

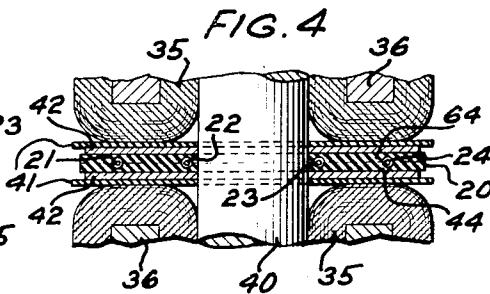
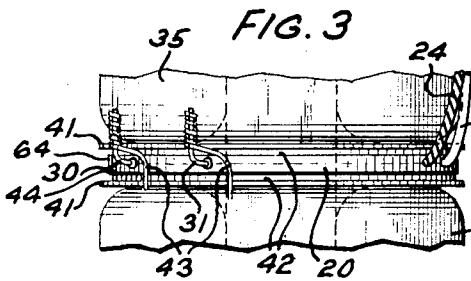
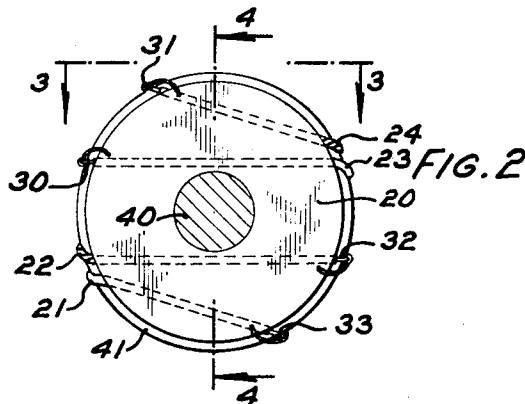
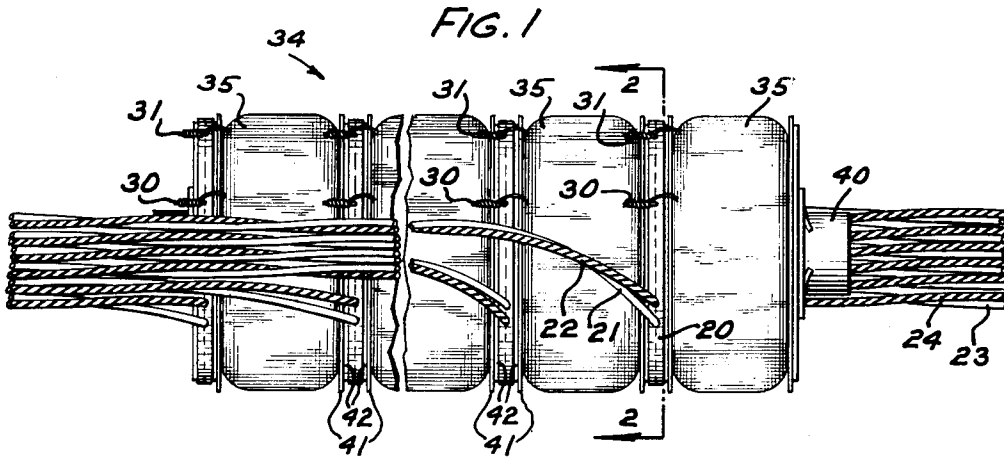
April 10, 1951

E. L. DROM
LOADING COIL TERMINAL

2,548,206

Filed Dec. 20, 1946

2 Sheets-Sheet 1



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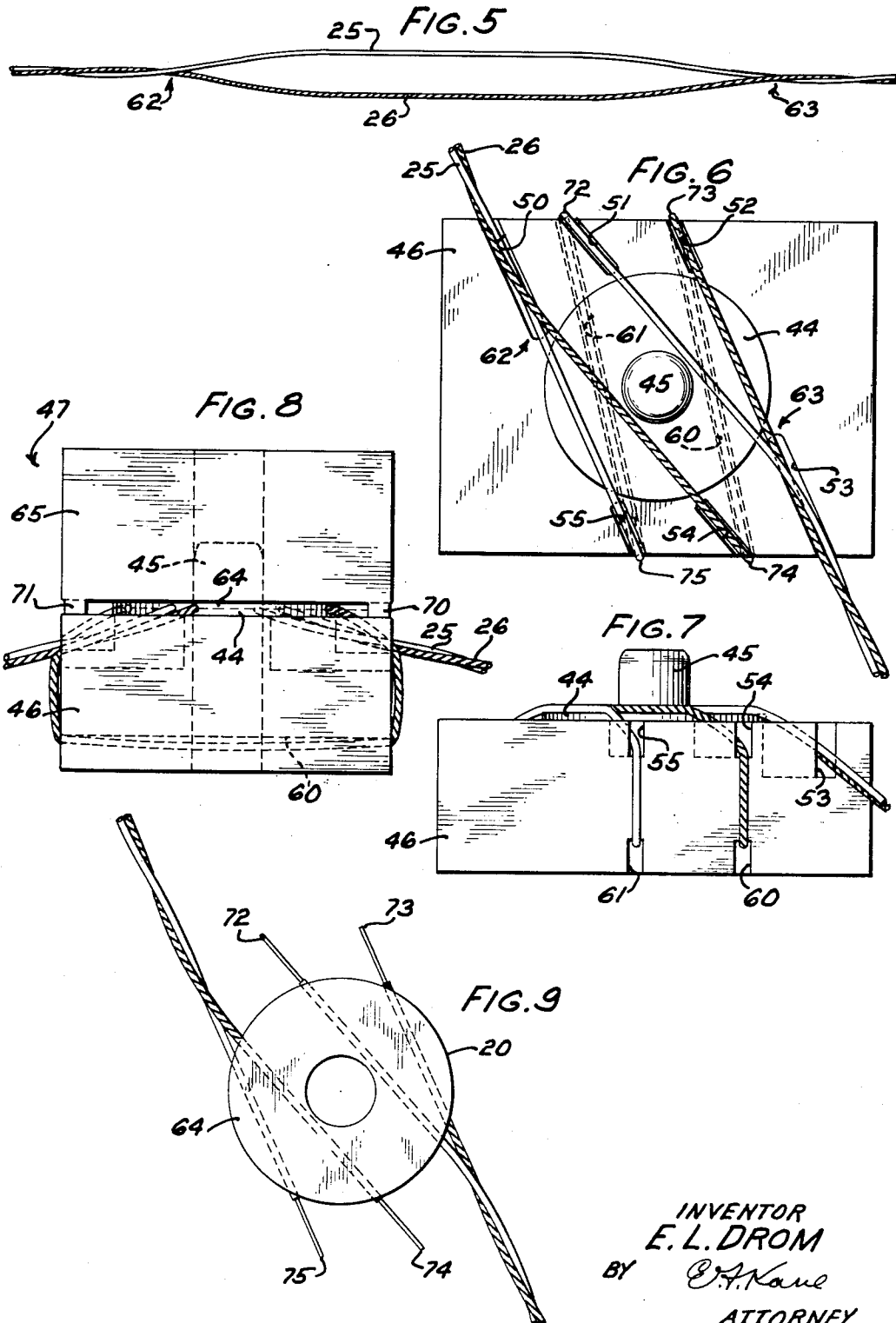
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UNITED STATES PATENT OFFICE

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LOADING COIL TERMINAL

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14 Claims. (Cl. 178—46)

1

This invention relates to electrical devices and more particularly to loading coils and associated terminal supports and to a method of making the same.

When connecting coils wound of fine wire into electrical circuits, it is necessary to devise a means of connecting the fine wire electrically to the relatively heavier connecting wires of a circuit without straining the fine wire or breaking it. In many types of mounted transformers and coils the ends of the coils are soldered to permanent terminals secured to insulating strips fastened to the coil mountings or to containers in which the coils are disposed.

In the manufacture of dowel-mounted toroidal loading coil assemblies disclosed and claimed in the co-pending application of E. J. Crane and R. P. Cross, Jr., Serial No. 717,526, filed December 20, 1946, and which are to be used in splice loaded telephone cables, an important consideration is the reduction in the bulk of the loading unit that is to be sheathed in the cable. All the known practical methods of coil end connection to telephone lines involve the fastening of a coil end to a terminal located on some type of terminal support and then securing the telephone line to the terminal, a time wasting process involving a bulky double connection on each terminal.

Objects of this invention are to provide a new and efficient terminal support and connection for electrical devices and a method of making the same.

In accordance with one embodiment of this invention, a toroidal coil is provided having a terminal support formed from a pair of fibrous washers impregnated with a thermosetting insulating compound between which washers insulated wire leads are placed, the whole then being pressed together between hot plates so that the two washers will adhere to each other trapping the wire leads therebetween. This forms a composite washer having insulated wires radiating therefrom. One end of each wire is cut near the periphery of the washer to form stub terminals to which coil ends of adjacent toroidal coils may be soldered.

Another embodiment of this invention resides in the method of preventing reversed connections by locating the wire leads between the washers before the washers are hot pressed together to prevent reversed connections to the coil. A pair of spaced-apart differently color-coded insulated wires are laid across one of the fibrous impregnated washers resting on a specially grooved block. Then the pair of wires is wound once

2

around the block, the spaced-apart relation being maintained by the specially placed grooves in the block. The turn of the pair of wires is continued to permit the wires to again cross the surface of the washer in a definite spaced-apart relation after which another insulating washer is placed directly over the first one, thereby sandwiching the wires between them. Heat and pressure are then applied to form a solid washer, having lead wires radiating therefrom.

A complete understanding of the invention may be had by reference to the following detailed description taken in conjunction with the accompanying drawings, in which

Fig. 1 is an illustration of a dowel-mounted toroidal coil loading unit in which one embodiment of the invention is used;

Fig. 2 is a sectional view of the loading coil unit shown in Fig. 1 and taken on the line 2—2 of that figure;

Fig. 3 is a fragmentary sectional view of the loading coil unit taken on the line 3—3 of Fig. 2 to illustrate in more detail the spacer and washer arrangement between adjacent coils;

Fig. 4 is a cross sectional view of the fragmentary portion shown in Fig. 3 and taken on the line 4—4 of Fig. 2;

Fig. 5 shows the spaced-apart portion of a pair of telephone lines;

Fig. 6 is a plan view of the assembling fixture showing the first washer in place and the spaced-apart portion of the telephone lines wrapped around the assembling fixture;

Fig. 7 is a front elevation of the fixture shown in Fig. 6 and showing in detail the grooves for guiding the wire;

Fig. 8 is a side elevation of the fixture shown in Fig. 6 showing the two washers with the conductors interposed therebetween being compressed between the fixture and the upper block; and

Fig. 9 shows the invention embodied in a terminal supporting washer.

As shown in the drawings (Fig. 1) one embodiment of the invention comprises a terminal supporting washer 20 made of insulating material, which has embedded therein portions of four insulated electrical conductors 21, 22, 23 and 24, which are cut from a pair of conductors 25 and 26 (Fig. 5) as hereinafter described. One end of each conductor is cut short near the periphery of the washer to form stub terminals 30, 31, 32 and 33 to which coil ends may be soldered. The combination of this terminal support and its associated toroidal coil is especially useful in the con-

struction of dowel-mounted toroidal loading coil units of a type shown generally at 34 (Fig. 1). Since these loading units are to be spliced and fitted directly into cables, it is imperative that all components be as small and compact as possible to adequately control the bulk of the entire unit.

The loading unit 34 comprises a plurality of toroidal coils 35 wound on annular cores 36 and mounted on a dowel 40, each of said coils usually having two windings of relatively thin wire. The coils are separated by insulating spacers 41 and iron washers 42 (Figs. 3 and 4). Each terminal supporting washer 20 is spaced from its associated coil first by an iron washer and then by an insulating spacer 41 between the iron washer 42 and the coil 35. The ends 43 of the relatively thin coil windings are soldered to the relatively heavy stub terminals 30, 31, 32 and 33. The other ends of the conductors 21, 22, 23 and 24 are brought out at the ends of the loading coil unit 34, as shown in Fig. 1.

The advantages of this terminal washer 20 are readily apparent, the conductors 21, 22, 23 and 24 will stand a substantial amount of abuse without in any way affecting the connection between the stub terminals and the ends of the coil windings which are of relatively thin wire. Another advantage is that the connecting lead and the stub terminal are the same conductor thus eliminating one connection and requiring only the soldered connection between the stub terminal and the coil end. It will be remembered that other types of terminals are originally separate from both the coil end and the lead thereto, both of which must be soldered to the terminal. Still another advantage is the flexibility of the terminal stub which is conducive to space saving.

Loading coils are usually provided with two windings to load both sides of a telephone line, each coil being in series with one of the lines. In connecting a set of loading coils into line, it is obviously important that the lines be connected to the proper coil ends to prevent the coils from being connected across the line instead of in series with the line. It is customary to color-code lines for identification purposes. For example, the insulation on one line of a pair of lines may be white and the insulation on the other line of the pair may be striped. In order to load the lines, the white line is broken and one winding of a loading coil is connected in series to the two open ends of the white line. The striped line is also cut and another coil connected in series with the open ends of that line. It will be apparent that if the insulation on the conductors 23 and 21 of the washer 20 are white in color it will greatly aid and facilitate the connection into the white telephone line of that winding of the loading coil which is connected to terminal stubs 30 and 33. The other two conductors 22 and 24 are striped to aid in connecting into the striped line the coil winding that is connected to the terminal stubs 31 and 32. The following method of forming a terminal supporting washer will ensure that the coil ends will be connected to the proper terminal stubs.

A circular washer 44 made from a fibrous insulating material and impregnated with an insulating material, preferably a thermo-setting material, is placed on a guide pin 45 mounted on the lower block 46 of the assembling fixture 47, which guide block has grooves 50, 51, 52, 53, 54 and 55 formed in the top, and grooves 60 and 61 formed in the bottom. A pair of insulated con-

ductors 25 and 26 along their length with an acetate bonding material, and which may be color-coded white and white striped with red are spread apart for a substantial distance intermediate their ends (Fig. 5) and are laid across the washer 44 on the block 46 in the manner shown in Fig. 6 so that a part of the bonded pair up to a point of divergence 62 lies in the groove 50. The conductors begin to diverge at the rim of the washer 44 and, passing over a portion of the washer, the individual conductors are laid in the grooves 54 and 55, the white in groove 55 and the striped in groove 54. The spread apart conductors are then wrapped around the block 46, the white following and being disposed in the groove 61 and the striped in the groove 60. As the conductors are brought up around the other side of the block, the white is laid in the groove 51 and the striped into groove 52, and both conductors are again laid across the washer converging at a point 63 which is just outside the rim of the washer 44 where the bonded pair of conductors are then laid in the groove 53.

It will be seen that this method of locating the wire forces the operator to maintain a definite spaced-apart relation and will invariably end with the conductors lying in a predetermined required position. Next, another washer 64 similar to washer 44 is placed on the pin 45 to form a sandwich with the conductors between the two washers. An upper block 65 of the assembly fixture 47 provided with spacers 70 and 71 is placed over the washer and the whole assemblage is placed between the heated platens of a press (not shown) which are pressed together thereby forcing the blocks 46 and 65 together, the meeting of the blocks being limited by the spacers 70 and 71. Sufficient heat and pressure are applied to soften the impregnant in the washers to provide enough flow to encompass the conductors and form a composite molded washer having wires radiating therefrom. The conductors are cut at points 72, 73, 74 and 75 and skinned to the rim of the washer thereby forming terminal stubs. The other ends of the conductors may be used to splice the loading coils to the wires of a cable.

What is claimed is:

1. A terminal support for annular shaped electrical devices, said devices having a plurality of peripherally extending terminal leads comprising an annular member made of insulating material of a diameter the same as that of the device and a plurality of conductors embedded in said member and extending from its peripheral edge, one end of each of said conductors forming stub terminals for connection to the terminal leads of the device.

2. A terminal support for annular shaped electrical devices, said devices having a plurality of peripherally extending terminal leads comprising a washer made of insulating material of a diameter the same as that of the device and a plurality of conductors embedded in said washer and having their ends extending from the peripheral edge of the washer for connection to the terminal leads of the device.

3. A terminal support for annular shaped electrical devices, said devices having a plurality of peripherally extending terminal leads comprising a washer made of fibrous material impregnated with an insulating compound of a diameter the same as that of the device and a plurality of conductors embedded in said washer and having their ends extending from the peripheral edge of the washer for connection to the terminal leads of the device.

4. A terminal support for annular shaped electrical devices, said devices having a plurality of peripherally extending terminal leads comprising an annular wafer made of insulating material, a second annular wafer similar to and bonded to said first wafer, said wafers having diameters the same as that of the device, and a wire interposed between said wafers, the ends of said wire extending from the peripheral edges of said wafers for connection to the terminal leads of the device.

5. A terminal support for annular shaped electrical devices, said devices having a plurality of peripherally extending terminal leads comprising a washer made of insulating material, a second washer similar to and bonded to said washer, said washers having diameters the same as that of the device, and a wire interposed between said washers, the ends of said wire extending from the peripheries of said washers for connection to the terminal leads of the device.

6. A terminating element for an annular shaped loading coil, said coil having a plurality of peripherally extending terminal leads comprising a pair of annular wafers of insulating material adhered one to the other, said wafers having diameters the same as that of the coil and a pair of relatively heavy wires cut to form two pair of terminal ends placed between the wafers before they are adhered one to the other with the terminal ends extending from the peripheral edges of the wafers for connection to the terminal leads of a loading coil and with the other ends of the pair of wires extending from the peripheral edges of the wafers for attachment to a line to be loaded.

7. A method of making a terminal support comprising placing a washer made of insulating material on a die block, winding a plurality of spaced apart conductors around said die block and washer and in engagement with the washer while maintaining the conductors in spaced-apart relation, maintaining the spaced apart relation for a complete turn to form opposed loops, placing a second insulating washer directly over said first washer and on top of said conductors, forcing the two washers together under sufficient heat and pressure to cause the insulating material to flow and encompass said conductors to imbed them in the structure formed by the washers, and cutting the loops to form a composite unit having conductors extending therefrom.

8. A method of forming a terminal support comprising laying a plurality of conductors in spaced apart relation across a washer formed from insulating material and in engagement therewith, bringing said plurality of conductors in a loop underneath said washer and in engagement therewith all the while maintaining said spaced apart relation, turning said pair of conductors upward and again laying them across said washer in a loop, placing another similar washer over said first washer to sandwich said conductors therebetween, compressing the assemblage at a sufficient pressure and the necessary temperature to cause said insulating material to flow around said conductors to imbed them in the structure formed by the washers, and cutting the loops to form a composite washer having conductors extending therefrom.

9. A method of making a terminal mounting comprising separating for a predetermined portion along their length at a point intermediate of their ends a pair of insulated wires normally substantially joined along their entire length thereby forming a spaced apart portion of said predeter-

mined portion, placing one end of said spaced apart portion on top of a wafer formed from thermo-setting material in such a way that one of the points of divergence of the wires lies at about the periphery of said wafer the wires diverging from this point across the top of said wafer, wrapping said wires in a loop underneath said wafer to maintain a spaced apart relationship between the wires in the loop, looping across the top of said washer the remaining end of said spaced apart portion so that the wires converge across the top of said wafer to a point at about the periphery of said wafer, placing another similar wafer on top of the first wafer, the portion of the conductors lying across the top of the said first wafer thereby being interposed between said wafers, pressing said wafers together under sufficient heat and pressure to cause said thermo-setting material to flow around said conductors and to thermo-set and cutting the loops thereby forming a composite member having wires extending therefrom.

10. A method of making a terminal assembly for electrical devices comprising spreading apart a pair of bonded conductors for a predetermined length intermediate of their ends, placing one end of the spread apart portion of said conductors on top of a thermo-setting sheet, bringing the conductors in a loop around the bottom of said sheet while maintaining a spaced relation between said conductors in said loop, looping the other end of said spread apart portion of said conductors across another portion of the top of said sheet, placing another thermo-setting sheet over said first sheet so that the conductors will be interposed therebetween, pressing the two sheets together under sufficient heat and pressure to cause the material in said sheets to flow around said conductors and to thermo-set and cutting the loops thereby forming a composite structure having conductors leading therefrom.

11. The method of attaching paired conductors to an insulated terminal mounting which comprises providing a predetermined length of a pair of conductors, separating the two conductors at a point intermediate the ends of the length, placing them on top of a thermo-setting disc at the point where the pair of conductors diverge, maintaining a definite spacing between the conductors of the pair and looping them in spaced relation around the bottom of the disc, looping a second length of the same paired spaced apart conductors across and on top of another portion of the thermo-setting disc adjacent the point where they converge, applying sufficient heat and pressure to coalesce the said discs with the conductor portions therebetween, and cutting the loops to form a composite disc with conductors extending therefrom.

12. A method of forming a terminal support comprising laying a plurality of conductors in spaced apart relation across and in engagement with a wafer of insulating material, bringing said conductors in a loop under said wafer while maintaining them spaced apart and in engagement with the wafer, again looping the conductors across the top of and in engagement with said wafer, placing a second wafer of the same shape as the first wafer on the conductors on the first mentioned wafer, pressing the wafers together to embed the conductors therein, adhering the wafers together and cutting the loops.

13. A method of forming a terminal support comprising laying a plurality of looped conductors

in spaced apart relation across and in engagement with a wafer of insulating material, placing a second wafer of the same shape as the first wafer on the conductors on the first mentioned wafer, the looped portions of the conductors being arranged outside the peripheries of the washers, pressing the wafers together to embed the conductors therein, adhering the wafers together and cutting the loops.

14. A terminating element for toroidal coil windings comprising a washer having embedded therein a plurality of conductors, one end of each of said conductors extending from the edge of said washer and being connected to the ends of the windings of said coil, the other ends of said conductors extending from the edge of said washer for connection to wires of a cable to be loaded.

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