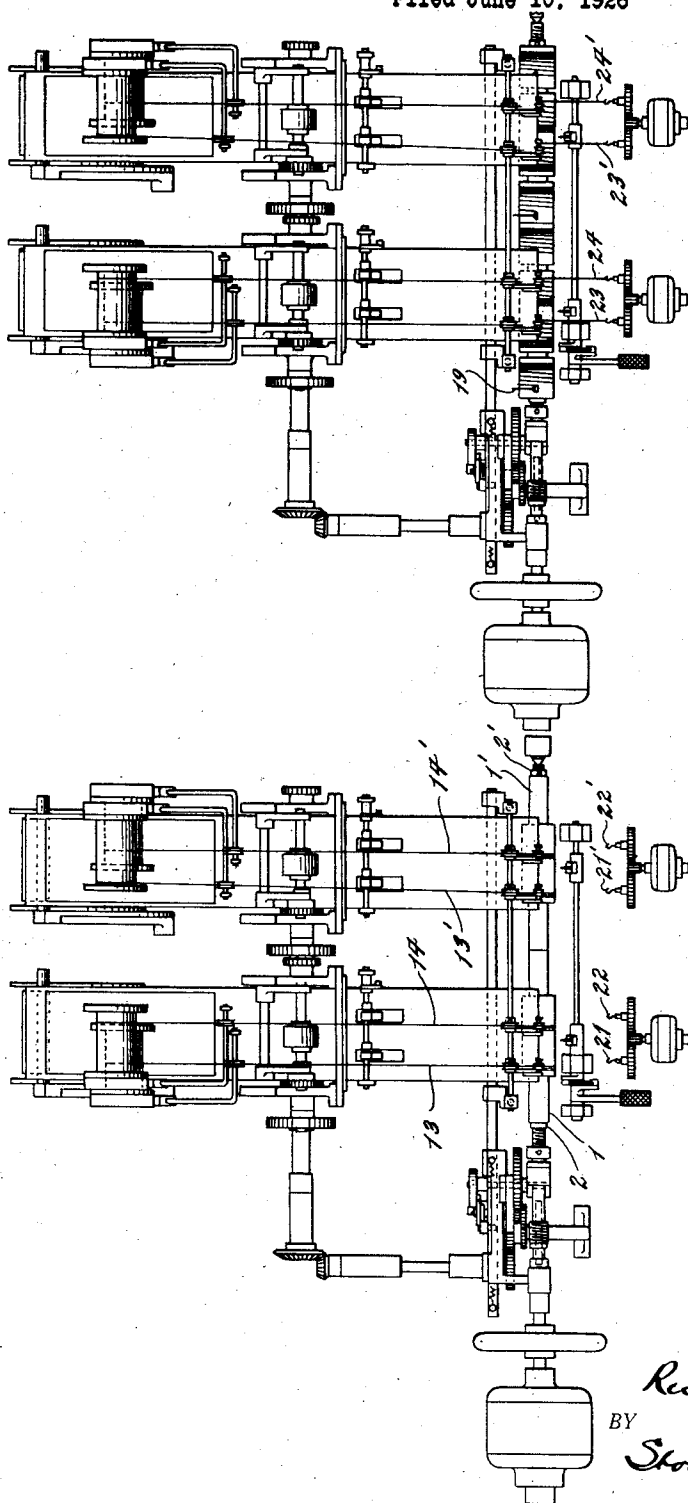


Fig. 13.

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UNITED STATES PATENT OFFICE.

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COIL AND METHOD OF WINDING THE SAME.

Application filed June 10, 1926. Serial No. 114,969.

This invention relates generally to coil winding and more specifically to the winding of secondaries of Ruhmkorff coils such as are generally used in certain types of ignition systems of internal combustion motors. This invention is particularly adapted to the winding of coils generally known as multiple winding described in the patent to J. C. Anderson, No. 644,311 issued February 27, 1900, and the article produced thereby, and takes advantage of the economy of such type of winding to ensure even greater economy and saving.

The secondary windings of Ruhmkorff coils comprises two longitudinally spaced sections or individual coils mounted upon a common core reversely to each other so that when their inner ends are connected the two coils are in simple series.

It is well known in the art to wind simultaneously two or more coils upon the same tube or core but when so doing it is obvious that the inside wire of one coil must be connected to the outside wire of the other to place the two coils in simple series. It is also well known in the winding art to mount such a coil by winding a single coil or a plurality of coils upon one portion of a common tube or tubes, and then to reverse the tube either with or upon its mandrel and wind the second portion of said coil in the reverse direction of the first wound coil. Thereafter in this method the tubes were removed and the center ends of the coils were fished out and connected to each other. In so doing, however, it frequently happened that inner layers of the coils collapsed during the fishing process. In an attempt to overcome these difficulties methods were invoked using two tubes one within the other. The wire of each coil was first anchored to the larger tube and the winding completed, after which the tubing was depressed by a blunt steel blade and the starting end of the winding of each coil was withdrawn. The coils with the inner ends exposed were then mounted in a reverse direction upon another inner tube. The two inner ends were then bared, joined, soldered and secured to the inner tube. This latter method was very inconvenient and expensive besides increasing the length of the mean turn by creating considerable space not occupied by coil windings.

It is the purpose of this invention to provide a method whereby secondary windings similar to those described may be manufactured without the difficulties enumerated and in an economical manner and at a low cost and to produce a winding having the inner ends of its coils connected in such a manner that the connection is fully protected. The finished product contains two coils wound directly in reversed relationship upon a single core or tube with their inner ends interconnected, the jointure lying beneath one of the coils.

The present method contemplates winding a plurality of sections each comprising one coil or a section of a completed secondary and then winding a plurality of other coils forming the other sections of the secondaries being made. Any number of coils may be wound at one time as long as the number is a multiple of two. The method will now be described in connection with the drawings which illustrate one form only of my invention and in which:

Figs. 1 to 12 illustrate the successive steps involved in the method embodied in this invention;

Fig. 1 illustrates the first step of the method showing the core mounted upon the mandrel and the wires for two coils attached;

Fig. 2 shows the coils partly wound;

Fig. 3 illustrates the two coils, each to form one-half of a complete winding, completely wound and ready to have leads attached;

Fig. 4 shows the leads attached and ready to be twisted or stranded with auxiliary terminal wires;

Fig. 5 shows the leads stranded;

Fig. 6 shows the leads stranded, cut, the two completed sections cut, and withdrawn from the mandrel;

Fig. 7 illustrates the first step in reversing the coils;

Fig. 8 shows the coils in completely reversed positions remounted upon the mandrel and ready to have the second pair of coils wound;

Fig. 9 shows the second pair of coils completely wound and ready to have leads attached;

Fig. 10 shows the leads attached and stranded;

Figs. 11 and 12 show two completed secondary windings ready to receive their outer coverings; and

Fig. 13 shows schematically a pair of standard machines each for simultaneously winding four coils or two complete secondary windings.

In carrying out this invention as illustrated in the accompanying drawings the usual paper tube 1 known as the core is mounted upon a two piece mandrel 2 consisting of an outer shell 2 which is interiorly bored and threaded and an inner member 3 which is correspondingly exteriorly threaded for left hand screw engagement with the outer member. The two members may be pinned together by a taper pin 4. A narrow tape 5 of linen or other suitable material substantially as long as the mandrel having kerfs or tongues cut therein as illustrated, is cemented longitudinally upon the mandrel. Three tongues 6, 7, 8 being cut close together in tandem at suitable distances along the tube, another kerf 9 is cut, two more 10, 11 at suitable distances from the opposite end and one more 12 near the end adjacent to 12, these kerfs or tongues forming anchoring means for the wire from which the coils are wound and may be cut directly in the core member.

In starting to make the secondary windings this strip of linen is cemented upon a suitable core, which core may be continuous or sectional, and the above mentioned kerfs are cut therein. The core is then mounted upon a two piece mandrel and the entire assembly placed in a winding machine which for purposes of simplicity will be assumed to be a machine for simultaneously winding two coils although any multiple of two may be wound at one time. It has been found convenient for one operator to manipulate a pair of machines, each one of which simultaneously winds four coils such as is shown in Fig. 13. The two wires 13, 14 from the supply spools are led down over suitable guides to the core 1, wire 13 from which coil 1 will be wound is twisted around kerf 8 thence along kerf 7 and around tongue 6. Wire 14 from which coil 2 is wound is wrapped around kerf 9 along tongue 10 and is secured around kerf 11 as illustrated particularly in Fig. 1.

The mandrel is then rotated and the wires fed transversely to the right a predetermined distance as illustrated in Fig. 2, when a single sheet of insulating material 18 is positioned to surround each layer of both coils and extends over the outer ends of the two coils. The two wires are then fed transversely to the left to the starting point when another sheet of material is placed to encircle the second layer of each coil. This cycle is repeated at each layer of the two coils, the lengths of the sheets of material

may be varied as the diameters of the two coils increase; however, it has been found economical to utilize the same size sheet of material.

It is to be noticed that coil 1 is wound on that portion of the core between the kerf 8 and a point to the left of kerf 9 leaving the kerfs 6, 7, 8 and an unoccupied portion of the tube 1 extending to the left. Coil 2 is wound upon that portion of the core lying between kerfs 9 and 10 leaving a portion of the tube including kerfs 10 and 11 extending unoccupied to the right and leaving a space between the two coils. When the coils have reached a certain size corresponding to a predetermined number of layers the machine stops, a second strip of linen 15 or any other suitable material with kerfs 16, 17 cut therein is cemented over the last layer of insulating material 18, the pin 4 is withdrawn and the mandrel is rotated by hand for several turns. This latter operation causes the last few turns, seven having been found to be a satisfactory maximum number, to be spaced apart due to the pin 4 having been extracted allowing the outer member 2 of the mandrel to travel laterally of the inner member 3 due to their threaded engagement. The outer ends of coils 1 and 2 are wrapped around kerfs 16, 17 and secured thereby, (Fig. 3). The separation of the last few turns of the coils is for the purpose of preventing breakdown of the coil due to the "kick back" resulting from any impedance in the output circuit connected to the secondary windings.

Inasmuch as the wire used for winding the coils is extremely thin it is unsuitable for lead wire, consequently it is necessary to attach heavier lead wires. This is accomplished as shown in Fig. 4 by wrapping a strand or strands of wire, 19, 20 of the desired size around the kerfs 16, 17 soldering these wires to the ends of the coils, which were previously wound around the same kerfs, looping the strands through hooks 21, 22, winding the ends of the leads again around the kerfs, and soldering. The hooks 21, 22 are rotated by means of gears attached to a motor as illustrated in Fig. 10 or by a manually operable mechanism or any other similar device thereby imparting a twist to the lead wires as shown in Fig. 5 after which they are cut as shown in Fig. 6. The mandrel is again rotated and a cutter is brought into contact with the insulating sheets so as to sever them through the center. The coils may, however, be separated after removal from the machine. The tube or core if not already in two sections is cut by the same operation there being in that case an annular groove in the mandrel to allow the cutter to penetrate through the tubing. This completes the winding of a pair of coils each of which will form one-half of a secondary winding of a Ruhmkorff coil.

The two coils are removed from the mandrel and relatively reversed while the two part mandrel is reassembled and pin 4 is reinserted. The reversing of the coils may conveniently be accomplished as illustrated in Figs. 7 and 8 in the following manner. Coil 2 is placed upon the opposite side of coil 1, see Fig. 7, and then the two coils together are turned 180° and replaced upon the mandrel (Fig. 8) thus bringing the unoccupied portions of the two cores together at the center between the two wound coils 1 and 2.

The two wires 13, 14, if the same machine is used, are then led down to the mandrel again and wrapped around the kerfs 6, 7 and 10, 11 respectively which already have the inner ends of coils 1 and 2 secured to them, thus interconnecting the center ends of the two coils. These connections may readily be soldered at this point. Wire 14 is then led around kerf 12 and the second two coils are ready to be wound. The machine is rotated and coils 3 and 4 are wound in a similar manner to coils 1 and 2. It is to be noted that coils 3 and 4 are wound in a direction opposite to that of coils 1 and 2 due to the fact that coils 1 and 2 have been reversed from their original position upon the mandrel. Leads 23, 24 are attached to coils 3 and 4 in a similar manner to leads 19, 20. The insulating sheets 18 are then cut thus forming two complete secondary windings each comprising two coils with their centers interconnected and the coils being wound in the reverse directions. The two windings are now ready to receive their outer protective wrappings.

It can readily be seen that windings manufactured in this manner have the splice connecting their inner ends placed under the coils and not exposed between the coils, also no "fishing" or shellacing is necessary as the original core or tube is used and left within the coils throughout the process. With the jointure of the two coils lying under one of the coils it is impossible for the splice to work out near the surface and the striking distance is maintained at a maximum.

For purposes of simplicity the above description has been made with reference to four coils or two complete windings. In actual practice it has been found that one operator can conveniently take care of two double machines as illustrated in Fig. 13 which machines will produce four complete windings. Coils 1 and 2, 1' and 2' are wound simultaneously upon the first machine and after being reversed they are preferably placed upon the second machine and coils 3, 4; 3' and 4' are wound simultaneously while four new coils are being started upon the first machine. In Fig. 13 the first machine is shown as starting upon coils 1, 2, 1' and 2' whereas the second machine is shown as giving the twist to leads 23, 24, 23' and 24' of coils 3, 4, 3' and 4'. The two lower sketches

illustrate the coil windings as they come from the machine ready to receive their outer protective coverings.

It is to be understood that various modifications may be made without departing from the spirit and scope of this invention.

Having now fully described my invention, what I claim as new and novel is:

1. The method of winding Ruhmkorff coils or the like which comprises attaching a wire to a core extending the wire longitudinally of said core to a point substantially one-half the width of the coil to be wound, winding a coil on said tube in a direction beyond said point, reversing said coil and core, winding a second coil upon the extension of said tube and wire, and attaching the inner ends of said coils.

2. The method of winding Ruhmkorff coils or the like which consists in simultaneously winding a plurality of coils upon a common core extending substantially from said coils, inserting sheets of material common to two coils between layers, severing said material and cores midway between each pair of coils, rotatably reversing said coils relatively to themselves, attaching lead wires to the outer ends of said coils, connecting the inner ends of each of said coils to the beginning of a second series of coils to be wound, simultaneously winding a second series of coils upon the extended portions of said core and attaching leads to the outer ends of said second series of coils.

3. The method of winding Ruhmkorff coils or the like which consists in cutting a series of kerfs upon a core, securing a pair of wires to two of said kerfs, extending said wires longitudinally along the core to a point laterally of where the coils are to begin, simultaneously winding a pair of coils upon said core, rotatably reversing said coils, simultaneously winding a second pair of coils and connecting the inner ends of said second series of coils to the extended inner ends of said first mentioned coils.

4. The method of winding Ruhmkorff coils or the like which consists in cutting a series of kerfs upon a core, securing a pair of wires to two of said kerfs, extending said wires longitudinally along the core to a point where the coils are to begin, simultaneously winding a pair of coils upon said core, rotatably reversing said coils, securing a second pair of wires to said kerfs and simultaneously winding a second pair of coils starting from said kerfs.

5. The method of winding two Ruhmkorff coils consisting in winding two coil sections in the same direction in close proximity upon a core so that the core extends substantially outside of each coil section, separating the core with the coil sections thereon between the coil sections, rotatively reversing the coil sections with respect to each other so as to

present the extended ends of the cores together, connecting the inner end of each of said coil sections to the beginning of a second coil section, and simultaneously winding
5 two other coil sections from said beginnings in the same direction as the first were wound one upon each core extension.

6. The method of winding two Ruhmkorff coils consisting in winding two coil sections
10 in the same direction in close proximity upon a common core so that the core extends substantially outside of each coil section, severing the core with the coil sections thereon between the coil sections, rotatively reversing
15 the coil sections with respect to each other so as to present the extended ends of the cores together, connecting the inner end of each of said coil sections to the beginning of a second coil section, and simultaneously winding two
20 other coil sections from said beginnings in the same direction as the first were wound one upon each core extension.

7. The method of winding two Ruhmkorff coils consisting in winding two coil sections in the same direction in close proximity upon
25 a core so that the core extends substantially outside of each coil section, inserting sheets of insulating material common to the two coil sections between layers thereof, separating the core and insulating material with the coil
30 sections thereon between the coil sections, rotatively reversing the coil sections with respect to each other so as to present the extended ends of the cores together, connecting the inner end of each of said coil sections to
35 the beginning of a second coil section, and simultaneously winding two other coil sections from said beginnings in the same direction as the first were wound one upon each core extension, inserting sheets of insulating
40 material common to the last two coil sections and severing the material between the last two coil sections wound.

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