Oct. 1, 1963 J. K. PARK ETAL 3,105,655

YARN SPOOL

Filed July 17, 1958 2 Sheets-Sheet 1

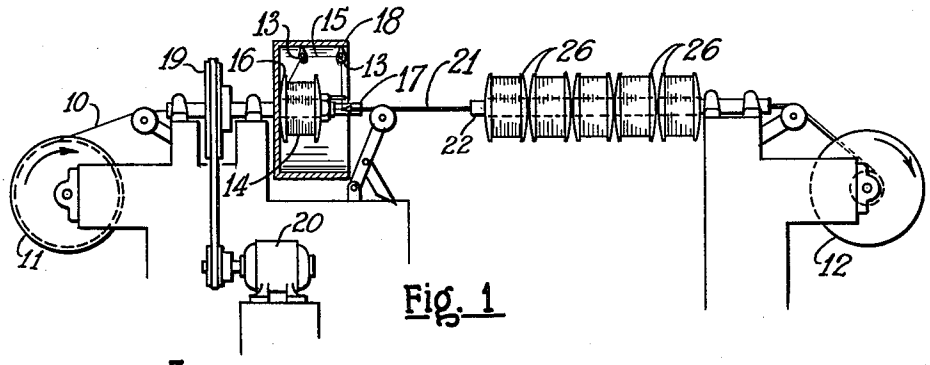

Fig. 1

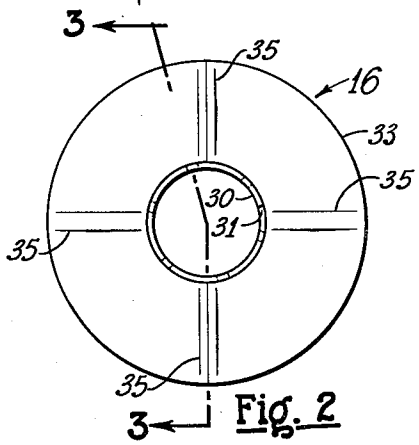

Fig. 2

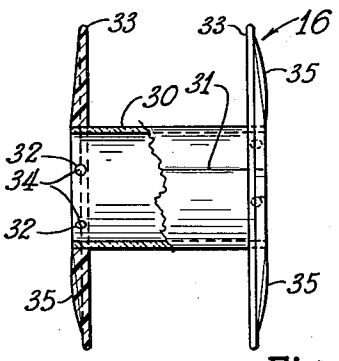

Fig. 3

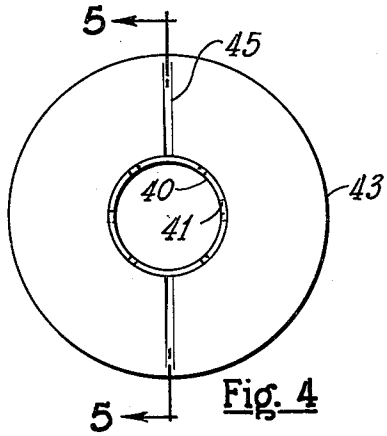

Fig. 4

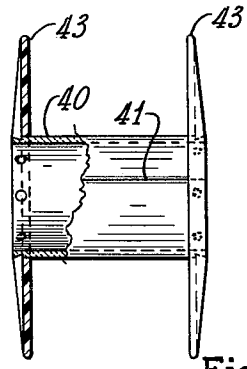

Fig. 5

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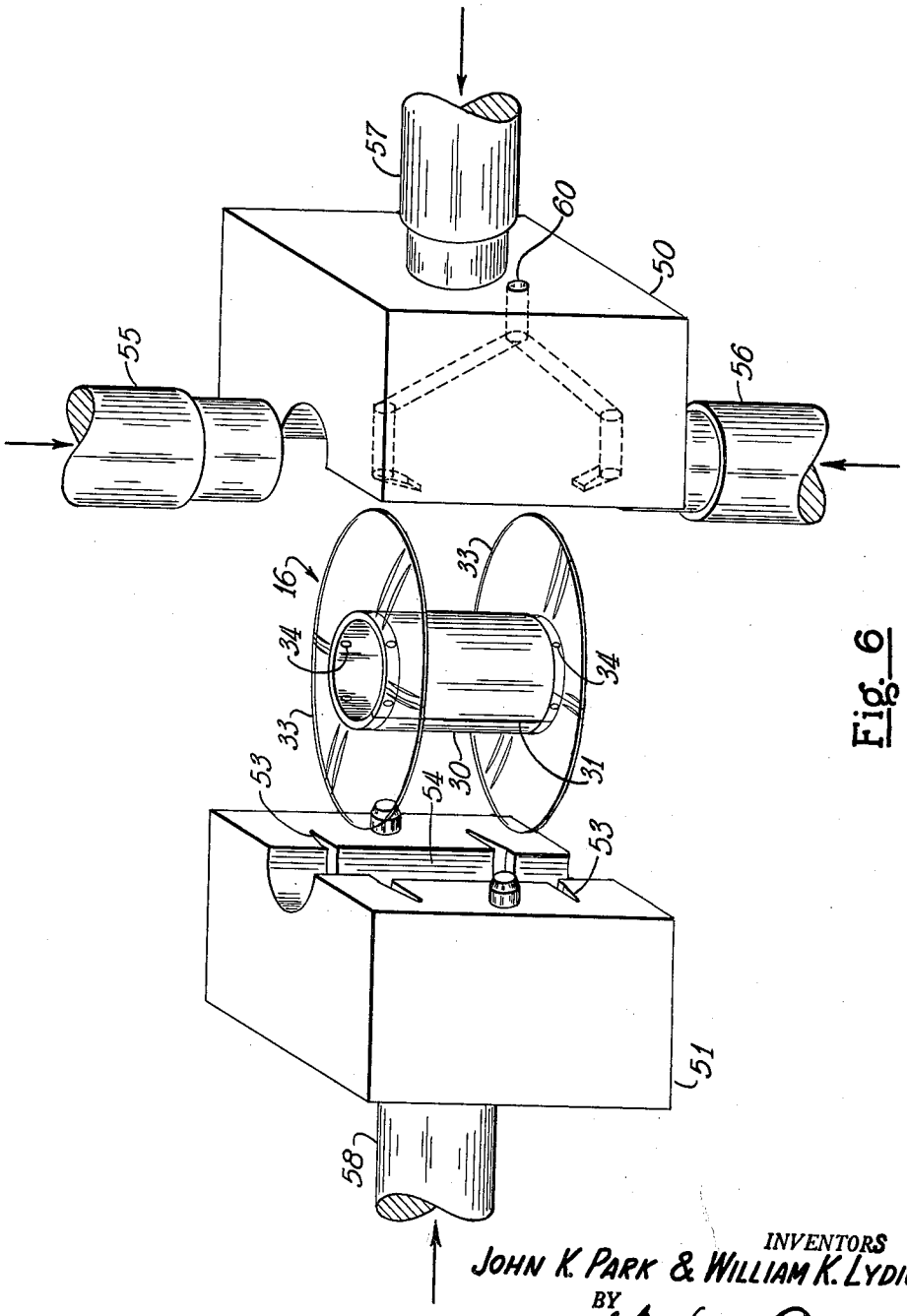

Fig. 6

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3,105,655

YARN SPOOL

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5 Claims. (Cl. 242—118.7)

This invention relates to carrier spools for yarns used in covering continuous lengths of wire with electrical insulation, and more particularly to a spool construction for support of yarn packages adapted particularly to providing wire insulation covering in wire insulating processes.

A conventional method of providing insulating covering for wire, such as magnet wire, is to pass the wire through a hollow mandrel on which a spool of yarn is placed and about which the spool is rotated as the yarn is served therefrom to form the covering for the wire. The wire is served from a drum-type reel and, after the insulation has been applied, is rewound onto a similar drum-type take up reel. The smaller spools of yarn used to provide the insulation material for covering the wire, however, are only large enough to provide yarn to cover a portion of the entire length of the wire fed during the covering operation. Accordingly, a series of the smaller spools of yarn are necessarily placed about the length of wire to be covered, such series being sufficient to provide a total length of yarn which will cover the entire length of wire from end to end.

Upon each individual spool being emptied, however, conventional practice requires that the spool be removed from its surrounding relationship with the wire and replaced on the mandrel with a full spool. In accomplishing this, the wire feeding operation is halted, while the empty spool is removed from its surrounding relationship with the mandrel and wire is replaced by a full spool of yarn. The end of the full spool of yarn is tied to the end of the yarn extending from the covering already on the wire, after which the covering operation is continued with the full spool being wound about the wire until empty, whereupon each subsequent full spool is inserted in sequence in position as a replacement for an empty spool until the entire wire is completely covered with the insulating yarn.

A problem is presented in the use of yarn carrying spools, however, since various manufacturers use different methods for securing the spool in place about the wire being covered. For example, practice has indicated a necessity for over forty different types of spools to meet the requirements of the number of manufacturers in the business of producing such wires in the United States. To alleviate this condition, it is a principal object of the present invention to provide a yarn carrying spool adaptable to a wide range of manufacturers' needs so that the spool construction for such purposes can be standardized.

In removing the yarn spool from its surrounding relationship with the wire being covered, it is necessarily so constructed that it can be readily removed from its surrounding relationship with the wire being covered without severing the wire.

Accordingly, it is another object of the present invention to provide a spool construction which is specifically designed so that it can be easily disassembled or at least partially broken away to effect the quick removal of the construction without need for severance of the wire being covered.

Packages of yarn for insulation of wire heretofore have been limited in their shape by reason of inability to provide permanent flanges or end pads on the spools used in the wire covering operation. For example, by reason of the inability to provide flanges which would retain

the package in place during the unwinding operation, it was necessary to provide a more integral low way wind on the package, which in turn presented problems during the severing operation, since in rotation of the package, the severing operation would be nonuniform or jerky as the diagonal wind was served with a uniform r.p.m. unwinding operation. In many instances, the revolutionary speed of the spool is in the order of 5400 r.p.m.'s or more during the unwinding operation, and accordingly, the high pitch diagonal of the low way wind would result in a relatively nonuniform, jerky feed of the yarn, and accordingly would in many instances result in skips in the wire covering.

Accordingly, it is an another object of the present invention to provide a yarn carrier spool which is adaptable to winding of the yarn package with a high way or parallel wind so that in revolving the spool at a uniform speed during the unwinding operation, uniform service is accomplished to provide a uniform pattern of coverage of the wire.

In brief, the present invention is embodied in a construction in which a hollow core, preferably of paper, is provided with a slit extending through its wall for its full length, with plastic flanges or end pads secured to the core ends holding it under compression.

Features of the invention lie in the fact that the spool is a rugged permanent spool for shipping and serving purposes and yet is easily broken from the wire following use of the material carried thereby so that it can be removed with a minimum of difficulty.

Another feature of the invention lies in the solid securement of the flanges to the core while yet being so secured that upon breakage, the flanges separate readily from the core, and correspondingly, to release the compressive force on the tube to permit formation of a gap at the slit.

A further feature of the construction embodying the invention is its economy of production, as well as the protection which it offers for the shipment of the less self-integrated yarn package more desirably used for service of yarn wire insulating operations.

Still another feature of the invention lies in the provision of a construction which allows formation of a yarn serving package which approaches the ultimate as a high way or parallel wind and yet can be formed without fear of its causing difficulty either in shipment or in unwinding operations. In this respect, the end flanges of the construction allow formation of a parallel wind or near parallel wind package without fear of sloughing of the package between formation and use.

Other objects and features which we believe to be characteristic of our invention are set forth with particularity in the appended claims. Our invention itself, however, in both organization and manner of construction, together with other objects and advantages thereof may be best understood by reference to the following description taken in connection with the accompanying drawings in which:

FIGURE 1 is illustrative of the general arrangement by which heavy gauge wire, such as magnet wire, is insulated by apparatus requiring the serving package to be positioned in surrounding relationship with the wire as it is longitudinally passed therethrough and about which the package is revolved to unwind the yarn therefrom;

FIGURE 2 is an end view of a yarn serving spool embodying the principles of the present invention;

FIGURE 3 is a partial cross-sectional elevational view extending across the length of the spool of FIGURE 2 as taken on line 3—3;

FIGURE 4 is an end view of another yarn serving spool incorporating the principles of the present invention; and

FIGURE 5 is a partial cross-sectional view of the serving spool of FIGURE 4 as taken on line 5—5; and

FIGURE 6 is illustrative of the process and apparatus used in molding serving spools according to the principles of the present invention.

Referring to FIGURE 1 in greater detail, the general arrangement of apparatus for providing an insulation covering for wire is illustrated wherein a bare wire **10** is unwound from a supply reel **11** and drawn through a hollow mandrel **17** on which a yarn package **14** is supported in a spool **16**. The mandrel **17** is rotationally driven by a drive mechanism **19**, powered by a drive motor **20** which correspondingly rotates the package **14** supported thereon. The mandrel, spool, and package are surrounded by a serving bell **18** which is supported and rotated with the mandrel **17**. The yarn **15** is withdrawn from the package **14** through a pair of guide eyes **13** on the bell interior upon rotation of the mandrel **17**. The serving bell **18**, by reason of its being anchored to the wire already started, causes a withdrawal of the yarn from the package **14** through guide eyes **13** located on the interior of the serving bell **18**. The mandrel and serving bell are rotated at a relatively high speed in the order of up to 5400 r.p.m.'s or more as the wire **10** is drawn through the hollow mandrel at rates in the order of 25 to 90 feet per minute in being rewound on the take-up reel **12**. One of the guide eyes **13** on the interior of the serving bell are located so that withdrawal of the yarn **15** from the package **14** is accomplished on a relatively straight line from the package, while the second guide eye **13** away from the package directs the yarn more positively to the guiding end of the mandrel in the zone of application of the yarn to the wire.

The insulated wire **21**, prior to being taken up by the reel **12** is drawn through a tubular spool carrier **22** which supports a series of full spools **26** which in sequence are used in replacement for the spool **16** and package **14** upon their being emptied.

In operation, the series of replacement spools are installed one after another as the successive packages being unwound become empty. When the end of the package being unwound is approached, the serving or covering operation is temporarily halted and the end of the package is then tied or spliced to the beginning end of a replacement package. The spool just emptied is then withdrawn from its position on the mandrel within the serving bell **18** and removed from its surrounding relationship on the wire **10**. The first replacement package and spool **26** on the carrier **22** is then removed for replacement on the mandrel and continuance of the covering operation.

The covering operation is continued in this fashion with each successive replacement spool being installed on the mandrel as the one being unwound is emptied until the last spool on the carrier **22** is used up. The wire **10** is then cut, or if a proper predetermination has been made, the end of the wire **10** from the supply reel will have been reached when the last serving package has been consumed in covering the wire.

In view of the foregoing description of the covering operation, it will be seen that efficient operation of the process would dictate that the empty spools **16** and **26** will have to be removed from the wire by special means. According to the present invention, these spools are specially designed with a slit in the core extending for the full length of the core and the end flanges of the spool made frangible so that they can be readily broken to permit removal of the core. In this respect, removal of the empty spool from the mandrel, and corresponding withdrawal thereof from the serving bell, is effected by breaking the flanges one after another, whereupon the tubular core is slid from over the wire by drawing it from the wire by passing it over the wire through the slit for the length of the tube.

One form of the spool construction is shown in greater

detail in FIGURES 2 and 3 wherein the spool comprises a slit tubular core **30**, preferably made of yieldable material such as convolutely wound paper, and the circular end flanges **33** are secured to the extremities thereof. The core **30** is preferably of yieldable material so that upon placement upon the mandrel **17**, it can be readily secured thereto by merely sliding it over the mandrel for snug fit engagement with blisters, knife edges, or other forms of securing projections on the mandrel which therefore are effective in preventing rotation of the spool on the mandrel.

The circular flanges **33** are secured to the tubular core by being molded thereto and are arranged to hold the core under compression with its slit **31** held closed. The flanges are preferably made of resinous material such as a styrene, polystyrene, methyl-methacrylate, phenol-formaldehyde, or urea-formaldehyde, capable of being molded directly on the paper core. The flanges **33** are also preferably transparent so that upon nearing completion of an unwinding operation from the spool, the necessity for replacement can be readily observed by viewing the diminishment of the package size during unwinding of the spool. Reinforcing ribs **34** are formed or molded on the exterior of the flanges **33** to improve their strength and accordingly permit reduction in their thickness and material required for molding.

The extremities of the paper core on which the flanges are secured are provided with circumferentially spaced apertures **32** designed to accommodate a series of radially inwardly projecting lugs **34** molded on the inner surface of the annular flanges **33**. The flanges are molded to the core **30** by inserting the ends of the tube into mold cavities into which the resinous material is injected to form the flanges. Thus, in the same operation in which the flanges are formed, they are secured directly to the ends of the tube **30**.

The tubular core in being provided with a longitudinal slit **31** running from end to end, can be readily removed from its surrounding relationship with the wire **10** upon destruction of the flanges **33**. The slit is provided in the core prior to the flange molding operation and is located at a position about the circumference of the tube between apertures in the extremities of the core to avoid interference of the lugs **34** with the slit. Upon breakage of the flanges for removal from the wire, the core in being yieldable and under compression, springs open to provide a sufficient gap for the slit that the core can be readily withdrawn from the wire therethrough.

FIGURES 4 and 5 illustrate another embodiment of the present invention wherein the spool construction is similar to that of FIGURES 2 and 3 except that in addition to the flanges **43** being molded to the core **40**, break lines or longitudinal depressions **45** are molded across at least a portion of the diameter of the flanges on their exterior surfaces to facilitate breakage of the flanges upon emptying of the package wound thereon. That is, slot-like identations **45** are provided on opposite sides of the aperture in the annular flange extending for at least a part or a full width of the flange between the inner and the outer diameters thereof. Thus, upon need for breakage of the flange and removal of the tubular core from the wire, the break may be more readily effected across the line of the indentations **45** to reduce the manual effort required for removal of the spool from the wire. Upon breakage of the flanges across the indentations **45**, the tubular core **40** springs open by reason of the release of compressive forces of the flanges to permit the core to be withdrawn over the covered wire to permit the replacement tubes to be inserted on the mandrel for continuance of the wire covering operation.

FIGURE 6 illustrates apparatus for molding a spool of the present invention like that of FIGURES 2 and 3. A pair of matched molds **50** and **51** are provided with a pair of spaced flange cavities **53** and an arcuate cut-out portion **54** extending therebetween for accommodation of

the paper core 30 of the spool 16. The paper core 30 has a slit 31 extending for its full length, and spaced apertures 32 circumferentially distributed about both ends of the tube. The core is inserted in place in the cut-out portion 54, whereupon the two mold sections 50 and 51 are closed to place the core under compression under the influence of forces exerted by a piston 58 pressing the mold 51 against the section 50 which is mounted stationarily. A pair of pistons 55 and 56 located above and below the closed mold are then brought together into the top and bottom open of the core 30. The pistons 55 and 56 are slightly tapered and so sized that upon insertion in the top and bottom of the core 30 respectively, a radially outward force is exerted on the interior of the core ends to align the core and to block the apertures 32 in the ends thereof. Resin for molding the flanges is then injected into the injection channel 69 of the mold section 50 for distribution into both of the flange cavities 53.

The plastic is injected under sufficient pressure in the mold cavities that the resin flows into the apertures 32 to form the lugs 34 which in the completed spool secure the flanges 33 to the core 30. The pistons 55 and 56 are then withdrawn and the mold halves 50 and 51 are opened. The completed spool is held by the stationary mold section 50 and is removed therefrom by actuation of an injection ram 57 projected through the rear of the mold section 50.

In view of the foregoing, it will be understood that while we have shown certain particular forms of our invention, that we do not wish to be limited thereto, since many modifications may be made within the concepts of the invention and we, therefore, contemplate by the appended claims to cover all such modifications which fall within the true spirit and scope of our invention.

We claim:

1. A textile spool comprising a tubular body of yieldable material, a slit through the wall thereof extending the length of the tube, apertures extending through the wall thereof spaced circumferentially about the extremities of the tube, annular end-flanges with integral lugs projecting radially inwardly from the inner circumferences thereof into the apertures in the tubular body in tight interlocking securement therewith, each of said annular end flanges having a groove in at least one face intersecting its inner circumference to facilitate and permit clean manual breakage thereof from said tube whereby said tube can be opened for the length of said slit.

2. A textile serving spool comprising a tubular core, said core having a slit in its wall extending from end to end, transparent annular flanges snugly engaging said core at its ends and having projections extending radially inwardly from their inner circumferences, said core having recesses at its extremities into which said projections extend in tight fit accommodation to establish a tight interlocking relationship between said flanges and tube, said flanges each having a groove in at least one face intersecting its inner circumference to facilitate and permit clean manual breakage thereof from said core.

3. A textile serving spool comprising a tubular core of paper composition, said core having a slit in its wall extending from end to end, which slit in unassembled condition of said core is adapted to present an appreciable space gap for the full length of said core, said core also having apertures circumferentially spaced about its ends, annular transparent frangible plastic flanges secured to the ends of said core, said flanges each having integral lugs projecting radially inwardly from its inner circumference with each lug molded in tight fit accommodation into one of said circumferentially spaced apertures, thereby establishing a tight interlocking relationship between said flanges and said core, each of said core flanges having a groove in at least one face intersecting its inner circumference to facilitate and permit clean manual breakage thereof from said core.

4. A textile serving spool comprising a tubular core of paper composition, said core having a slit in its wall extending from end to end, said core also having apertures circumferentially spaced about its ends, annular transparent frangible plastic flanges secured to the ends of said core, said flanges each having integral lugs projecting radially inwardly from its inner circumference with each lug extending in tight fit accommodation into one of said circumferentially spaced apertures, thereby establishing a tight interlocking relationship between said flanges and said tube, and each of said annular end flanges having a diametrical groove in its outer face to facilitate and permit clean sharp manual breakage thereof from said core.

5. A textile spool comprising a yieldable resilient tubular body of paper having a slit through the wall thereof extending the full length of the tube, said tubular body while unassembled in said spool being normally open at said slit, and disk end flanges secured in locked relation to the tubular body holding said body with the wall edges formed by the slit in the tubular body in mated abutting relation under compression with said slit closed, said flanges being locked to said tubular body by having apertures circumferentially spaced about the extremities of the tubular body and extending through the wall thereof, and said annular flanges having integral lugs projecting from their inner circumferences into said apertures in the tubular body in tight interlocking securement therewith.

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