United States Patent [19]

Knebel

[11] **3,739,312**

[45] **June 12, 1973**

[54] **SPOOL WITH MEANS FOR START WIRE INSULATION**

[75] Inventor: **William J. Knebel,** Waynesboro, Va.

[73] Assignee: **General Electric Corporation,** Waynesboro, Va.

[22] Filed: **June 19, 1972**

[21] Appl. No.: **264,002**

[52] **U.S. Cl.** **336/192,** 242/125.1, 336/208

[51] **Int. Cl.** **H01f 15/10,** H01f 27/30

[58] **Field of Search** 336/192, 198, 208; 242/125.1, 125.2

[56] **References Cited**

UNITED STATES PATENTS

3,271,760	9/1966	Sloan, Jr.	336/192 UX
3,453,575	7/1969	Davis	336/192
3,095,635	7/1963	Laviana	336/192 X

Primary Examiner—Thomas J. Kozma

Attorney—Michael Masnik, Frank L. Neuhauser, Oscar B. Waddell et al.

[57] **ABSTRACT**

A spool formed of insulating material having two end flanges axially spaced apart on a core for carrying a wire coil, one end flange containing a slot and flap, the flap being foldable against the end flange to protect a lead-in end of the wire coil which passes through the slot and is positioned between the flap and the flange.

9 Claims, 6 Drawing Figures

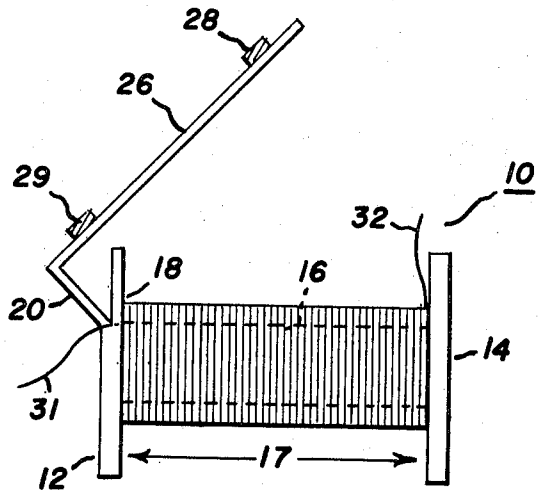


FIG. 1.

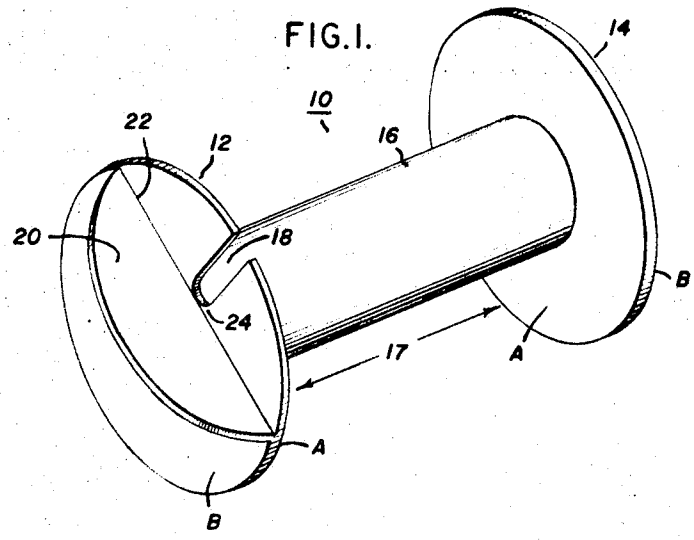


FIG. 2A.

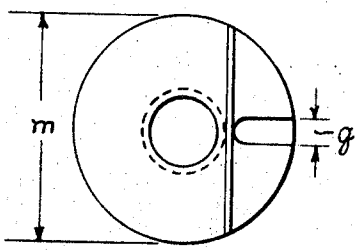


FIG. 2B.

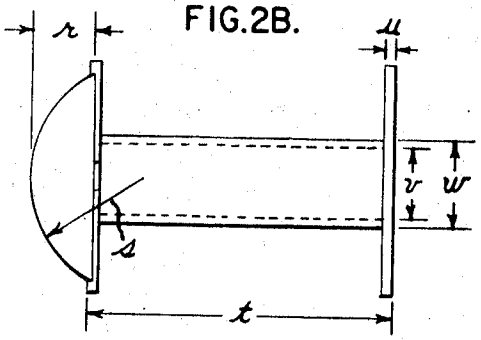


FIG. 2C.

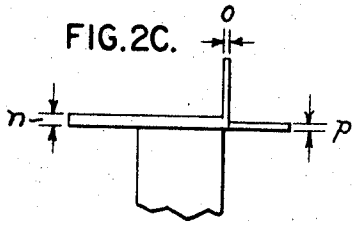


FIG. 3.

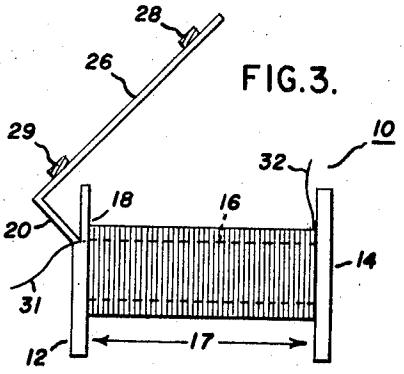
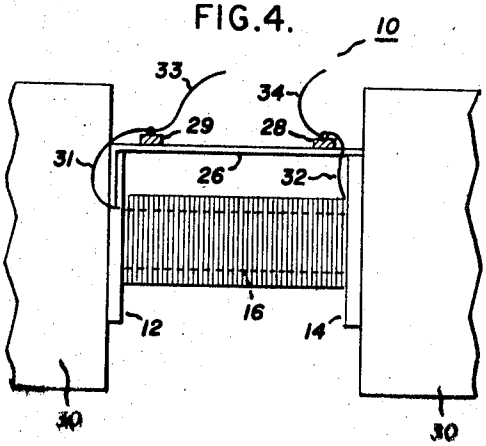


FIG. 4.



SPOOL WITH MEANS FOR START WIRE INSULATION

BACKGROUND OF THE INVENTION

Inductive assemblies comprising coils of wire mounted on insulative spools are used for a multiple of purposes in today's electronic society. The high volume demand for and consequent high volume production of inductive assemblies means that the slightest reduction in material used or the smallest increase in efficiency of production can result in a vast overall dollar savings. As a result, industry has developed high-speed machines for automatically winding wire on spools as quickly and accurately as currently possible.

A problem has historically existed, however, in protecting the lead-in end of the coil of wire from electrical contact with the end section of the coil formed by subsequent layers of windings on the spool. Initially, the lead-in end was first run into the spool along the inside surface of one end flange and a piece of insulating tape or film was placed over the wire to protect the lead-in end from electrical contact with the end of the subsequently wound coil. However, the tape or film is tedious to install manually and no known automatic winding machine can economically install the tape or film at a high enough speed, especially on very small spools. Furthermore, the tape or film represents additional material which must be figured into overall cost and the tape or film tends to interfere with efficient coil winding.

Since the turn of the century, slots have been cut into one end flange through which the lead-in end of wire is brought inside the spool. This procedure provides effective insulation of the lead-in end of wire from the coil, but the lead-in end of wire becomes exposed to any electrical or structural parts adjacent the spool such as a mounting assembly or frame in which the spool is ultimately positioned.

Various modifications have recently been attempted to protect the lead-in end of wire from unwanted external contact. One modification teaches the use of a molded flange formed with a pocket adjacent the flange slot in which pocket the lead-in end of wire is positioned and protected both from parts external to the spool and the coil wound on the spool. This type of modification has only limited effectiveness since the pocket is difficult to mold. The pocket uses up valuable winding space and the operation of positioning the lead-in wire into the pocket is oftentimes difficult to accomplish. Hence, the need currently exists for a spool structure: which insulates a lead-in end of wire from both internal and external electrical contact; which does not require extra pieces of insulation; which is relatively easy and inexpensive to build; which uses up very little space; and which is readily adaptable for use with currently existing automatic coil winding machines.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a spool with improved means for providing lead-in wire insulation.

It is another object of the present invention to provide a spool with improved means for providing lead-in wire insulation without the need to employ extra pieces of insulation.

It is a further object of the present invention to provide a spool with improved means for providing lead-in wire insulation, which spool is easy and inexpensive to mold.

It is still a further object of the present invention to provide a spool with improved means for providing lead-in end of wire insulation, which spool is readily adaptable for use with currently existing automatic coil winding machines.

One preferred embodiment of the present invention comprises an insulating spool having first and second flanges axially spaced from one another on an elongated core to define a winding space on the core for supporting a coil of wire. The first flange contains an opening which provides a passageway for a lead-in end of wire from exterior the spool through the first flange into the winding space. To accomplish the above objectives, the spool further comprises a flap hingeably attached to the outside surface of the first flange adjacent the opening. The flap has an open position in which the opening is readily accessible from exterior the spool and a closed position in which the flap lies against the outside surface of the first flange whereby the lead-in end of wire extending through the opening into the winding space may be positioned between the outside surface of the first flange and the flap.

In another embodiment of the present invention, the flap includes an extended member which lies across the top of the wire coil and rests on the peripheral edges of the first and second flanges when the flap is in the closed position. The second surface thereby provides a structural element on which an electrically conductive terminal is positioned to receive the lead-in and lead-out ends of the wire coil.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the present invention, reference is made to the detailed description below when taken with the drawings wherein:

FIG. 1 is an isometric view of one embodiment of the present invention;

FIG. 2 is an orthogonal view of the embodiment disclosed in FIG. 1;

FIG. 3 is a side view of another embodiment of the present invention; and

FIG. 4 is another view of the embodiment of the present invention disclosed in FIG. 3.

DETAILED DESCRIPTION OF THE INVENTION

FIG. 1 discloses a spool **10** of an electrical insulating material such as molded plastic having first and second flanges **12** and **14** axially spaced apart on an elongated core **16**. Inside surfaces A of first and second flanges **12** and **14** and core **16** define a winding sapce **17** in which a coil of wire may be wound, utilizing automated winding machines as are well known to those skilled in the art of assembling inductive devices. The flanges **12** and **14** in defining the winding space **17** may take on any shape that is necessary to facilitate the use of automated winding machines provided that each flange **12** and **14** has an inside surface A and an outside surface B. First and second flanges **12** and **14** in FIG. 1 are shown to assume a circular shape merely to provide an illustration of one shape commonly used with automated winding machines.

In order to provide a pathway from the exterior of spool **10** to the winding space **17** in which a wire coil

is formed, an opening or aperture **18** is formed in first flange **12.** The opening **18** extends completely through first flange **2** from the outside surface B to the inside surface A to provide a pathway from exterior the spool **10** through first flange **12** to the winding space **17.** In FIG. **1,** oepning **18** is shown to assume a slot-like shape starting at a peripheral edge of first flange **12** and extending inwardly toward the core **16.** This particular configuration for openig **18** is provided only as an illustrative example. Different shaped openings may also provide suitable passageways. For example, opening **18** instead of lying in a radial direction as shown in FIG. **1** may lie in a portion of a cord of first flange **12.** In the alternative, opening **18** may merely comprise a hole in first flange **12** and not extend outward so as to break the peripheral edge of first flange **12** as shown in FIG. **1.**

A flap **20** is shown hingeably attached to the outside surface B of first flange **12.** Flap **20** is movable to assume a first open position whereby opening **18** is readily accessible from exterior the spool and a second closed position whereby flap **20** lies adjacent outside surface B of first flange **12** to provide insulative protection for any wire passing through opening **18** from contact with objects adjacent outside surface B of first flap **12.**

In the particular embodiment shown in FIG. **1,** flange **20** is hinged along an axis **22,** which axis **22** defines a chord of first flange **12** and which cord is positioned tangent the base **24** of opening **18.** This embodiment provides suitable protection for a lead-in wire which extends from opening **18** to a peripheral edge of first flange **12.** This particular embodiment also readily lends itself to construction by plastic molding. The axis **22** of flap **20,** however, is not to be limited to a chord as shown in FIG. **1.** For example, the axis **22** of flap **20** may run parallel to the longitudinal axis of the opening **18** and thereby also provide suitable protection for any lead-in wire passing through opening **18.**

The size of spool **10** and the dimensions of first flange **12,** opening **18,** and flap **20** are not intended to be fixed by the one preferred embodiment disclosed, but rather are intended to be adapted for use with various size spools used in the assembly of inductive devices. However, the present invention is particularly effective in the assembly of a very small inductive spool. For example, dimensions illustrated by FIG. **2** of the drawings and the following table represent a molded spool which has already been proven capable of economic and efficient mass production: $m = .145$ inch; $n = .008$ inch; $o = .004$ inch; $p = .004$ inch; $q = .012$ inch; $r = .035$ inch; $s = .072$ inch; $t = .205$ inch; $u = .006$ inch; $v = .06$ inch; $w = .076$ inch. It should be noted that by limiting the width of first flange **12** which is to lie under flap **20** to one-half the width (0.004 inch) of the remainder of first flange **12** (0.008 inch) and dimensioning flap **20** to have a width (0.004 inch) also equal to one-half the width of the remainder of first flange **12,** then the construction of a spool incorporating the present invention will not require any additional material over that required by a prior art spool of similar size. Again, it is, of course, understood that the present invention is not limited to the above given dimensions.

In practicing the present invention disclosed in FIGS. **1** and **2,** spool **10** is formed by any suitable plastic molding process known to those skilled in the art. Since no pocket or complicated groove need be formed, almost any known molding process can be used. In a preferred assembly, flap **20** is initially biased in a first position whereby hole **18** is readily accessible from exterior spool **10.** A lead-in end of wire to be wound on core **16** is passed from exterior spool **10** through opening **18** into the winding space **17.** The wire is then wound on core **16** a desired number of turns as is well known to those skilled in the art of manual or automatically wound inductive devices. Upon assembly of the coil **10** into a suitable frame holder, the flap **20** is forced into a second position whereby it lies adjacent outside surface B of first flange **12** and thereby provides protection for the lead-in wire from contact with the frame or any other external apparatus.

FIGS. **3** and **4** disclose a modification of the embodiemnt taught in FIGS. **1** and **2.** In FIGS. **3** and **4** spool **10** again comprises first and second flanges **12** and **14** axially spaced along coil **16** to define a winding space **17** therebetween. In FIGS. **3** and **4,** however, flap **20** has an extended member or second surface **26** whcih is positioened at an angle to a first surface defining flap **20.** The length of extended member **26** and the angle member **26** makes with flap **20** may be chosen, as shown in FIGS. **3** and **4,** such that member **26** bridges the peripheral edges of first and second flanges **12** and **14** when flap **20** is in the closed second position.

Conductive contact terminals **28** and **29** are shown mounted on member **26.** The contacts may comprise metal deposition or any other suitable means for providing external circuit connections.

In opration of the embodiment of the present invention disclosed in FIGS. **3** and **4,** spool **10** is formed of plastic molded material, such as nylon and other comparable materials well known to those skilled in the molding art. Flap **20** is initially biased in an open first position enabling opening or aperture **18** to provide a passageway for a lead-in wire **31** from extenral spool **10** through first flange **12** to the winding space of coil **10.** The remaining portion of the wire is then coiled around core **16** either manually or by an automatic winding machine as is readily known to those skilled in the art until a satisfactory number of layers have been wound on core **16.**

The spool **10** may then be placed in a suitable framing member illustrated by supports **30** in FIG. **4.** As coil **10** is placed between supports **30,** flap **20** is forced from the open first position to a closed second position whereby the lead-in end of the wire **31** extending from the winding space through the opening **18** is positioned between the outside surface of the first flange **12** and the flap **20** to protect it from contact with support members **30** or any other external apparatus. The other end or lead-out end **32** of the wire wound on core **16** is passed from the winding space **17** between the first and second flanges **12** and **14** and connected to the conductive contact terminal **28** thereby providing a readily accessible external circuit connection. A second conductive contact terminal **29** may be similarly provided for external connection to the lead-in wire **31.** Leads **33** and **34** provide the connections to outside circuitry.

Having described two specific embodiments of a spool with means for lead-in wire installation, it is to be understood that various changes may be made in detail within the scope of the claims without departing from the spirit of the invention. It is, therefore, to be under-

stood that the invention is not to be limited to the specific details shown and described.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A spool for mounting a coil of wire comprising:
an elongated core;
first and second flanges axially spaced from one another on said core, said first and second flanges having inside surfaces which define a winding space on said core for supporting said coil of wire;
said first flange having an opening extending from said inside surface to an outside surface of said first flange; and
a flap hingeably attached to said outisde surface along an axis defined by a chord of said flange of said first flange adjacent said opening, said flap having an open position in which said opening is accessible from the outside side of said first flange and a closed position in which said flap lies against said outside surface and overlies said opening whereby a lead-in end of a wire extending from said winding space, through said opening may be positioned between the outside surface of said first flange and said flap.

2. The spool claimed in claim 1 wherein said first flange and said flap comprise a single piece of molded plastic.

3. The spool claimed in claim 2 wherein said opening forms a break in a peripheral edge of said first flange.

4. The spool claimed in claim 1 including a member extending from and at an angle to said flap such that said member lies across said first and second flanges when said flap is in said closed position, said member providing a means for supporting external connections.

5. A structure for insulating the lead-in end of a wire coil from the lead-out end of a wire coil comprising a spool for mounting the wire coil, said spool comprising an elongated core, first and second flanges axially spaced from one another on said core, said first and second flanges having inside surfaces which define a winding sapce on said core for supporting said wire coil, said first flange having an opening extending from said inside surface to an outside surface of said first flange, said spool being formed of an insulating material, a flap of insulating material extending from said first flange from an axis defined by a chord therof and said flap having first and second surfaces positioned at an angle to one another, said flap having an open position in which said flap forms an angle with said outside surface and a closed position in which said first surface of said flap lies against said outside surface of said first flange and overlies said opening whereby said lead-in end of wire extending from said winding space and passing through said slot may be positioned between the outer surface of said first flange and the first surface of said flap and wherein in said closed position said second surface of said flap lies across the wire coil and rests on peripheral edges of said first and second flanges.

6. A structure according to claim 4 further comprising means providing at least one conductive contact terminal on at least one surface of said flap for connecting thereto the external connections of said wire coil.

7. A spool formed of insulating material comprising two end flanges spaced apart on a core for carrying a wire coil, one portion of one end flange containing a slotted sector and a separate but abutting flap sector overlying said slotted sector, said flap sector being moveable about an axis defined by a chord of said one flange such that in an open position a lead-in end of the wire coil may be passed through the slotted sector, whereas in a closed position the passed lead-in wire is covered by said flap sector overlying said slotted sector.

8. A spool formed of insulating material comprising two end flanges spaced apart on a core for carrying a wire coil, one sector of one end flange essentially being divided to comprise a slotted sector and a separate but abutting flap sector overlying said slotted sector, said flap sector being hingeably attached to said slotted sector along an axis on said one flange such that in an open position a lead-in end of the wire coil may be passed through the slotted sector, whereas in a closed position the passed lead-in wire is covered by said flap sector overlying said slotted sector.

9. A spool formed of insulating material comprising two end flanges spaced apart on a core for carrying a wire coil, one end flange having a sector defined by a chord and the periphery beyond said chord, said sector being divided into a component slotted sector and a component flap sector overlying said slotted sector, said flap sector being moveable about an axis defined by said chord such that in an open position a lead-in end of the wire coil may be passed through the slotted sector, whereas in a closed position the passed lead-in wire is covered by said flap sector overlying said slotted sector.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,739,312 Dated June 12, 1973

Inventor(s) William J. Knebel

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On title page, line starting with [73] Assignee:		after "General Electric" cancel "Corporation" and insert -- Company --
Column 3,	line 3	cancel "2" and insert -- 12 --
	line 9	cancel "openig" and insert -- opening --
Column 4,	lines 16 & 17	cancel "embodiemnt" and insert -- embodiment --
	line 22	cancel "whcih" and insert -- which --
		cancel "positioened" and insert -- positioned --
	line 32	cancel "opration" and insert -- operation --
	line 38	cancel "extenral" and insert -- external --
Claim 5,	line 41	cancel "sapce" and insert -- space --

Signed and sealed this 19th day of November 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,739,312 Dated June 12, 1973

Inventor(s) William J. Knebel

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On title page, line starting with [73] Assignee:	after "General Electric" cancel "Corporation" and insert -- Company --
Column 3, line 3	cancel "2" and insert -- 12 --
line 9	cancel "openig" and insert -- opening --
Column 4, lines 16 & 17	cancel "embodiemnt" and insert -- embodiment --
line 22	cancel "whcih" and insert -- which --
	cancel "positioened" and insert -- positioned --
line 32	cancel "opration" and insert -- operation --
line 38	cancel "extenral" and insert -- external --
Claim 5, line 41	cancel "sapce" and insert -- space --

Signed and sealed this 19th day of November 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334