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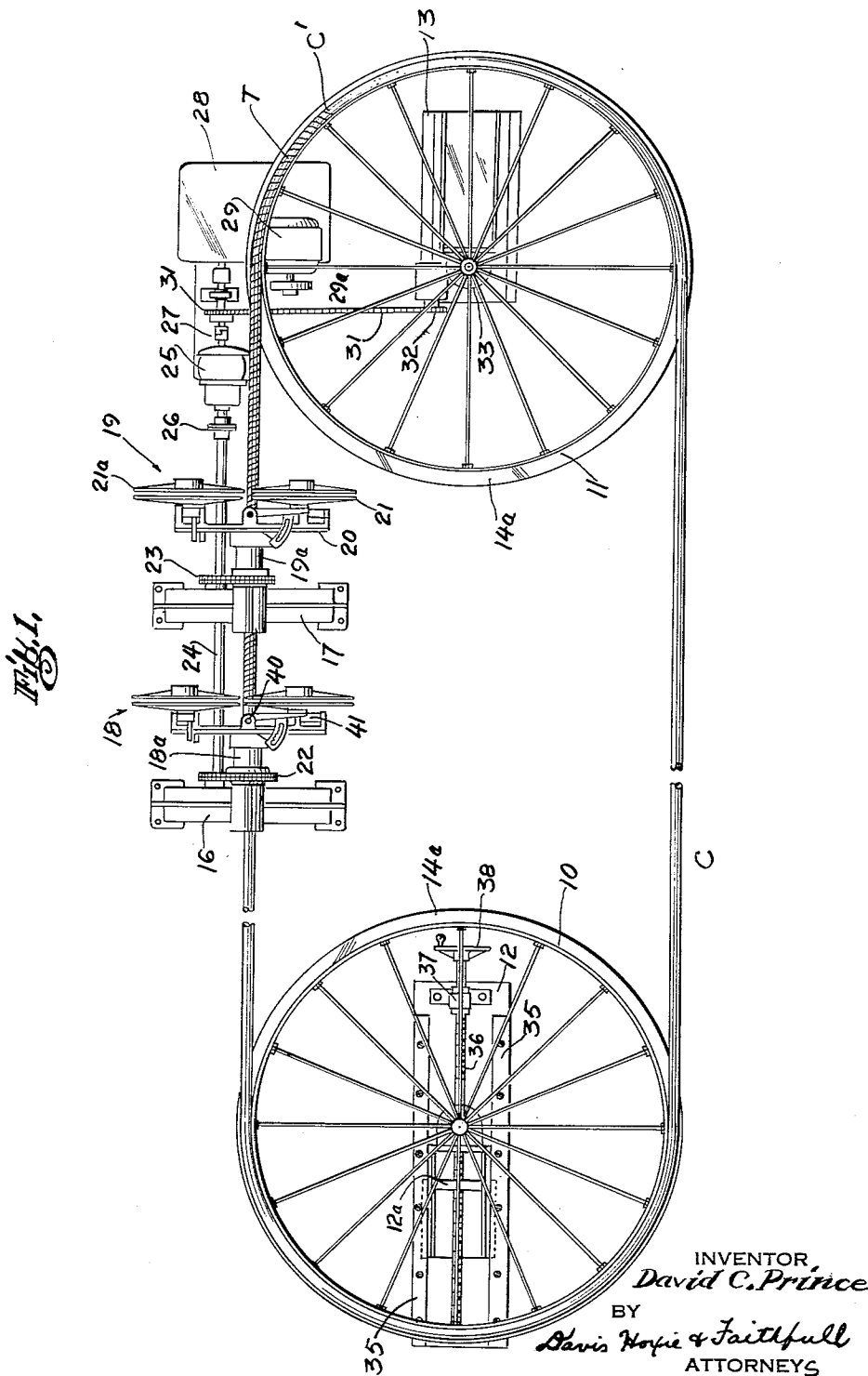
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MANUFACTURE OF INSULATED ELECTRIC CABLES

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2 Sheets-Sheet 1



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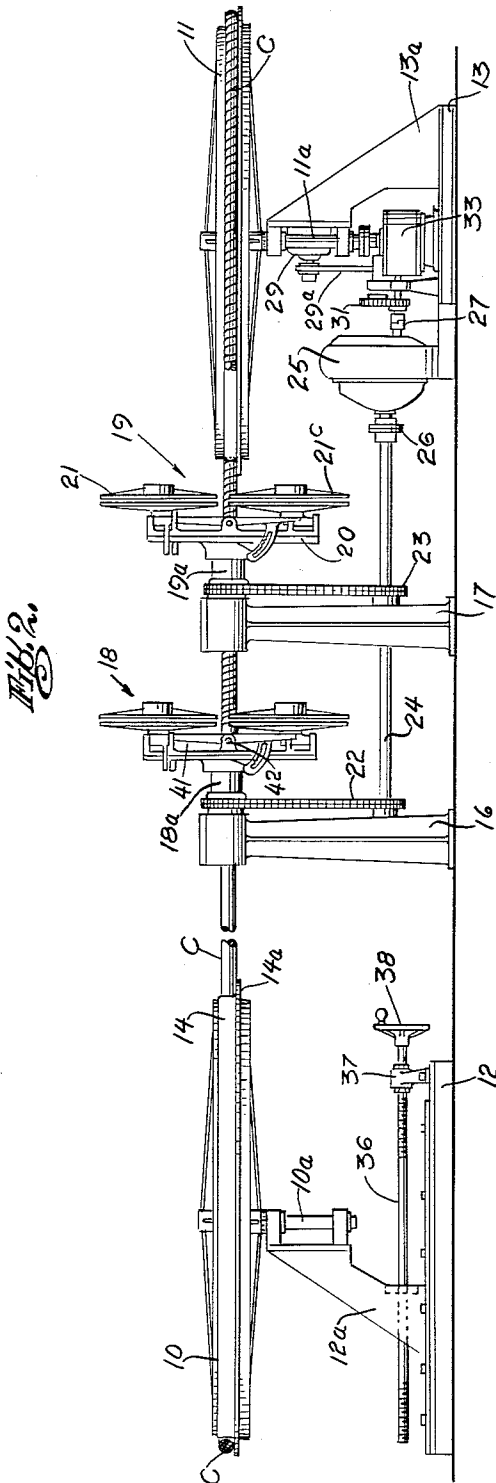
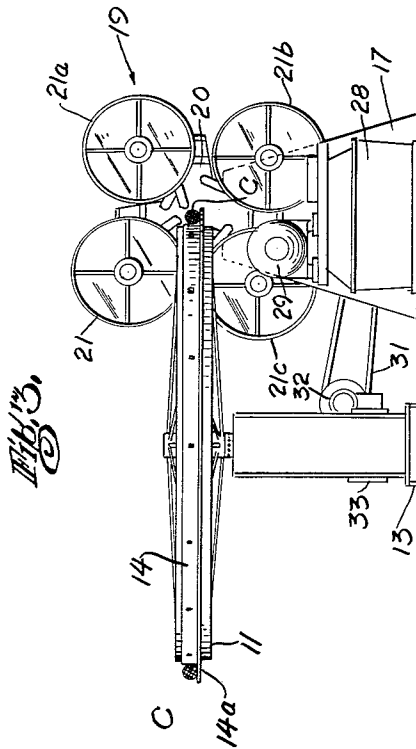
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1

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MANUFACTURE OF INSULATED ELECTRIC CABLES

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2 Claims. (Cl. 154—2.27)

This invention relates to the manufacture of insulated electric cables of the type having a central conducting core and layers of insulating tape wrapped around the core. It is concerned particularly with an improved method and apparatus for wrapping the tape layers around the conducting core.

In taping electric cables according to conventional practice, the conducting core is drawn from a supply reel to a take-up reel by way of a series of taping heads, the number of which depends upon the number of tape layers to be wound upon the core. Each taping head is rotated about an axis through which the path of the conducting core extends and carries at least one and commonly four tape supply reels. As the head rotates about the moving conducting core, the tapes are wound in spiral fashion around the core from the tape reels carried by the head. The pitch of each spiral tape layer, or the lead between the edges of the tape in one layer on the core, is determined by the linear speed of the core relative to the speed at which the taping head is rotated about the core.

It is frequently necessary to wrap a large number of tape layers around the conducting core, for example, up to one-hundred layers or more. Since each taping head cannot usually be provided with more than four tape supply reels, this means that a large number of separated taping heads must be mounted in sequence along the path of the conducting core between its supply and take-up reels. Consequently, the numerous taping heads and their associated stands will occupy a large space for the taping machine itself, for example, in the order of 170 linear feet where one hundred thirty-six tape layers are to be wrapped on the cable from thirty-four taping heads each having four tape supply reels. The problem of providing the necessary space for a taping machine of this size will be readily apparent.

A further difficulty with conventional cable-taping practices is that they do not lend themselves to the manufacture of short lengths of cable economically. Thus, in the example given above, it would be necessary to attach a leader of 170 feet to the leading end and a tail of 170 feet to the lagging end of the useful cable section, in order to pass the cable through the machine. In practice, it is feasible to use such machines only for taping long lengths of cable, at least as long as the machine itself.

The principal object of the present invention is to provide a method and apparatus which overcome the above noted difficulties.

According to the invention, the conducting core which is to constitute the central part of the finished cable is first formed into a closed loop by joining the ends of a core section corresponding in length to the desired length of the finished cable. The looped core is then cycled once in an endless path through a wrapping zone while winding at least one layer of tape around the core in this zone. This initial pass of the loop is followed by one or more additional passes through the tape wrapping zone, until the desired number of tape layers has been

2

wound on the conducting core. The loop is then cut to form one or more lengths of the finished cable.

The cable taping apparatus of the present invention, in its preferred form, comprises a pair of cable reels having peripheral portions adapted to support the conducting core. These cable reels are mounted for rotation about spaced axes and are arranged with their peripheral portions partly defining a closed path for an endless loop of the core. The taping zone is formed by one or more taping heads mounted between the reels and rotatable about an axis through which the closed path for the loop extends. The taping head, which may be of conventional design, is driven to wind the tape or tapes on the conducting core; and means are provided for driving one of the cable reels to cycle and recycle the core loop through the closed path which includes the taping head. One of the cable reels is preferably supported on a movable mount so that it can be adjusted bodily relative to the other cable reel. In this way, the spacing between the cable reels can be varied so that these reels are adapted to support core loops of different sizes.

For a better understanding of the invention, reference may be had to the accompanying drawings, in which,

Fig. 1 is a plan view of a preferred form of the new cable-taping apparatus;

Fig. 2 is a side elevational view of the apparatus shown in Fig. 1, and

Fig. 3 is an end view of the apparatus shown in Figs. 1 and 2.

Referring to the drawings, the apparatus there shown comprises a pair of reels 10 for supporting an endless loop of the conducting core C. These cable reels are rotatable about vertical axes and are mounted on bases 12 and 13, respectively. The supporting bases are provided with vertical sections 12a and 13a in which the vertical shafts 10a and 11a, respectively, of the cable reels are journaled.

The cable reels 10 and 11, as shown, are spaced apart in a common horizontal plane. The peripheral portion of each reel is formed by a metal rim 14 which is provided at its lower portion with an outwardly extending radial flange 14a adapted to support the conducting core C. As will be observed from Fig. 1, the two cable reels 10 and 11 are arranged to support a closed loop of the conducting core C, which may be formed by joining the ends of a section of the core in any suitable manner at C'.

Between the cable reels 10 and 11 are a pair of stands 16 and 17 for supporting taping heads 18 and 19, respectively. These taping heads include hollow hubs or axles 18a and 19a, respectively, rotatably mounted on the stands and disposed in the endless path of the core C looped around the cable reels, so that the cable loop extends through these hubs. Each taping head also comprises an aperture plate 20 secured to its corresponding hub and rotatable therewith, it being understood that the cable core extends through the plates 20 as well as their hubs. Each plate 20 carries four tape supply spools or reels 21, 21a, 21b, and 21c rotatably mounted on the plate and spaced equidistantly about the axis of its hub. Since taping heads of this general type are well known in the art, it is unnecessary to describe the further details of the heads 18 and 19. While I have shown two of these heads mounted between the cable reels, it will be understood that any other desired number of such heads may be employed; and the number of tape supply reels 21 carried by each head may also be varied.

The hubs 18a and 19a of the taping heads are rotated through chain drives 22 and 23 from a common shaft 24 rotatably mounted in the stands 16 and 17. The shaft 24 is connected to a variable speed transmission 25 through a flexible coupling 26. The transmission 25, in turn, is

connected through a clutch 27 to another variable speed transmission 28. The latter is driven by an electric motor 29 mounted on top of the transmission housing and connected to the transmission through a driving belt 29a.

The motor 29 also drives the adjacent cable reel 11 through a sprocket chain 31. As shown, the chain 31 is connected to the driving connection from motor 29 at a point between the variable speed transmission 28 and the clutch 27. The chain 31 drives a gear 32 on the base 13, and the gear 32 drives the vertical shaft 11a of the cable reel through a gear reduction assembly 33.

One of the cable reels 10 and 11 is supported on an adjustable mount. As shown, the adjustable mount is associated with the reel 10 and comprises a pair of rails or ways 35 secured to the base 12 and extending in the direction of the other cable reel 11. The vertical portion 12a of the base 12 is in the form of a carriage slidable in the ways 35. The carriage 12a may be adjusted toward or away from the cable reel 11 by an adjustment device in the form of a rod 36 threaded in a bracket 37 on the base 12. One end of the rod is rotatably secured in the carriage 12a while the other end is provided with a hand wheel 38.

In the practice of the invention with the apparatus as described, the ends of the desired length of conducting core C are joined together at C', and the resulting loop is placed upon the cable reels 10 and 11 so that it is supported by the flanges 14a. Any slack in the loop can be taken up by rotating the hand wheel 38 so as to move the reel 10 away from the reel 11. The ends of the tape rolls carried by the heads 18 and 19 are then wound initially around the core C in the proper sequence, to establish starting connections between the core and the tapes. The motor 29 is then started to drive the cable reel 11 and the heads 18 and 19 simultaneously, so that the tapes are wrapped in the proper sequence around the core as the latter moves through the taping heads, as shown at T. It will be understood that each complete cycle of the looped core C around its closed path on the reels 10—11 will result in the winding of eight layers of tape on the core, one layer for each of the eight tape reels 21 on the heads 18 and 19. Thus, if it is desired to wrap sixteen tape layers on the core, the latter is cycled twice through its closed path before the taping operation is discontinued; and three complete cycles of the core will result in a cable having twenty-four tape layers, etc. Consequently, the number of tape layers (in multiples of eight) on the finished cable can be determined simply by controlling the number of times the core loop is to be recycled in its closed path through the taping heads. When the taping machine is stopped after application of the desired number of tape layers, the resulting cable is cut, as at C' and removed from the machine.

By moving the cable reel 10 away from the reel 11, through operation of hand wheel 38, the apparatus can be made to accommodate a larger loop of the conducting core; and, conversely, movement of the reel 10 toward the reel 11 will adjust the apparatus to take a smaller loop of the core. In this way, the length of the finished cable can be readily varied in different runs.

From the foregoing, it will be understood that any desired number of layers of tape may be wound on the cable with the use of only two taping heads (or even a single taping head) by simply recycling the loop through its closed path on the cable reels. The set-up time required for initially attaching the ends of the tapes to the core from the tape supply reels 21 is obviously much less than that required in the conventional practice, where each tape layer on the finished cable is supplied from a separate tape supply reel. Since the finished cable is endless, there is no wastage on either end after the loop is cut.

The practice of the present invention also enables the

manufacture of a cable of improved quality. The radius on which cables of this type can be bent depends upon the spacing between the individual turns of each tape as it is wound. This spacing or lead should generally be such that there will be approximately $\frac{1}{16}$ " between the edges of the tape in each layer. When a large cable is bent, the tapes on the inside of the bend tend to come together, while the tapes at the outside of the bend tend to open an increasing gap. If the gap between the turns of the outer layers of the tape could be made larger, the cable could be bent on a smaller radius, and this bending could be effected even if a smaller gap is provided between the turns of the inner tapes. With the present invention, it is possible to change the lead of the tape turns as the diameter of the cable grows, by adjusting the variable speed transmission 25 so as to vary the rotational speed of the heads 18 and 19 relative to that of the cable reel 11. Thus, after the core loop C has made one or more cycles through the taping heads, the transmission 25 may be adjusted to decrease the angular speed of the taping heads relative to that of the reel 11, so as to increase the lead or gap between the subsequent turns of tape wound upon the core in the subsequent recycling of the core. In this way, the gap or lead between the turns of the outer layers on the finished cable can be made relatively large as compared to the gap between the turns of the inner layers. Also, in cases where the first layers of tape on the core are foil layers, which require a different lead than the subsequent layers, the change in the lead can be readily effected after one or more cycles by adjusting the variable speed transmission 25.

The relative locations of the individual tape layers on the cable can be adjusted by changing the relative positions of the tape supply reels 21 on their respective heads. For this purpose, each hub 18a—19a has a shoe 41 secured thereto on a pivot 40 (Fig. 1), and the plate 20 is secured to the shoe 41 by means of a pivot 42 at right angles to the pivot 40. Accordingly, when the hub 18a or 19a is stationary, the corresponding plate 20 can be swung about a horizontal axis as well as a vertical axis to vary the relative positions of the tape reels 21 along the path of the conducting core. These and other arrangements for the same purpose are well known in the art.

By adjusting the variable speed transmission 28, the operating speed of the machine can be changed without altering the speed ratio between the taping heads 18—19 and the driven cable reel 11.

I claim:

1. In the manufacture of insulated electric cable having a conducting core and layers of tape wrapped around the core, the improvement which comprises forming a closed loop of said core, making a first pass of the looped core in an endless path through a wrapping zone while winding at least one layer of tape around the core in said zone, making a second pass of the core through said zone to wind at least one more tape layer around the core, and cutting the wrapped loop to form a length of insulated cable.

2. The improvement according to claim 1, in which the lead between the edges of the tape wound in each of said passes is maintained substantially constant, but said lead in the second pass is greater than the lead in the first pass.

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