

United States Patent [19]

Anderson et al.

[11] 3,843,946

[45] Oct. 22, 1974

[54] DUAL BOBBIN ASSEMBLY FOR COILS

[75] Inventors: David S. Anderson; Lawrence F. Kottke, both of McHenry, Ill.

[73] Assignee: Original Equipment Motors Inc., Crystal Lake, Ill.

[22] Filed: Oct. 5, 1973

[21] Appl. No.: 404,377

[52] U.S. Cl. 336/90, 310/194, 336/192, 336/198

[51] Int. Cl. H01f 15/10

[58] Field of Search 336/192, 198, 208, 90; 242/125.2; 310/194

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Primary Examiner—Thomas J. Kozma

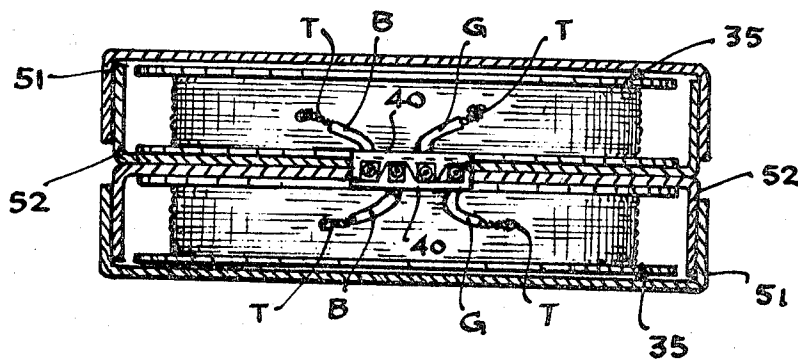
Attorney, Agent, or Firm—Kinzer, Plyer, Dorn & McEachran

[57]

ABSTRACT

A bobbin for a motor coil is constructed with a flange having a lead wire retainer extended therefrom. The retainer is in the form of a tab having spaced fingers which present pockets for capturing the lead wires. The retainer has an opening through which the lead wires are passed for strain relief. A complementary member with complementary fingers opposes the tab to clamp the wires.

15 Claims, 12 Drawing Figures



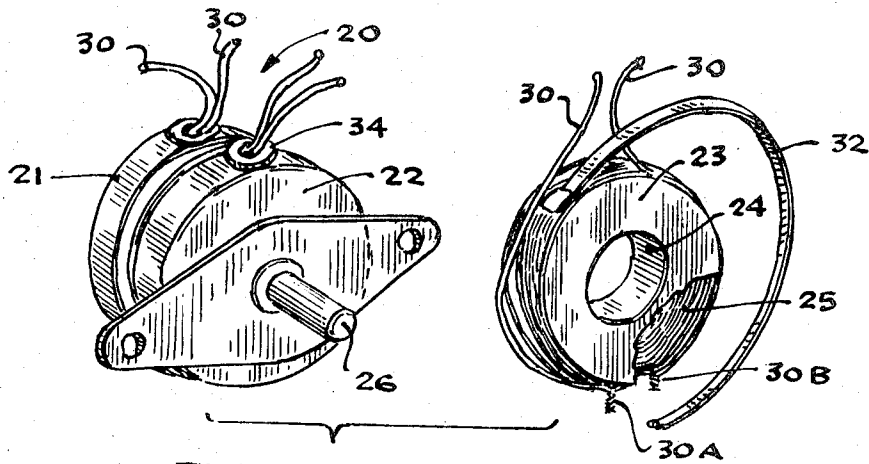


FIG. 1 PRIOR ART

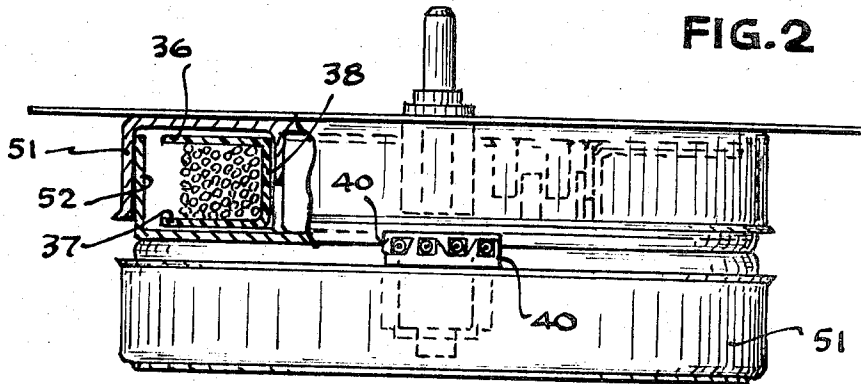


FIG. 2

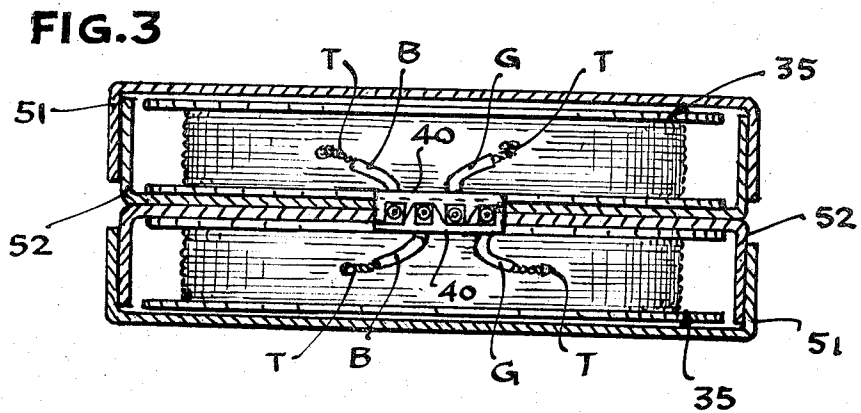


FIG. 3

FIG.5

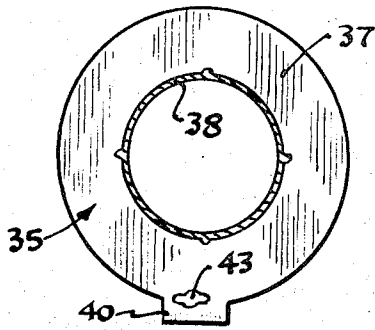


FIG.4

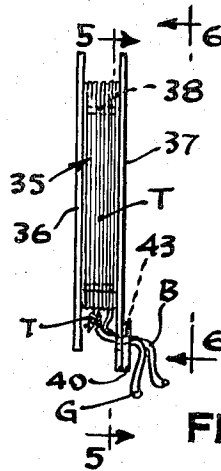


FIG.6

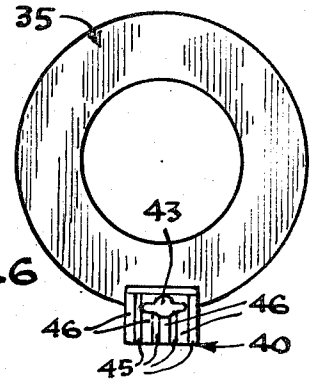


FIG.8

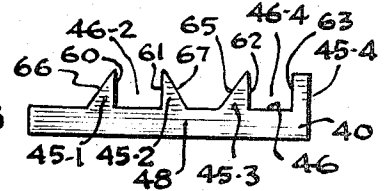


FIG.7

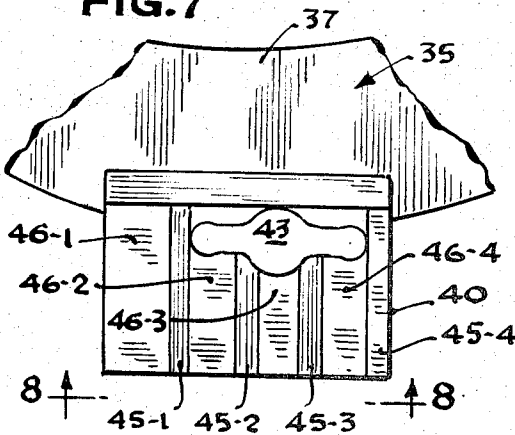


FIG.8A

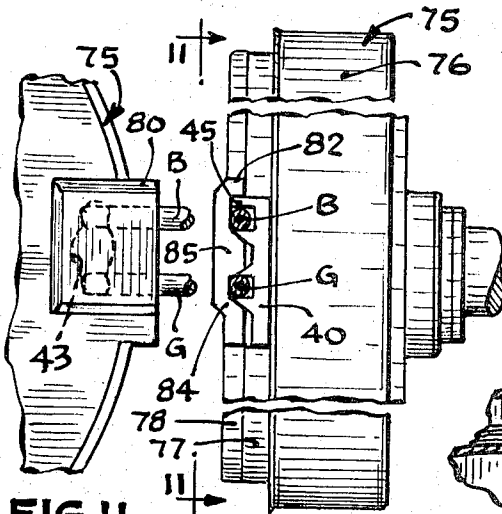
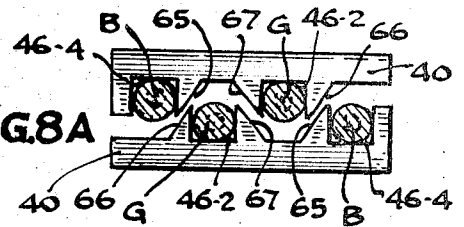


FIG.11

FIG.10

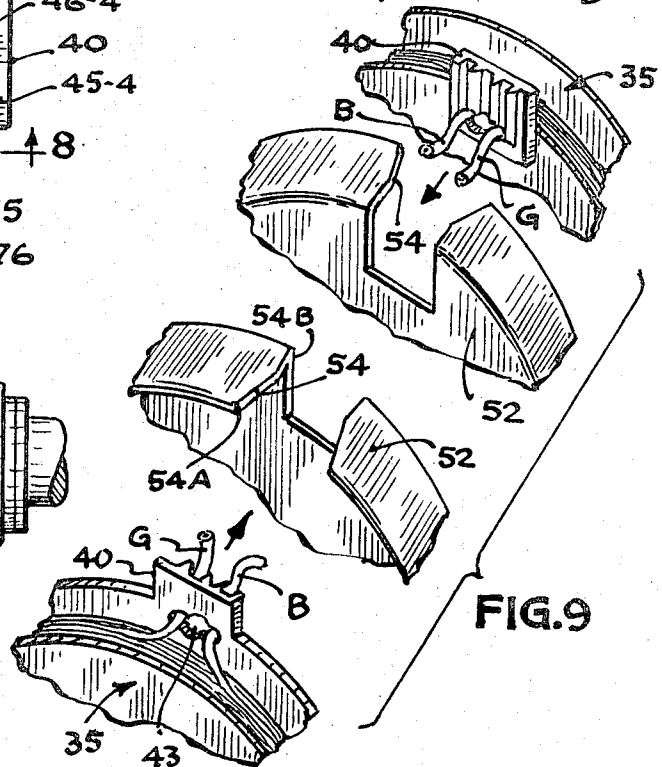


FIG.9

DUAL BOBBIN ASSEMBLY FOR COILS

This invention relates to the construction of bobbins used in electric motors, both single coil and dual coil.

In a dual coil electric motor two bobbins are arranged in co-axial relation, each bobbin being wound with many turns of small diameter copper wire. Two lead wires are spliced to the ends of each coil winding, merely by twisting and securing (e.g., soldering) the wire ends. Conventionally, to prevent separation of the spliced wire ends, the splices are made at a low point on the coil circumference, the lead wires are brought to the top of the bobbin, tape is wrapped about the circumference of the coil and the free ends of the lead wires are then extended through grommet-protected openings in the cup-shaped metal frames which house the two bobbins. Nonetheless, the anchor for the leads is merely the partial capstan effect represented by a partial lap of the lead wires on the outer circumference of the coil winding, no more than a 180° lap. The same procedures are followed for a single coil motor.

The primary object of the present invention is to construct the bobbins so that the lead wires are not only clamped in the bobbins but are bent on two turns in different directions, constituting a very effective resistance to separation of the spliced ends. Additional objects of the invention, attained by interfitted wire retainer tabs on the bobbins, are: to anchor the lead wires in a neat, predetermined alignment compared to the random, knotty disposition presently involved; to protect the insulation on the lead wires; to isolate the lead wires from metal surfaces; to achieve a grommet effect without need for separate attachable grommets, and to effect fixturing of the leads while making connections. Another object of the invention is to achieve the same objectives in a single bobbin.

In the drawing:

FIG. 1 is a perspective view of the known, prior art construction;

FIG. 2 is a plan view of a motor constructed in accordance with the present invention, partly in section;

FIG. 3 is a sectional (cut-away) view of the motor shown in FIG. 2;

FIG. 4 is an elevation of a bobbin constructed under the present invention;

FIG. 5 is a section on the line 5—5 of FIG. 4;

FIG. 6 is an elevation on the line 6—6 of FIG. 4;

FIG. 7 is a fragmentary detail view of the retainer or holder on an enlarged scale compared to FIG. 6;

FIG. 8 is a detail view on the line 8—8 of FIG. 7;

FIG. 8A is a view similar to FIG. 8 showing the way in which two wire holder tabs interfit;

FIG. 9 is an exploded view showing the manner in which two bobbins are related to the frame members of a dual coil motor assembly;

FIG. 10 is a view of a single coil motor incorporating a bobbin constructed in accordance with the present invention; and

FIG. 11 is an elevation on the line 11—11 of FIG. 9.

Referring to FIG. 1, perspective view of a dual coil motor 20 of known conventional form, two coil housings 21 and 22 respectively contain a wound bobbin 23 separated for clarity in FIG. 1. The bobbin 23 is of known form and the core 24 thereof is wrapped with fine copper wire 25.

Rotors, not shown, are arranged within the core openings of the bobbin inside the housing 21 and 22, being mounted on a shaft 26 constituting the driven element of the motor.

In completing the coil assembly, a pair of lead wires 30 for each coil have ends thereof spliced at 30A and 30B to the ends of the wire winding 25 on the bobbin. Such splicing, for reasons to be explained, is effected at what constitutes the bottom of the bobbin, after which the insulated lengths of the lead wires are drawn upwardly in snug contact with the periphery of the coil winding 25. A piece of tape 32 is then wrapped about the coil to cover the spliced ends and to secure the lead wires in place on the winding.

After the bobbin sub-assembly has been completed in the fashion described above, that is, after the tape 32 is applied, the bobbin is arranged within the corresponding motor housing. The motor housings are split cups, as will be explained in the description to follow.

The lead wires 30 are extended through openings in the top of the motor housing and grommets 34 are then applied, fitting the openings, to protect the lead wires from the sharp edges of the openings in the motor housings through which the lead wires were passed.

The reason for using the tape 32 and for effecting the splices 30A and 30B at the locations shown in FIG. 1 is to relieve strain on the lead wires so that the splices will remain intact. Such procedures entail efforts properly to locate the splices and also entail the use of tape 32 to say nothing of the time and expense required to apply the grommets. Moreover, the lead wires in the motor assembly are in disarray. These deficiencies are overcome under the present invention.

A bobbin constructed in accordance with the present invention is shown in FIGS. 4, 5 and 6, a bobbin 35 of circular form having a pair of annular flanges 36 and 37 joined by a core or collar 38.

The bobbin 35 may be of molded plastic material known in the art, and one of the circular flanges thereof is molded to present a radially projecting lead wire retainer 40 of tab form. As shown in FIG. 5, the inner face or surface of the tab 40 lies in the plane of what constitutes the inner wall of the related bobbin flange 37. A slot 43 is formed in the bobbin flange 37. The slot 43 opens at the opposite side of the related bobbin flange as shown in FIG. 6.

The outer side of the tab 40, FIGS. 6, 7 and 8, is molded to present a plurality of integral flexible fingers collectively identified by reference character 45 in FIG. 6. Each of the fingers 45 projects axially and is elongated parallel to a diameter of the bobbin.

The spaces between the fingers afford pockets collectively identified by reference character 46 in FIG. 6. These are four fingers and four pockets as will be described, selected pockets serving to capture the lead wires and the related fingers being effective to crimp the lead wires.

FIGS. 7 and 8 show the tab 40 at a greatly enlarged scale. The tab includes a base 48 representing the radial extension of the related flange as 37 and as will be evident in FIG. 8 there are, for the dual coil bobbins under consideration, four fingers, 45-1, 45-2, 45-3 and 45-4, the fingers projecting at right angles to the plane of the base 48, which is to say that the fingers 45 project axially from the outer wall of the bobbin flange 37.

As will be evident in FIG. 8, the pockets 46 referred to above are of a width readily to accommodate the lead wires which are to be retained therein. For the dual bobbins under consideration the four tab fingers define four pockets. End finger 45-4 and the next adjacent finger 45-3 define a three-sided squared-off pocket of a width slightly less than the diameter of the insulated lead wire to be housed therein; this is equally true of the pocket between fingers 45-1 and 45-2. The pocket between fingers 45-2 and 45-3 is wider than a wire, equally true of the open-ended pocket to the left of finger 45-1.

Referring to FIG. 4, lead wires B (black) and G (grey) have the bare ends thereof connected as by a twist T and solder (or crimp) respectively to the free ends of the copper winding representing the coil of the bobbin shown in FIG. 4. This splice or connection of the lead wires to the coil may be accomplished at the tab end of the bobbin and need not be effected at the bottom of the coil in the manner of the prior practice shown in FIG. 1.

The connections at T are made after the lead wires B and G are extended through the clearance hole 43, FIG. 4, having the effect of fixturing, repeated for each bobbin, FIGS. 3 and 9.

Prior to completing the motor assembly, the lead wires are press fitted into two alternate pockets 46 of the related retainer tab, the two squared pockets 46-2 and 46-4 as best shown in FIG. 8A.

Slot 43 is located at the root of the pockets, FIG. 7, the pockets being numbered like the fingers. It will be recognized that as an incident to passing the lead wires B and G through the slot 43 and pressing them into the pockets 46-2 and 46-4, two right angle bends are made in the lead wires. One bend is made, FIG. 9, when the lead wire is extended from the periphery of the coil winding into the slot 43 and a second bend is made when pressing the wire into the tap pocket assigned thereto. From this it will be seen that in arranging a lead wire within a retainer pocket two bends are made therein in different directions, so that a tug force in tension far beyond any force normally encountered is required in order to break or separate the spliced ends of the wires.

In accordance with standard practice, the bobbins 35 are to be housed between complementary cup-shaped frame members 51 and 52, FIG. 3, frame 51 being of larger diameter so that frame 52 may be telescoped therein. Referring to FIG. 9, the inner frame members 52 are provided with respective slots 54 for receiving the retainer tabs 40 of the paired bobbins 35.

Referring again to FIG. 9, a bobbin 35 is juxtaposed with respect to the casing or housing 52, the tab being aligned with the receiving slot 54. The receiving slot has a wide (throat) end 54A wider than the span of the tab 40, neatly receiving the tab.

The slot 54 is narrowed to a neck at 54B to a width slightly less than the span or long dimension of the tab 40 so that the tab 40 has a slight press fit at the end 54B of the receiving slot 54. These dimensions are of course equal for each bobbin 35 and each frame member 52 having a slot 54.

The tabs 40 of two bobbins are so configured that one is the complement of the other and consequently the opposed fingers are self-guiding and interfit to trap the lead wires in the pockets. In fact, the configuration is such that the lead wires are crimped by wedging

forces as a further resistance to forces that might disrupt the wire splices; the press fit of the tabs 40 in the housing slots 54 is yet further assurance to preserving the splice intact.

Referring to FIG. 8, there is an end finger 45-4 and three additional fingers. The fingers have spaced opposed walls which of course define pockets for the lead wires. More specifically, the two pockets 46-2 and 46-4 are squared off so to speak by opposed parallel inside finger walls, 60-61 and 62-63 respectively. These opposed inner walls are spaced apart by a distance just slightly less than the diameter of the insulated lead wires so that the latter (B and G) may be press fitted therein after the lead wires are extended through slot 43. Such press fit maintains the lead wires in a readily identifiable array.

It will be realized that fingers 45-1 and 45-2 are paired to define a pocket 46-2 accepting a lead wire; fingers 45-3 and 45-4 are a second, similar pair. At least one of the paired fingers has a sloped outer wall so that the paired outer walls are convergent proceeding outward (axially) from the base. Thus, finger 45-3, paired with finger 45-4, has a sloped outer wall 65. The two fingers in the other pair each have a sloped outer wall, 66 and 67 respectively.

Consequently, by presenting an opposing member having fingers with complementally shaped walls, the fingers may easily be nested and the wires in pockets 46-2 and 46-4, FIG. 8, may be crimped and retained by a positive force. In a dual coil assembly, the opposing member is the twin tab. Thus, as shown in FIGS. 3 and 8A, the fingers of the two tabs 40 fit complementally so that one guides the other. More specifically, FIG. 8A, finger walls 65 and 66 of the two opposed tabs wedgingly engage one another to crimp the two B wires in the respective end pockets 46-4 of the two retainers 40; the two opposed finger walls 67 wedgingly engage to crimp wires G in the two inside pockets 46-2. The tabs neatly and snugly fit together.

It will be recognized that at least one finger defining each pocket is preferably flexible and has a sloped outer wall so that it may guide and incidentally be wedged inward by a finger of the opposing member, the opposing finger having a complementary slope. The principle of guiding may be readily recognized by observing the interfit between the fingers which house wires G; the principle of crimping may be readily recognized by considering the way in which the fingers with complementary slopes 65 and 66 are effective to crimp the righthand lead wire B, FIG. 8A. Also, in principle, at least three fingers are required to define two pockets for the two lead wires; two of the fingers would therefore be flexible in the preferred embodiment. In the two coil assembly, the advantage of two fully complemented retainer tabs is apparent: only one mold is required to shape the bobbins; there is no lefthand or righthand so that two bobbins may be juxtaposed with the tabs facing one another, FIG. 8A, as mirror images of one another.

The principle of the invention may be further studied in terms of a motor having a single coil, the motor 75, FIG. 10, having two interfitting C-shaped frames 76 and 77.

A bobbin identical to 35 described above, having a retainer tab 40, FIG. 10, is encapsulated by the housing frames 76 and 77. The tab 40, FIG. 10, has the same

four fingers 45 described above and the same slot 43.

A rigid die cast cover 78 is staked to frame 77, completing the motor assembly.

Cover 78 is cast with an integral tab 80 constituting the opposing member for retainer tab 40. Tab 80 is provided with two end fingers or lugs 82 and 84 and an intermediate finger 85 having walls complementary to those presented by the fingers of tab 40, whereby the latter guide the opposing tab 80 to produce an easy, neat fit and whereby the slopes of the fingers on tab 80 flex the fingers 45, FIG. 9, to crimp the lead wires.

Additional pressure is applied by the skirts of the outer cups on the twin tabs in still another direction.

From the disclosure in FIGS. 10 and 11 it will be realized that the set of fingers of the tab and the set of fingers of the opposing member need not both be flexible, it is enough that selected ones of the tab fingers be flexible, thereby to guide the fingers of the opposing member which may be rigid, comparatively speaking. In this same connection, as already noted, it is sufficient, in principle, that one finger for each pocket be flexible to create the incidental crimp or clasp on the lead wire. In a dual coil assembly, however, and since the bobbins are of insulating plastic material, all fingers of the mating tabs are flexible.

In any event, when the opposing member is presented and nested with respect to the tab as 40, both in a dual coil assembly (FIG. 3) and in a single coil assembly (FIG. 10) the mating fingers capture or encapsulate the lead wires as B and G on four sides, namely, the four-sided pockets. The tab fingers and the root or base of the pocket (e.g. base element 48) define three sides and the base of the opposing member completes the four-sided pocket.

Since the pockets as 46 extend parallel to the plane of the tab base as 48, that is, parallel to a diameter of the bobbin, and since the lead wires are bent, FIGS. 3 and 9, incidental to being passed through slot 43 and then are bent in a second direction incidental to being nested in the pockets, it will be seen that effective strain relief is achieved by two bends to say nothing of the final crimp or squeeze effect when press-fitting the wires in the pockets and bending the fingers inward when the opposing member is nested in the pockets.

In view of the foregoing it will be seen that while preferred embodiments have been disclosed, the principles of the invention may be applied to modified and varied forms.

I claim:

1. In a dual bobbin assembly for a dual coil motor, a pair of bobbins arranged in co-axial relation, each bobbin having a core to be wound with a wire and a pair of end flanges attached to the core for retaining the winding, a flange of each bobbin being provided with a retainer for immobilizing the lead wires connected to the ends of the related coil winding, each retainer being the complement of the other and comprising: a radially projecting tab having one axially projecting end finger, and an odd number of additional axially projecting fingers arranged in spaced relation as a set to afford pockets for said lead wires, each of the additional fingers having a sloped wall with the fingers on the tabs of the two bobbin flanges in opposed interfitting relation so that the sloped walls of one set of additional fingers wedge on the sloped side walls of the other set of addi-

tional fingers, thereby to crimp and retain the lead wires disposed in the pockets.

2. A dual bobbin assembly according to claim 1, wherein the fingers are elongated parallel to a diameter of the bobbin core and where each tab has a slot formed therein through which the lead wires may be extended, a lead wire so extended being bent in one direction to lay in a pocket and being bent in another direction to be joined to the related coil end.

3. A dual bobbin assembly according to claim 1 wherein the pockets retaining the lead wires are of a dimension less than the diameter of the lead wires so that the lead wires may be press-fitted therein.

4. A dual bobbin assembly according to claim 1 wherein each bobbin is housed between cup-shaped frame members, one of the frame members having a slot for receiving the related tab, said frame slot having an entrance throat of greater width than the tab and having a neck of less width than the tab to crimp the tab.

5. In a spool-like bobbin for a motor coil, wherein the bobbin has a core on which the coil is wound and a pair of end flanges for retaining the coil winding, a lead wire retainer tab attached to the periphery of one flange of the bobbin, said tab having a base with at least three spaced apart flexible fingers projecting therefrom, the spaces between the fingers constituting pockets for capturing lead wires, selected of the fingers each having a sloped outer wall and said sloped outer walls being convergent toward one another proceeding outward of the tab base.

6. A bobbin according to claim 5 wherein a slot is formed in the tab at the root of the pockets enabling lead wires to be passed therethrough and bent to lie in the pockets.

7. A bobbin according to claim 5 combined with a member opposing the retainer tab, said opposing member having fingers with walls shaped complementary to the sloped walls of the fingers on said retainer tab thereby to wedgely hold the lead wires in the pockets.

8. A bobbin according to claim 6 combined with a member opposing the retainer to clamp the wires in the pockets, said opposing member having fingers with walls shaped complementary to the walls of the retainer fingers.

9. In a spool-like bobbin for a motor coil, wherein the bobbin has a core on which the coil is wound and a pair of end flanges for retaining the coil winding, a lead wire retainer tab supported on a flange periphery, said tab having spaced, flexible fingers projecting axially therefrom and having a length parallel to a diameter of the bobbin, each finger having an inner wall and an outer wall, spaces between adjacent walls of the fingers affording at least two pockets for two lead wires, and selected walls of the fingers being sloped so that the tab fingers may be used as guides for an opposing member having complementary fingers thereby to encapsulate the wires on four sides.

10. A bobbin according to claim 9 wherein the tab has a slot through which may be extended the lead wires attached to the ends of the coil.

11. A bobbin according to claim 9 wherein the tab fingers are flexible.

12. A bobbin according to claim 10 wherein the tab fingers are flexible.

13. In a bobbin for a motor coil, the bobbin having a core to be wound with a wire and having a pair of special end flanges attached to the core for retaining the winding: a wire retainer tab attached to one of the flanges and lying substantially in the plane thereof, said tab having spaced fingers defining pockets for receiving lead wires each having end attached to a respective end of the coil winding, said pockets extending parallel to the plane of the tab, said tab having a slot therein communicating with the root of the pockets whereby the lead wires attached to the coil winding may be bent in

one direction incidental to being extended through the slot and bent in another direction incidental to being placed in the pockets.

14. A bobbin according to claim 13 wherein selected fingers have sloped walls for guiding complemented fingers of an opposing member to capture the wires in four-sided pockets.

15. A bobbin according to claim 14 wherein the tab fingers are flexible thereby to crimp the wires in the four-sided pockets.

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