

Sept. 19, 1961

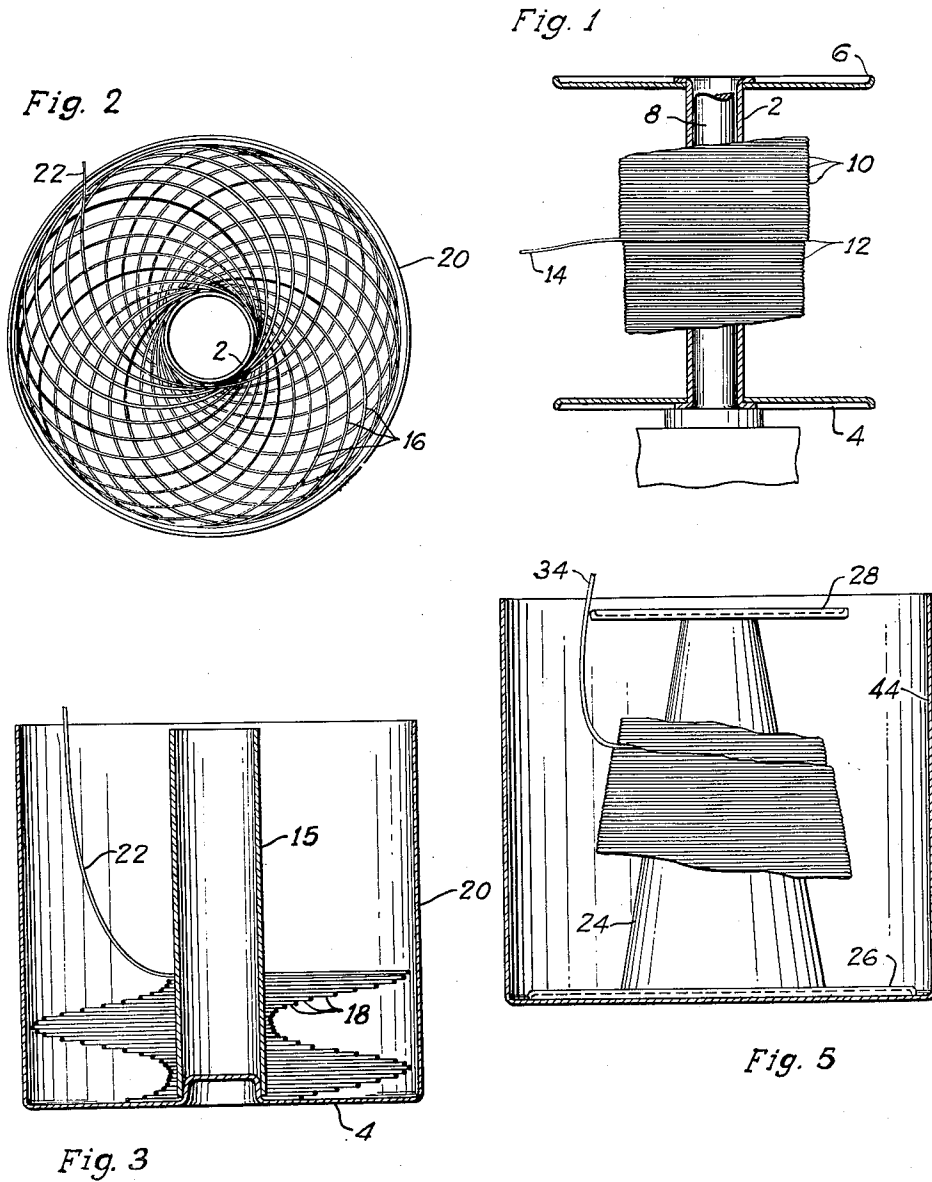
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3,000,493

WIRE PACKAGE AND REEL

Filed July 11, 1957

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

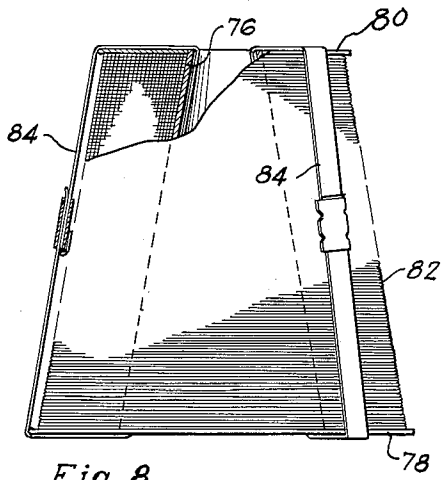


Fig. 8

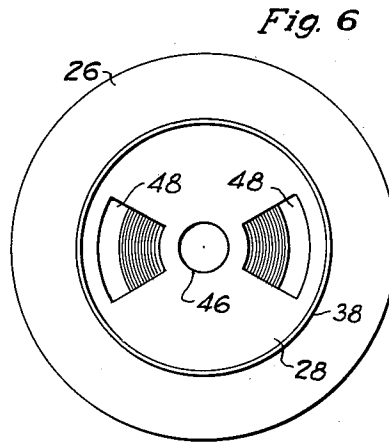


Fig. 6

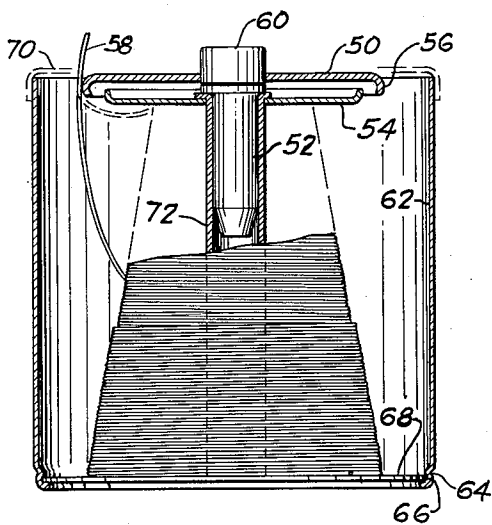


Fig. 7

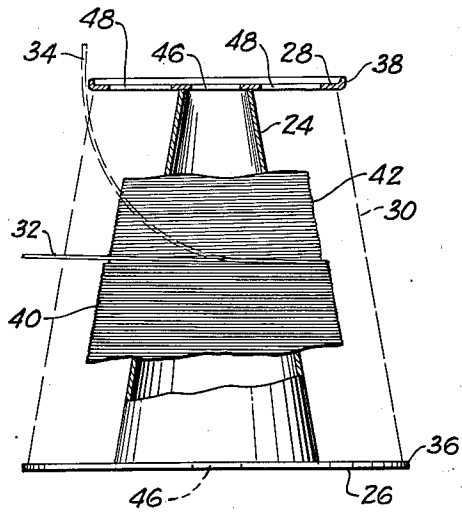


Fig. 4

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WIRE PACKAGE AND REEL
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This invention relates to the packaging of wire and is directed particularly to a new type of holder which is preferably in the form of a reel or spool having wire applied thereto in a manner which facilitates the application and removal of wire from the holder. The invention is especially useful in handling magnet wire or wire of the type used in manufacturing coils, armatures, solenoids and other electrical equipment. The invention is nevertheless of general application for use with wire formed of various sizes and materials.

The type and size of the wire to be used in any operation is, of course, determined by the product being manufactured. However, the type and size of the holder used and the manner in which the wire is laid up on the holder are largely determined by the type of equipment employed in handling the wire. Thus, with some types of coil winding equipment it is advantageous to support the reel on a spindle or arbor for rotation about its axis. When the wire is to be removed from a reel in this manner, it must be laid up on the reel in layers having the turns of the wire arranged side by side or in a random wind lengthwise of the hub of the reel. The wire is thereafter drawn tangentially from the reel as the reel is rotated about its axis. However, the inertia of such a reel of wire is such that breakage of the wire often occurs in starting a winding operation since the wire is often very thin and relatively weak and cannot withstand the strains imposed thereon in sudden starting or rapid acceleration of the reel. Furthermore, when the reel is rotating, it is necessary to employ complicated and expensive braking equipment in order to stop the reel and avoid over-run and tangling of the wire. Moreover, it is desirable to lay up the greatest possible length of wire in a continuous strand on the reel so as to reduce the frequency of work stoppages for changing reels. Therefore, large reels carrying a considerable length and weight of wire are preferred, but the problems due to inertia and over-run are thereby increased. As a result, such packages of wire are not generally adapted for use with modern high speed coil winding equipment and similar devices.

In order to overcome these difficulties and eliminate the inertia of a rotating reel, the wire is often drawn off the reel over one end flange thereof while holding the reel stationary. This method of removing wire renders it possible to use larger packages of wire. On the other hand, in order to permit the high speed dereeling required by many modern coil winding devices, it has been found desirable to arrange the wire within a pail or similar container and to remove the wire from the upper portion of the container through the open top thereof. For this purpose it is usual to lay up the wire in loose coils or turns within a pail or other similar container with the coils generally disposed in circumferentially displaced relation about a hub or core fixed centrally in the pail. The loose coils are thus, in effect, stacked one upon another from the bottom of the pail toward the top. This type of packaging is sometimes known as "Rea Pak." The loose arrangement of turns of wire within a pail limits the weight and length of wire which can be packaged in a container of given size. Furthermore, it is not possible to draw off the wire tangentially from such a package and, therefore, such packages cannot be used with the older types of coil forming equipment.

Thus, the manner in which the wire is laid up on a

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reel has heretofore determined the manner in which it may be removed from the reel. Prior art wire packages accordingly have not been interchangeably or universally applicable for use with different types of coil winding or wire using equipment.

A further objectionable characteristic of prior art wire packages, whether random wound or stacked about a hub within a pail, arises from the fact that the central hub or body of the reel has been of a cylindrical form which allows the wire to settle or slip axially along the hub whenever the reel is set on end or in the event the turns of wire should become loose during storage or shipment, or during a winding or unwinding operation. As a result, the tangling and breakage of wire has presented a serious problem which causes frequent stoppages of the equipment no matter what type of coiling of the wire is employed. Moreover, the loose coiling of wire within a pail makes it necessary to fill the pail to the top in order to prevent displacement and tangling of the turns of wire and, therefore, customers cannot purchase a half pail or limited quantity of any given size of wire. In fact, when loose coils of wire are stacked about a hub in a pail to permit high speed dereeling, the problem of tangling becomes more serious since the danger of axial displacement increases the danger of tangling, whereas the difficulties presented in untangling such loose coils of wire often render it more economical to scrap the tangled wire rather than to attempt to untangle it.

In accordance with the present invention, these objections and limitations inherent in wire packages of the prior art are overcome, and a new type of package provided whereby an increased weight of wire in the form of a continuous length can be carried by a spool or reel and yet the wire can be drawn off the reel either tangentially, with rotation of the spool, or endwise from a stationary reel by spinning over an end flange thereof. At the same time, slippage or displacement and tangling of the wire remaining on the reel is reduced to a minimum.

These advantages are preferably attained by providing a reel with a hub or body portion which is generally conical in form and by providing the reel with flanges at both ends of the body. Wire may be wound tightly on such a reel, using either layer or random winding and if desired, universal winding of the type wherein successive coils are helical in form and opposite in pitch may be employed. Because of the tight winding, a relatively great weight of wire may be wound on the reel, whereas the conical form of the body or hub of the reel serves to decrease slippage of the turns axially along the conical body by reason of the tightening of the wire due to increase in diameter of the body in an axial direction. The wire may be laid up on reels of this type at high speeds and directly from drawing, enameling and other wire forming equipment without any intermediate operations.

In a preferred embodiment of the invention, the end flange adjacent the smaller end of the body is of less diameter than the end flange at the opposite or larger end of the body. Further, if desired, the reel may be provided with a rotatable end plate or guide means which aids in guiding the wire from the upper or smaller turns on the reel when the wire is spun off over the smaller end flange of the reel.

Wire packages of this type can be used interchangeably on practically all types of coiling, winding or wire using equipment.

Accordingly, the principal object of the present invention is to provide a novel type of wire package which is interchangeably usable with different types of unwinding and dereeling equipment and with either high speed or low speed coil winding devices.

Another object of the invention is to provide a novel type of reel or spool for use in wire packaging.

A specific object of the invention is to provide a wire package embodying a hub or body which is generally conical in form and provided with an end flange adjacent the smaller end of the body which is of less diameter than the flange at the larger end of the body.

Another specific object of the invention is to provide a wire package comprising a reel having wire carried thereon and arranged in a tight conical form about a central core or hub.

These and other objects and features of the present invention will appear from the following description thereof wherein reference is made to the figures of the accompanying drawing.

In the drawings:

FIG. 1 is a diagrammatic illustration of a known type of wire package wherein the wire is laid up in layers or random wound upon a cylindrical hub permitting tangential removal of the wire from the reel;

FIG. 2 is a diagrammatic plan view of a known type of wire package wherein the wire is arranged in loose stacked turns or coils designed for spinning of the wire out of a container;

FIG. 3 is a vertical sectional view of the construction shown in FIG. 2;

FIG. 4 is a vertical sectional view through a preferred type of wire package embodying the present invention;

FIG. 5 is a sectional view through a container including a wire package of the type shown in FIG. 4;

FIG. 6 is a top plan view of the combination illustrated in FIG. 5;

FIG. 7 is a side elevation of an alternative construction embodying the present invention; and

FIG. 8 is a side elevation of a further alternative construction embodying the present invention.

The type of wire package illustrated in FIG. 1 of the drawings is typical of those heretofore used in that it embodies a reel having a hub or cylindrical body 2 and similar end flanges 4 and 6 forming a reel or spool. The body is provided with a central opening so that the reel may be rotatably mounted on a spindle or support 8. The wire is laid up on the body 2 in adjacent or random turns 10 of equal diameter arranged in layers 12 whereby the wire may be drawn tightly about the body 2 during application and may be removed tangentially from the package as shown at 14 while the reel is rotatable on spindle 8.

The wire package shown in FIGS. 2 and 3 is of the high speed dereeling type wherein the wire is coiled about a cylindrical hub or body 15 in the form of a series of relatively loose turns 18 within a pail 20 to which the body 15 is secured. The turns of wire 18 are substantially larger in diameter than the body 15 and arranged in layers one upon another progressing from the bottom flange of the pail 20 to the top thereof. Packages having wire arranged therein in this manner are held in fixed position during the dereeling, or more accurately, the depailling operation.

The limitations and objections to wire packages of the type shown in FIGS. 1, 2 and 3 have been indicated above and are overcome in accordance with the present invention by providing constructions of the type shown in FIGS. 4 to 7 of the drawings. As shown in FIGS. 4, the reel is provided with a central hub or body 24 which is generally conical in shape and has a lower end flange 26 secured to the larger end of the conical body 24 and an upper end flange 28 secured to the smaller end of the body. The flange 28 is smaller in diameter than flange 26 but the radial difference between the outer surface of the body 24 and the periphery of the flanges 26 and 28 is preferably approximately the same whereby wire may be laid up on the body 24 in uniform thickness as indicated by the dotted line 30.

As further indicated in FIG. 4 the wire may be ap-

plied to the body 24 in closely or tightly wound turns in layers or random winding generally similar to the method of application shown in FIG. 1. The wire therefore can be removed tangentially from the reel as shown at 32 by rotation of the reel about its axis. In the alternative, the wire may be spun off over the smaller upper end flange 28 of the reel as shown at 34 while holding the reel stationary for high speed dereeling of the wire. Reels embodying the present invention, therefore, can be used interchangeably with winding equipment designed for either tangential withdrawal of the wire with rotation of the reel or by endwise spinning for high speed dereeling as the wire is drawn off over the smaller end flange 28 of the reel.

Since the wire can be tightly wound on the body 24 of the reel, the reel may carry a great length and weight of wire for continuous operation of coil winding means without frequent stoppage for the replacement of reels. Furthermore, axial slippage or movement of the wire along the body 24 of the reel is substantially prevented by reason of the axially increasing diameter of the body. The coils automatically tend to tighten themselves on the body and against each other upon settling or axial movement of the turns of wire relative to the conical body. For this reason the danger of tangling of the wire is substantially reduced even if loosening of the wire should occur during shipment or usage of the wire.

While the larger lower flange 26 of the reel may have a square or sharp edge 36, the outer peripheral edge 38 of the upper end flange 28 is preferably rounded so as to provide a smooth guiding surface for the wire 34 when dereeling is effected by spinning off over the end flange.

It will further be noted that by reason of the conical arrangement of the wire upon the body 24, the diameter of the turns of wire drawn from the lower portion of the reel near the end flange 26 is relatively large and frequently exceeds the diameter of the end flange 28. Such greater diameter of the turns of wire as it is drawn from the reel at points removed from the end flange 28 reduces the tendency for lower turns of wire to rub across or axially displace the upper turns of wire forming an inner layer of turns 42. This increase in diameter, together with the centrifugal force which tends to cause the wire 34 to swing outward from the reel during the dereeling operation, greatly decreases the danger of tangling of the wire even though withdrawn from the reel at very high speeds. In fact, with the present invention it is possible to draw wire from the reel at speeds of 2000 feet per minute or more, whereas such high speed dereeling of wire from packages of the type shown in FIGS. 2 and 3 renders it necessary to use special vibration damping means to prevent tangling of the loose turns of wire. Moreover, the wire may be laid up on the reel of FIG. 4 at high speeds, say 1500 to 2000 feet per minute, directly from wire forming, enameling or treating equipment whereas such direct and high speed coiling operations cannot be employed in producing packages of the type shown in FIGS. 2 and 3.

In that form of the invention shown in FIG. 5, the reel is of the type illustrated in FIG. 4, but is employed in combination with a pail or container 44. The reel may simply be placed in the pail for dereeling thereof and after the desired length of wire has been drawn therefrom, the reel may be removed and another reel carrying a different size of wire can be inserted for a different winding operation. Thus any number of reels can be used with the same pail or dereeling container whereby any desired number of reels and sizes wire can be conveniently carried in storage by the user without storing a large number of pails, many of which may contain only a limited amount of wire.

Further, as shown in FIG. 5, the reel, whether layer or random wound, or even if universally wound, may be placed within or secured to the can or pail 44 to limit the outward swing of the wire 34 as it is spun off

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over the end flange 28 of the reel. The diameter of the larger flange 26 of the reel may be substantially equal to the internal diameter of the pail 44 since the inward sloping arrangement of the coils on the reel provides adequate clearance between the outer turns of the wire and the inner surface of the pail 44 to permit free upward movement of the wire as it is drawn from the lower portion of the reel. At the same time the smaller diameter of the upper flange 28 of the reel provides ample space between the edge of the upper flange and the sides of the pail 44 to permit free spinning of the wire off over the end flange.

As shown in FIG. 6, both end flanges of the reel may be provided with central openings 46 to permit mounting of the reel on a spindle or support for rotation about its axis when tangential dereeling is desired. Further, the upper end flange 28 is preferably provided with radially extending openings in the form of segments 48 through which the wire may be seen, so that an operator may, at any time, see how much wire remains on the reel. The coil winding or other wire using equipment, therefore, can be stopped or slowed down as the wire is exhausted.

As shown in FIG. 7, a separate and additional wire guiding disc 50 may be applied to the upper end of the reel by insertion of a spindle 52 into the central opening 46 in the upper end flange 54 of the reel. The guiding disc 50 thus provided is preferably formed with a downwardly or upwardly turned outer edge portion 56 which is suitably rounded for smooth engagement with the wire 58 as it is spun off over the upper end of the reel. The guiding disc preferably also is mounted on an anti-friction bearing means 60 secured to the spindle 52 whereby the guiding disc 50 can rotate freely while serving to cause the wire 58 to pass around the edge 56 of the guiding disc 50. The angle at which the wire 58 passes to the coiling device or other guide means is thus maintained constant despite the fact that the diameter of the turns of wire adjacent the upper and lower flanges of the reel may differ considerably.

The construction shown in FIG. 7 also embodies other modifications which may be employed in the constructions of FIGS. 4, 5 and 6. Thus, instead of using the conventional or fully formed pail 44 of FIG. 5, the pail may be composed of a cylindrical wall member 62 having a bead or channel 64 extending about the lower edge thereof for clamping engagement with the squared or otherwise formed edge 66 of the larger lower flange 68 of the reel. The flange 68 thus, in effect, forms the bottom of the pail, whereas the top of the pail may be closed by a conventional lid as shown in dotted lines at 70 in FIG. 7. The lid 70, of course, will be removed when the package is opened for dereeling or use of the wire or when the guiding disc 50 is to be employed.

Further, as shown in FIG. 7, the body or hub 72 of the reel may be cylindrical in form while the wire is laid up on the reel in a conical form as indicated. The thickness or depth of the layers of wire applied to the body adjacent the lower larger flange 68 of the reel will then be greater than that adjacent the smaller upper flange 54 of the reel.

As shown in FIG. 8, the form and construction of the reel or spool may be varied. Thus the body 76 of the reel in FIG. 8 is formed of stiff rigid material, whereas the lower flange 78 and the upper flange 80 of the reel are formed of relatively light cardboard. The wire 82 is laid up upon the body 76 as in the construction of FIG. 4 and is held in place on the body during shipment or handling by the metal straps or bands 84. When the wire is to be used, the package may be placed in a pail as shown in FIG. 5 and the bands 84 can then be cut and removed to release the wire for depailling from the body 76.

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The upper end flange 80 of the construction of FIG. 8 may be removed altogether from the body 76 for depailling of the wire if desired. Similarly, the smaller flanges of the reels shown in FIGS. 4, 5 and 7 may be of a loose head or removable type if desired. Such loose head reels are especially useful when a wire guiding disc such as that shown at 50 in FIG. 7 is used in depailling or dereeling the wire.

The size and diameter of reels embodying the present invention may of course be varied depending upon the size and length of wire to be carried by the reel. Furthermore, the angle of inclination or taper of the body 24 of the reel may be varied although in practice, it has been found that an inclination of approximately 3 to 10 degrees with respect to the axis of the reel is preferred. The hub or body of the reel in any of the forms of the invention preferably presents a corrugated, knurled or roughened surface to limit slippage of the wire thereon, and the body and end flanges may be formed of any preferred type of material or combinations of materials desired.

It will thus be apparent that the size and form of wire packages embodying the present invention may be varied considerably while permitting the reel to carry the maximum length of wire. At the same time, the package may be used interchangeably with substantially any type of coil winding or wire using equipment. It will, therefore, be apparent that the manner of laying up the wire on the reel and the methods employed in dereeling or unwinding the wire can be varied at will. In view thereof it should be understood that the particular embodiments of the invention chosen for purposes of illustration in the drawings are intended to be illustrative only and are not intended to limit the scope of the invention.

I claim:

1. A wire shipping, storage, handling and dispensing package from which wire can be drawn through the open top end thereof at high speeds, comprising an enclosure open at one end and having a smooth cylindrical inner surface, a removable reel unit, having a conical core with radially extending flanges at opposite ends thereof, the flange at the smaller end of the core being of smaller diameter than the flange at the larger end of the core, and a body of wire closely wound on said core, in a plurality of layers extending generally parallel to the surface of said core, so that said body is of substantially uniform thickness throughout the length of the core, and means for supporting said reel unit concentrically within said enclosure so that its smaller flange is substantially in the plane of the open end of the enclosure to form an annular gap therewith through which the wire can be withdrawn.

2. In the combination of claim 1, said last means comprising a seat formed on said enclosure on which said larger flange rests.

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