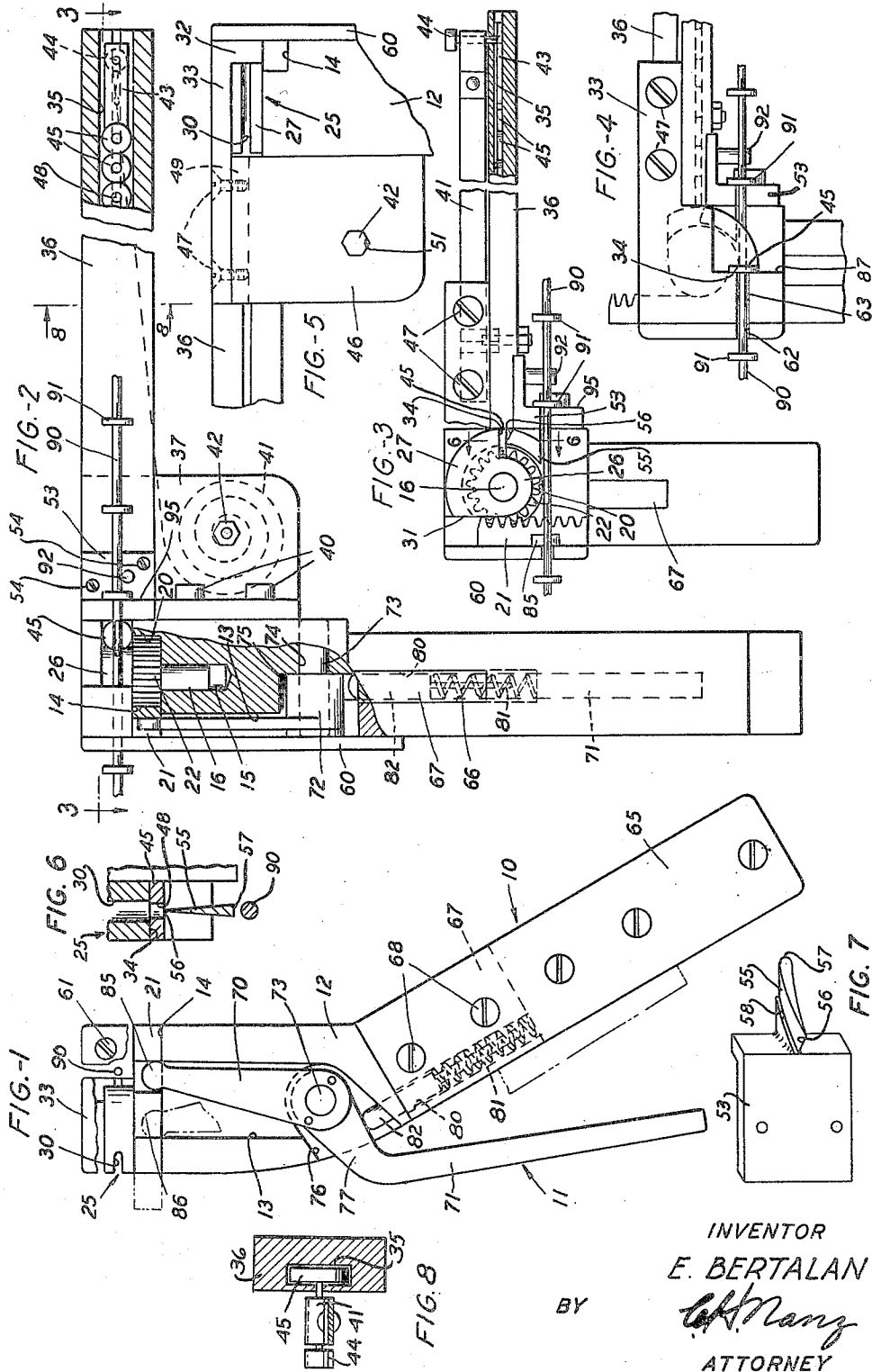


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ASSEMBLING APPARATUS

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ASSEMBLING APPARATUS

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This invention relates to assembling apparatus and more particularly to apparatus for applying insulating discs upon a conductor.

The present invention embodies apparatus for applying relatively soft, plastic insulating discs upon the central conductor of a core unit used in the manufacture of coaxial cable units. A plurality of these coaxial cable units may be combined to form a coaxial cable used in telephone and television transmission networks. A coaxial unit usually comprises a core unit made up of a central conductor having a plurality of annular insulating discs uniformly spaced thereon, an outer tubular conductor formed over the core unit, and thin steel tape spirally wound around the outer conductor.

The various operations necessary to form these coaxial units usually are incorporated and coordinated in a single coaxial unit forming machine. Such machines are provided with means for detecting the failure of the disc applying mechanism to apply a disc to the moving conductor at a desired point, and means for detecting the presence of foreign conductive matter in the discs. If there is a missing disc, a disc must be manually applied at the appropriate position on the central conductor. If there is a defective disc, it is necessary that the old disc be removed and a new disc be applied manually to the conductor at the point where the defective disc was removed.

It is obvious that the application of an insulating disc on the central conductor at this stage in the manufacture of a coaxial cable unit must be performed by a manually operated apparatus. The particular functions to be performed by the manually operated apparatus are governed mainly by the kind of insulating material used in making the discs to be applied to the conductor. Irrespective of the type of material used in the manufacture of the insulating discs or the type of coaxial unit forming machine used for applying the discs on the central conductor, it is clear that, in order to assemble annular insulating discs on the central conductor, they must be provided with a radial slit or slot communicating with the center aperture thereof so that, when the discs are applied to the conductor, the conductor may pass therethrough into the center aperture.

It has been suggested heretofore that insulating discs used in the manufacture of coaxial cable units be made of a suitable stiff material, such as hard rubber, or from a plastic, such as polystyrene. However, because of the relatively poor electrical characteristics of hard rubber and the manufacturing difficulties involved in using polystyrene, the insulating discs generally used in the manufacture of coaxial cables are made of the plastic known as "polyethylene."

As its name implies, polyethylene is obtained by polymerizing ethylene. The usual commer-

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cial form of polyethylene is a moderately soft, pliable material having a high molecular weight and possessing excellent electrical insulating characteristics. Polyethylene is sufficiently hard to permit insulating discs made therefrom to maintain their shapes under ordinary circumstances, but it is soft enough to cause some manufacturing difficulties to arise when slotted discs are punched from strips thereof.

Furthermore, when slotted discs of the type formerly made of hard rubber were made of polyethylene and were forced upon a central conductor, the sides of the slots occasionally were deformed by the passage of the conductor therethrough. As a result, the discs would not adhere firmly to the central conductor and would tend to slide along the conductor or might even come off the conductor. In addition, it is relatively easy to force such discs off the conductor by a thrust applied on the sides of the discs opposite the slots and substantially longitudinally of the conductor, because the small amount of the material in the walls of the slots against which the conductor presses under those circumstances does not possess enough sheer strength to hold the discs in place. Consequently, coaxial cable units could not be satisfactorily manufactured by using discs made of polyethylene which had been pre-slotted and then forced on the central conductor.

In order to overcome these manufacturing difficulties, it was necessary to provide suitable means for cutting radial, line-like slits in centrally perforated polyethylene insulating discs, means for holding the slits open so that the central conductor may be passed therethrough into the central aperture without damaging the forward corners and sides of the slits, and means for applying the slitted discs to a central conductor with a wiping motion. It is evident that by cutting a line-like, radial slit from the center aperture to the periphery of the disc, no material is removed from the disc. By virtue of this fact, the entire wall surface of the center aperture of the disc is preserved, and when such radially slit discs are in position on a central conductor, they will readily withstand considerable thrust applied on the sides of the discs adjacent to the slit.

Furthermore, discs so applied to a central conductor adhere more forcibly thereto because the natural resiliency thereof causes the sides of the radial slit to close together, whereby the conductor is firmly gripped by the walls of the center aperture and is also engaged by a substantially solid ring of insulating material. It is obvious that the manual application of such plastic discs must be performed by a tool which will also slit and apply the discs to the conductor in the above-described manner and must also have means for spacing the manually applied discs with respect to the discs already present on the conductor.

The present invention comprises an apparatus for radially slitting and applying plastic insulating discs upon a conductor with a wiping motion in one operation. Preferably, means are provided for gauging the position of the manually applied discs with respect to the adjacent discs present on the conductor.

An object of the invention is to provide new and improved assembling apparatus.

In one embodiment of the invention there is provided a plier-like tool having a disc supply magazine secured to the nose portion thereof. An oscillatory disc carrier is positioned on the nose portion and aligned with the discharge end of the disc magazine. A knife is positioned on the nose of the tool so that its cutting edge is adjacent to the shoulder of the disc carrier, whereby when the disc carrier is oscillated, a disc engaged thereby is carried past the knife, which cuts a radial slit in the disc and serves to hold the slit open so that the disc may be applied to a conductor with a wiping motion.

A clear understanding of the invention may be had from the following detailed description of a specific embodiment thereof, when read in conjunction with the appended drawings, in which:

Fig. 1 is an end view of a tool, which may be used to practice the invention, having portions of the cover plate broken away;

Fig. 2 is a right hand side view of the tool shown in Fig. 1, in which portions thereof have been broken away;

Fig. 3 is a longitudinal, sectional view of the tool taken along line 3—3 of Fig. 2;

Fig. 4 is a fragmentary view of the top of the tool showing the tool in its operated position;

Fig. 5 is a fragmentary, left hand, side view of the upper portion of the tool;

Fig. 6 is an enlarged, vertical section of a portion of the apparatus taken along line 6—6 of Fig. 3;

Fig. 7 is an enlarged, isometric view of the disc slitting knife used in the apparatus, and

Fig. 8 is a vertical section taken along line 8—8 of Fig. 2.

Referring now in detail to the drawings, and more particularly to Fig. 1, there is shown a plier-like tool comprising a stationary arm 10 and a movable arm 11. The stationary arm 10 comprises a body portion 12 which is provided with a wide, longitudinal slot 13 communicating with a transverse slot 14. The body portion 12 is provided with a bore 15 in which is rigidly positioned a post 16. A bore 20 is also provided in the body portion 12 concentric with the bore 16 and having a portion of its periphery communicating with the slot 14 (Figs. 2 and 3). A rack 21 is slidably positioned in the slot 14 and engages a pinion 22 positioned in the bore 20 and movably mounted on the shaft 16.

An oscillatory disc carrier 25 (Figs. 1, 2, and 3) is pinned to the pinion 22 and movable therewith. The disc carrier 25 is provided with a semi-circular body portion 26 and a larger arcuate portion 27 whose periphery is provided with an arcuate groove 30 extending the full length of the arcuate portion 27. A left hand face 31 of the disc carrier 25 formed by the junction of the body portion 26 and the arcuate portion 27 abuts a projection 32 provided on a top cover plate 33 (Fig. 3). The projection 32 serves to align a shoulder 34 provided on the disc carrier 25 with a T-shaped slot 35 provided in a disc supply magazine 36.

The disc supply magazine 36 is rigidly secured to a bracket 37, which is secured to the body por-

tion 12 by means of a pair of bolts 40—40. The bracket 37 also serves as one side of a housing which encloses a torsion spring 41 having one end fixed to a post 42 and the other end thereof attached to a slide 43 by means of a pin 44 (Figs. 3 and 4). The torsion spring 41 by means of the slide 43 serves to urge a plurality of centrally perforated, plastic insulating discs 45—45 positioned in the T-shaped slot 35 of the magazine 36 toward the shoulder 34 of the disc carrier 25. The plastic discs 45—45 have been punched from strips of plastic material such as polyethylene, or the like, during which operation they are provided with a central bore 48.

The opposite side of the housing enclosing the torsion spring 41 comprises a plate 46 which is secured to the top cover plate 33 by means of a pair of screws 47—47 threaded into a flange 49 provided on the end of the plate 46. The post 42 is hexagonal in cross-section and secured to the bracket 37 by a bolt 50 so that it is aligned with a hexagonal aperture 51 provided in the plate 46. The hexagonal aperture 51 prevents rotation of the post 42 when the end of the torsion spring 41 is secured to the slide 43 positioned in the T-shaped slot 35 (Fig. 2).

An L-shaped knife holder 52 (Fig. 7) is secured to the disc magazine 36 by a pair of screws 54—54, adjacent to the body portion 12. An irregularly shaped knife blade 55 (Fig. 6) is secured to the short leg of the L-shaped holder 53 and projects inwardly in the path of the disc carrier 25. The knife blade 55 is provided with a cutting edge 56, which projects in an oblique direction from the back of the knife holder 53 to the center aperture 48 of the disc 45 positioned against the shoulder 34 of the disc carrier 25 (Figs. 3 and 6). The cutting edge 56 (Fig. 7) is sharpened in such a manner that a gradual taper is provided therefrom to a substantially thicker back edge 57 of the blade 55.

This manner of sharpening the cutting edge 56 also provides an arcuate shoulder 58 on both sides of the blade which extends from the cutting edge 56 to the back edge 57 of the blade 55. The knife holder 53 is positioned on the magazine 36 so that the blade 55 is aligned with the arcuate groove 30 of the disc carrier 25, which permits the disc carrier 25 to carry the discs 45—45 from the cutting edge 56 to the back edge 57 of the blade. The arcuate shoulders 58—58 provided on the blade 55 serve to engage the periphery of the disc 45 adjacent to the ends of the radial slit, whereby the disc 45 during its travel over the knife blade 55 is urged toward the body portion 26 of the disc carrier 25. The urging of discs in this direction serves to prevent an arcuate side 59 of the blade 55 from damaging or cutting into the opposite wall of the center bore 48 of the disc. An end cover plate 60 is secured to the body portion 12 and the top cover 33 by means of a plurality of bolts 61—61 and has provided therein a slot 62 which is aligned with a slot 63 provided in the top cover plate 33.

The stationary arm 10 of the plier-like tool is provided with a handle 65 having a groove 66 provided therein to receive a tongue 67 integral with the body portion 12. The handle 65 is secured to the tongue 67 by a plurality of bolts 68—68 (Fig. 1). The movable arm 11 comprises an upper arm 70 and a lower arm 71 pinned together, as shown in Fig. 1, so as to form a hub 72. The hub 72 is provided with a bore 73 whereby the arm 11 may be rotatably mounted on a post 73 rigidly secured in a bore 74 provided in the body

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portion 12. The body portion 12 is also provided with a counterbore 75 concentric with the bore 74 and communicating with the bottom of the slot 13. A slot 76 merges with a portion of the periphery of the counterbore 75 and extends to the bottom of the counterbore 75 and through the left wall of the slot 13. The movable arm 11 is positioned on the post 73 with the hub 72 positioned in the counterbore 75 and the slot 76, whereby the upper arm 70 operates within the slot 13. The lower arm 71 has a bent end 77 adjacent to the hub 72 positioned in the slot 76.

A bore 80 is provided in the tongue 67 to receive a compression spring 81 and a plunger 82 which engages the bent end 77 of the lower arm 71 and serves to maintain the upper arm 70 of the arm 11, substantially adjacent to the right hand side of the slot 13. Also, the face 31 of the disc carrier 25 is thereby maintained against the projection 32 on the cover plate 33. The arm 70 is provided with a ball-shaped end 85 which engages a longitudinal slot 86 provided in the rack 24. When the movable arm 11 is actuated, the upper arm 70 moves toward the left hand side of the slot 13 and causes the rack 24 to slide along the slot 14, whereby the pinion 22 in engagement therewith is rotated. The disc carrier 25 secured thereto is rotated until the shoulder 34 thereof is substantially adjacent to a shoulder 87 provided on the cover plate 33.

The slots 62 and 63 provided in the end cover plate 60 and the top cover plate 33, respectively, are provided therein to receive a center conductor 90 on which has been applied a plurality of insulating discs 91-91 by means not shown. A pin 92 is positioned in the knife holder 53 so that the upper portion of its periphery is substantially in line with the bottom of the slots 62 and 63, whereby the conductor 90 positioned in the slot may be aligned with the back edge 57 of the knife blade 55.

The operation of this embodiment of the invention is as follows:

The plier-like tool (Fig. 1) is positioned over the conductor 90, so that a face 95 provided on the knife holder 53 is in engagement with the particular disc 91 which is adjacent to a blank space on the conductor 90. With the tool positioned on the conductor in this manner, the handle 11 is squeezed toward the handle 10, whereby the disc carrier 25 is oscillated and carries one of the discs 45-45, which has been fed from the magazine 36 to the shoulder 34, past the cutting edge 56 of the knife blade 55, whereby the disc 45 is slit radially from the periphery of a center hole 48 provided therein to the outer periphery of the disc. As the disc 45 continues to travel from the cutting edge 56 to the back edge 57 of the knife blade 55, the radial slit cut therein is spread open so that the radial slit may be engaged by the conductor 90 positioned adjacent to the back edge 57 of the knife blade 55. The disc 45 is further carried by the disc carrier 25, whereby the slitted portion passes by the conductor 90 until the center hole 48 is engaged by the conductor and the disc abuts the shoulder 87 of the top cover plate 33. The disc 45 which has been applied by the tool to the conductor 90 in this manner is now properly positioned thereon with respect to the discs 91-91 previously applied to the conductor.

The handle 11 may now be released whereupon the spring-pressed plunger 82 will cause the disc carrier 25 to return to its normal position, whereupon the tool may be removed from the conduc-

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tor 90. As the arcuate portion 27 of the rotatable member 25 moves by the end of the magazine 36, the torsion spring 41 connected to the slide 43 urges another of the discs 45-45 into place against the shoulder 34 in which case the tool is ready to apply another of the discs 45-45 to a conductor such as a conductor 90 when the occasion arises.

The above-described apparatus is particularly well adapted to slit and apply annular plastic discs on a central conductor of a coaxial cable core unit with a wiping motion.

What is claimed is:

1. Apparatus for applying centrally perforated plastic discs on a conductor, comprising a disc carrier having a cam-shaped periphery which serves to form a single shoulder thereon to carry a single disc and also having an arcuate groove provided in a portion of its periphery and extending to said shoulder, means for successively feeding discs in positions to be engaged by said shoulder of the disc carrier, a knife blade having its free end positioned adjacent to said disc carrier, said knife blade having a thin cutting edge positioned adjacent to the shoulder of and aligned with the arcuate groove in the disc carrier, a substantially thicker back edge and an arcuate shoulder provided on both sides of said knife blade and extending in an arc from said thin edge to said thick edge and spaced from said free end, and means for turning the disc carrier one-quarter turn, whereby a disc engaged by said shoulder is thrust against the cutting edge of said knife to cut a radial slit in the disc and as the disc is carried across the surface of the knife blade the arcuate shoulders on said blade guide the disc in an arcuate path of travel with the carrier.

2. A plier-like tool for assembling centrally perforated discs on a conductor, which comprises a body member, a disc carrier mounted on the body member and arranged to carry one disc at a time, means for successively feeding discs in position to be engaged by said disc carrier, means pivotally mounted on said body member for turning said disc carrier and a disc engaged thereby through a predetermined arc, means for aligning a conductor directly in the path of movement of a disc carried by the disc carrier, means for cutting a radial slit in a disc carried by said disc carrier when said disc carrier is turned, said slitting means being of sufficient length to hold the slit open so that the disc slit thereby may be slid on a conductor positioned in the aligning means with a wiping motion, and means for stopping the travel of the disc carrier when the disc is so positioned that the conductor passes through the central perforation of the disc.

3. A plier-like tool for applying centrally perforated discs to the central conductor, a pre-assembled coaxial cable core unit, which comprises a handle, an arm pivotally mounted on said handle, a disc carrier mounted on the end of said handle, means actuated by said pivotally mounted arm for oscillating said disc carrier, means for successively feeding discs in the path of the disc carrier, means positioned adjacent to the disc carrier for cutting a radial slit in a disc carried by the disc carrier during its arcuate movement in one direction, means for aligning a core unit on which a disc is to be applied with the slitting means, means for stopping the arcuate movement of the disc carrier after a predetermined travel, and means for locating the stopping means with respect to a disc already present on said core unit, whereby when said

pivotally mounted arm is actuated a disc engaged by said carrier is carried in an arcuate path past the slitting means is forced on the conductor of the core unit and accurately positioned thereon with respect to a disc already present on the core unit.

4. A tool for applying centrally perforated plastic insulating discs to a conductor comprising a handle, a disc carrier mounted on the end of the handle, said disc carrier being provided with a single shoulder for carrying one disc at a time, and an arcuate groove cut in a portion of its periphery and extending to said shoulder, an arm pivotally mounted on the handle member, means actuated by movement of the arm for oscillating the disc carrier, means positioned on the end of the handle member for successively feeding plastic insulating discs in position to be engaged by the shoulder of the disc carrier, a knife positioned adjacent to the shoulder on the disc carrier for cutting a radial slit in a disc as it is carried by the disc carrier, said knife having a thin cutting edge aligned with the arcuate groove provided in said disc carrier and a substantially thicker back edge, and means for positioning a conductor adjacent to the back edge of said knife, whereby when the arm is actuated the disc carrier carries a disc engaged thereby past the cutting edge of the knife and the arcuate groove provided therein permits the disc carrier to carry the disc to the back edge of the knife and thereafter force it on the conductor positioned adjacent to said back edge of the knife.

5. A plier-like tool for manually applying centrally perforated insulating discs to a core unit having a center conductor and a plurality of insulating discs positioned thereon, which comprises a handle, an arm pivotally mounted on said handle, a disc carrier positioned on the end of said handle, means actuated by movement of the pivotally mounted arm for oscillating said disc carrier, a disc supply magazine mounted on the end of said handle and having its discharge end adjacent to said disc carrier, means for urging discs positioned in said magazine into position to be engaged by the disc carrier, said disc carrier arranged to carry one disc at a time, means for aligning the disc carrier with respect to the discharge end of the disc magazine, means positioned adjacent to said disc carrier for cutting a radial slit in a disc carried by said disc carrier, means for positioning the tool over the conductor so that the disc carrier is aligned with the conductor, and means for limiting the travel of the disc carrier and the disc carried thereby.

6. A device for assembling plastic washers upon a core unit having a center conductor and a plurality of insulating discs equally spaced thereon, which comprises a handle, a disc carrier mounted on the end of said handle, said disc carrier having a single shoulder thereon for engaging one disc at a time, and an arcuate groove provided in a portion of its periphery, an arm pivotally mounted on said handle, means actuated by movement of said arm for oscillating the disc carrier, a disc supply magazine mounted on the end of the handle and having a slot formed thereon for receiving a plurality of insulating discs having holes in the center thereof, means for aligning the shoulder of the disc carrier with the slot of said magazine, means positioned on the handle for urging the discs in the supply magazine in position to be engaged by the shoulder provided on the disc carrier, a knife positioned on the handle and having its cutting edge ad-

5 adjacent to the shoulder provided on the disc carrier and aligned with the arcuate groove provided in the disc carrier, said knife being substantially thicker than the cutting edge on the edge opposite its cutting edge so as to hold open a slit cut by the knife in a disc carried by the disc carrier, means for positioning the device over the core unit so that the center conductor thereof is aligned with the thick edge of the knife, and means for orientating the tool positioned on the core unit with respect to the adjacent insulating discs present thereon, whereby when the movable arm is actuated the disc carrier and a disc engaged thereby are moved in an arcuate path past the knife whose cutting edge radially slits the disc and whose thick edge holds said slit open so that as the disc leaves the knife it is positioned transversely on the conductor aligned therewith at a predetermined distance away from the adjacent discs.

7. A tool for applying plastic insulating discs upon a conductor, comprising a handle having a transverse slot provided in the end thereof and a longitudinal slot communicating therewith, a disc carrier mounted in the end thereof, a pinion rigidly secured to said disc carrier in situ, a rack slidably positioned in said transverse slot and having its teeth in engagement with said pinion, an arm pivotally mounted on the said handle and having an upper portion thereof positioned in said longitudinal slot, said upper portion of the pivotally mounted arm engaging said rack, a longitudinal slot provided in the end of the handle for receiving a conductor, said disc carrier being provided with a shoulder and an arcuate groove cut in a portion of its periphery and communicating with said shoulder, a disc supply magazine mounted on the end of the handle and having a slot formed therein for receiving a plurality of insulating discs, means provided on the disc carrier for aligning the shoulder thereof with the slot in the disc supply magazine, tensioning means secured to the end of the handle for urging discs positioned in the magazine in position to be engaged by the shoulder on the disc carrier, and a knife positioned on the end of the handle member and having its cutting edge adjacent to the shoulder of the disc carrier and aligned with the arcuate groove provided in the said disc carrier, whereby when the pivotally mounted arm is actuated the movement of the rack engaged thereby causes the disc carrier to turn in one direction so that a disc engaged by the shoulder is moved in an arcuate path past the knife which cuts a radial slit therethrough and as the disc moves from the end of said knife it is slid on the conductor positioned in the slot provided in the end of the handle.

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