Sept. 5, 1967 H. BURR 3,340,113

APPARATUS AND METHOD FOR APPLYING TAPE TO ADVANCING STRANDS

Filed Nov. 9, 1964 2 Sheets-Sheet 1

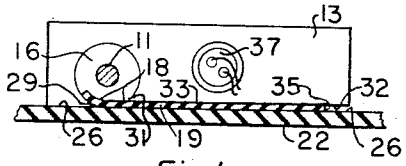

Fig. 1

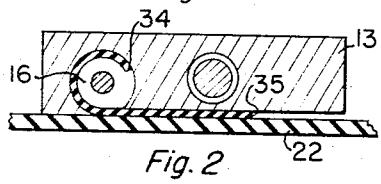

Fig. 2

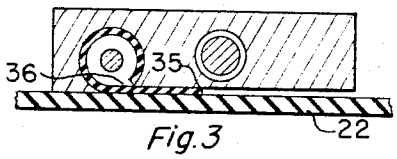

Fig. 3

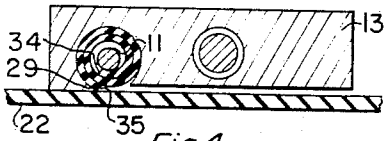

Fig. 4

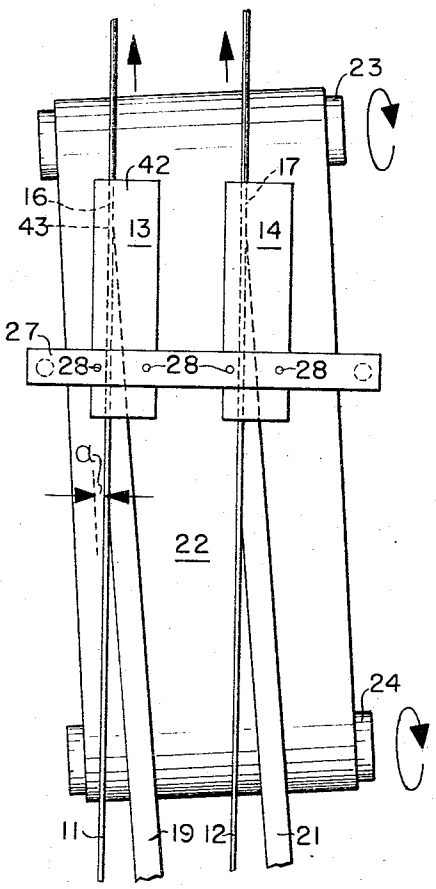

Fig. 5

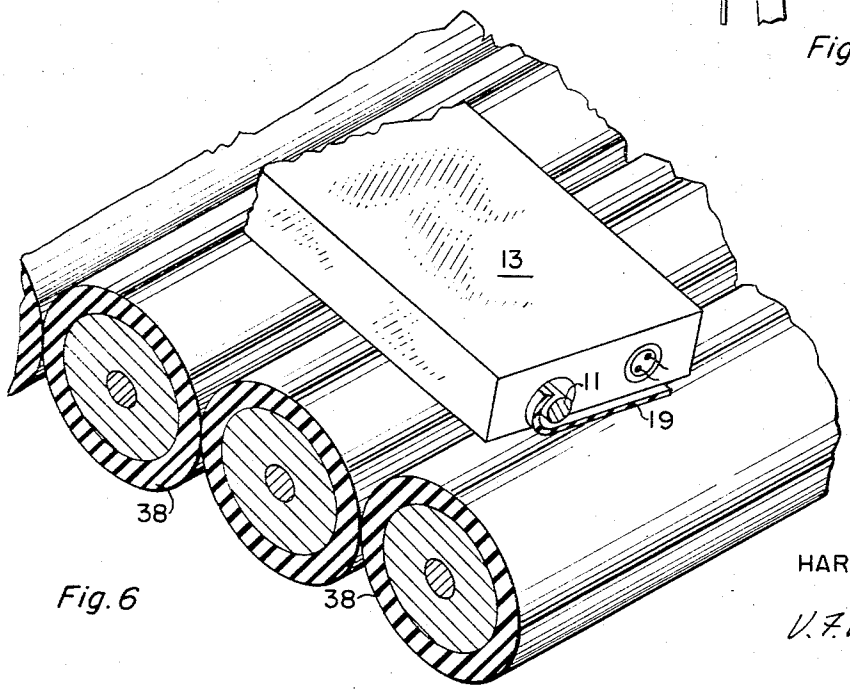

Fig. 6

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APPARATUS AND METHOD FOR APPLYING TAPE TO ADVANCING STRANDS

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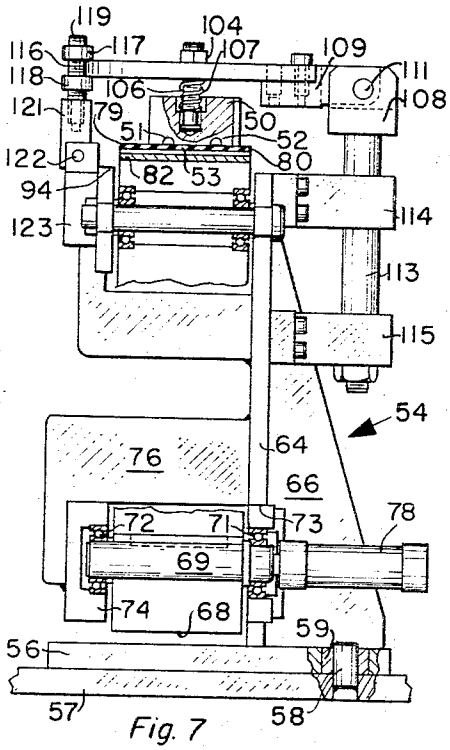

Fig. 7

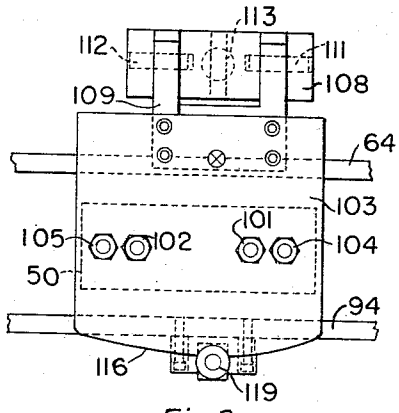

Fig. 8

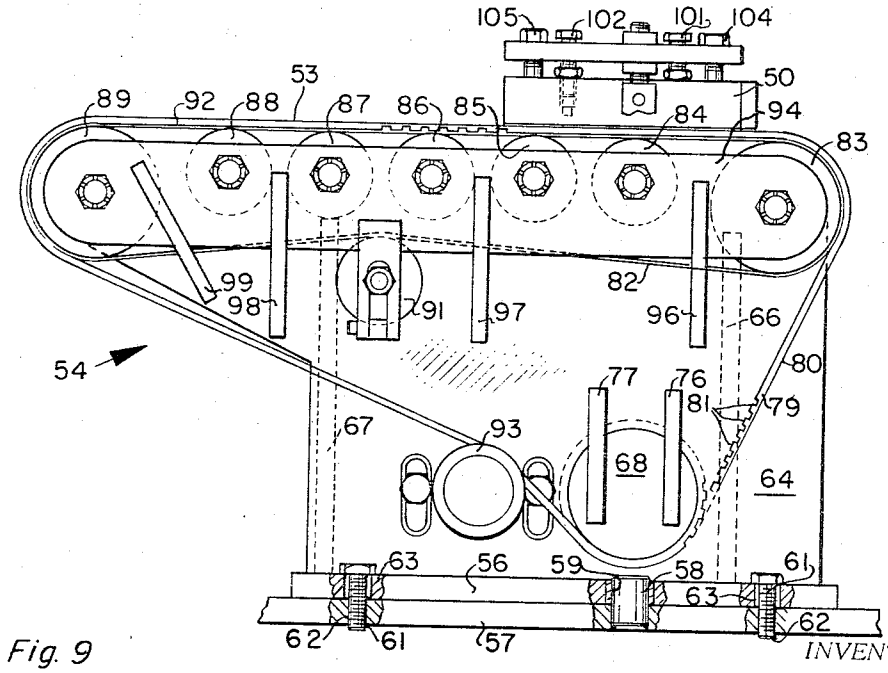

Fig. 9

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United States Patent Office 3,340,113 Patented Sept. 5, 1967

3,340,113
APPARATUS AND METHOD FOR APPLYING TAPE TO ADVANCING STRANDS

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Filed Nov. 9, 1964, Ser. No. 409,898
10 Claims. (Cl. 156—54)

This application is a continuation-in-part of my application Ser. No. 383,335, filed July 17, 1964.

My invention relates to apparatus and method for applying tape to advancing strands and particularly to the application of said tape in a longitudinal inward spiral.

In the art of strand covering and particularly in the insulating of electrical conductors with paper tape for use in telephone cables, it has long been commercial practice to wrap the paper around the conductor in an overlapping helix. This practice has at least three outstanding disadvantages. Firstly, it requires expensive, complex apparatus capable of rotating the paper supply around the advancing conductor. Secondly, because of the rotating feature the operating speed is limited and conductors cannot be insulated at the same speed as subsequent operations in the cable-making process, such as twining the insulated conductors together. And thirdly, each overlap presents a potential weak point in the conductor insulation where the turns may become separated and expose the conductor if the cable is bent sharply or mishandled during its manufacture.

In my application Ser No. 383,335, filed July 17, 1964, I disclosed a novel die which has been used to great commercial advantage for applying paper tapes to telephone conductors in a longitudinal inward spiral. The quality of the paper applied with this die has been high and the inherent stiffness of the paper has been advantageous to its application. It is desired now to disclose an improved apparatus which is capable of applying a less uniform, softer and less expensive paper to insulate telephone conductors and also to apply tapes of other materials, such as thermoplastic, which have less inherent stiffness.

I propose by my invention to provide an improved apparatus for applying a tape around an advancing strand so that it is free from circumferential seams or overlaps.

I further propose to provide a taping apparatus capable of reliable operation at very high speed.

I further propose to provide an apparatus capable of applying tapes of softer material than have hitherto been applied with a longitudinal inward spiral.

I have achieved these objects with an apparatus comprising a die defining a tubular passage that substantially surrounds a length of the strand to be covered. There is a slot in the die that communicates tangentially with the passage and provides access for tape to reach the strand. My apparatus has means such as a moving belt or at least one roller external to the die that frictionally engage the tape and simultaneously advance it with the strand and urge it through the slot tangentially into the passage so that the longitudinal edge of the tape is advanced in an inward spiral around the strand.

In my method of wrapping a tape around an advancing strand I advance the strand through a tubular passage that has a longitudinal slot. At the same time I advance the tape at a very acute angle to the strand and frictionally engage the surface of the tape outside of the passage with a moving belt, roller, or other means to urge it edgewise, tangentially through the slot to make it spiral inwardly around the strand.

A more thorough understanding of my invention will be gained from the appended drawing.

In the drawing:

FIGURE 1 shows a section through my apparatus at the die entrance.

FIGURE 2 shows a section through my apparatus at a point on the die.

FIGURE 3 shows a section through my apparatus at a farther advanced point on the die.

FIGURE 4 shows a section through my apparatus at a still farther advanced point on the die.

FIGURE 5 shows a plan view of an embodiment of my apparatus.

FIGURE 6 shows a perspective view of another embodiment of my apparatus.

FIGURE 7 shows a front elevation of a preferred embodiment of my invention.

FIGURE 8 shows a plan view of a portion of the embodiment of FIGURE 7.

FIGURE 9 shows a side elevation of the embodiment of FIGURE 7.

Referring first to FIGURE 5 which shows an embodiment wherein two conductors are being insulated simultaneously, although it will be understood that my invention is by no means limited thereto, the conductors **11**, **12** are moving in the direction of the arrows from pay-off means, not shown, onto take-up mechanisms, also not shown. Such pay-off and take-up means are well known in the cable arts and do not form a novel element of the instant invention. They may be integral units of other operations such as coating and twisting in an overall process of which the instant taping operation is, itself, an integral unit. The strands **11**, **12** which in this case are electrical conductors are passed through respective dies **13**, **14** which have respective tubular passages **16**, **17** bored therethrough. It will be understood that although I have shown separate dies **13**, **14**, each with its individual passage, it is within the scope of my invention to combine the two dies so that the passages **16**, **17**, or even a larger number of passages, may be bored in a single die (FIGURE 7). The passages **16**, **17** are not fully closed but have longitudinal slots such as the slot **18** (FIGURE 1) shown in the die **13**. These slots provide access for tapes **19**, **21** which are to be wrapped longitudinally around the strands **11**, **12**. As the tapes **19**, **21** advance they are supported on an endless belt **22** in frictional engagement therewith. The dies **13**, **14** are preferably made of steel with those surfaces coming in contact with the tapes **19**, **21** being highly polished. Or the steel dies may be case hardened or have inserts so that the tapes are contacted only by especially wear-resistant surfaces or carbide. The belt **22**, on the other hand, is heat-resistant rubberized fabric or other material with a high coefficient of friction relative to the tapes **19**, **21**. A flexible steel belt with or without an etched or engraved surface to provide increased friction may also be used. Steel belts composed of flat links, such as used for conveyor belts, may also be employed within the scope of my invention. The belt **22** is mounted around rolls **23**, **24**, at least one of which is driven by means, not shown, in a manner well known to persons skilled in mechanical arts so that the belt **22** advances the tapes **19**, **21** at a speed equal to or very slightly greater than the speed of advance of the strands **11**, **12**. The belt **22** moves at a very acute angle α to the strand **11** and its parallel strand **12** so that the tapes **19**, **21** have a component of motion caused by the belt urging them edgewise, toward the conductors, as well as forward, with the conductors. In FIGURES 1–4 the effect of the belt **22** on the tape **19** can be studied in detail. Here it is seen that the die **13** has a bottom surface **26** against the belt **22**, the die being restrained from movement with the belt by the bracket **27** (FIGURE 5) from which it is suspended by studs **28**. The passage **16** is defined by the die **13** and opens into the slot **18**. The slot **18** is defined by a left hand, lower, sharp-pointed protuberance **29** and an upper right hand protuberance **31** separated in elevation by the depth of a broad groove **32** substantially equal to the thickness of the tape **19**. A sur-

face 33 defining the groove 32 is highly polished so that its frictional resistance to the motion of the tape 19 is lower than the friction of the tape on the rubber belt 22. Consequently the tape 19 moves up the projection 29 into the passage 16 to the position shown in FIGURE 2. The tape 19 has a leading longitudinal edge 34 and a trailing longitudinal edge 35 and in FIGURE 2 the leading edge 34 has followed around the polished wall of the passage 16 to a point opposite the projection 29. Because the traction of the belt 22 against its tape is greater than the resistance of the polished die surface, the edge 34 continues around the walls of the passage until it reaches the projection 31 and makes contact with a point 36 (FIGURE 3) on the upper surface of the tape 19 that has just entered the slot 18. Thence the edge 34 spirals inwardly until the belt 22 has carried the entire width of the tape 19, including the trailing edge 35, to the projection 29. In FIGURE 4 the tape is seen to be inwardly spiralled two full turns around the strand 11 and this number of turns, or more, is fully possible with my unique apparatus, although, for many purposes 1½ or even 1¼ turns may be sufficient. The number of such turns is, of course, determined by the diameter of the passage 16 in combination with the width and thickness of the tape 19.

The die 13 has an exit end 42 (FIGURE 5) from which the wire 11 emerges with the tape 19 wrapped completely around it. A point 43, at which the entire width of the tape has been carried to the projection 29 may preferably be some distance from the exit end 42 so that the trailing edge 35 will have advanced beyond the projection 29 around the passage 16 before it emerges from the die.

My apparatus has particular application, in the wire insulating art, to dies of the type wherein a paper tape is heated during application and the "ironing" effect gives it a permanent curl. For this reason the die 13 is heated by an electric heater 37 of known type. It is a feature of my invention that, since the belt 22 urges the tape 19 past the slot 18 between the projections 31 and 29 there is no edge of the tape that remains outside of the passage 16 and the entire width of tape is curled by the passage through the die. This is particularly true, in the preferred construction, when the point 43, at which the trailing edge 35 of the tape 19 has entered the passage 16, is a considerable distance from the end 42 of the die 13. For in this case the trailing edge is thoroughly ironed before it leaves the die. It is a further feature of my invention that if there are any lumps or irregularities in the tape 19, such as those that may be caused by splices, so that the thickness of the tape exceeds the depth of the groove 32 this irregularity is easily accommodated by the resilience and flexibility of the rubber belt 22 and will not be a source of tape breakage or plugging of the die, provided of course that the extra thickness is not enough to plug the passage 16.

In FIGURE 6 an embodiment of my invention is shown wherein the belt 22 has been replaced by a plurality of rubber-surfaced rollers 38, each driven by any of a number of well known means not shown in the drawing.

In my method of applying a tape to an advancing strand the tape is urged laterally as well as advanced longitudinally by the belt 22 (or rollers 38) and tangentially enters the passage 16 through the slot 18. The continued urging of the belt pushes the tape around the smooth inside surface of the passage and forces it to spiral inwardly around the strand 11.

FIGURES 7, 8 and 9 illustrate a preferred embodiment of my invention utilizing a single die 50 wherein are cut two passages 51, 52. It is a feature of the apparatus of FIGURES 7 and 8 that the angle formed between the line of advance of a belt 53 and the die 50 can be changed, as required, during the operation of the apparatus. It is an additional feature that the angle formed between the line of advance of the belt and the line of advance of the wires can also be changed. The apparatus indicated generally by the numeral 54 is supported on a base plate 56 greased to slide on a mounting plate 57. A solid post 58 projects upwardly from the plate 57 through a bushed hole 59 in the plate 56 so that the sliding of the base plate 56 upon the mounting plate 57 occurs in an arc with its center at the post 58. The angle of the arc can be locked by means of hold-down screws 61, 61 that fit into threaded holes 62, 62 in the mounting plate 57 through arcuate slots 63, 63 in the base plate 56. This permits the whole apparatus to be aligned in proper relation to the strands (not shown in FIGURES 7, 8 and 9) equivalent to the strands 11 and 12 and to the tapes (also not shown in these figures), equivalent to the tapes 19, 21 to be wrapped around the strands in the die 50. A vertical plate 64 is welded to the base plate 56 and reinforced by uprights 66, 67. A toothed drive roll 68 is keyed to a shaft 69 mounted in bearings 71, 72 of which the bearing 71 is supported in an opening 73 in the plate 64 and the bearing 72 is supported in a block 74 welded to two identical angle brackets 76, 77. The drive roll 68 is locked to a flexible coupling 78 which can be driven by any of a larger number of known means not shown in the drawing. A wide, fabric-reinforced rubber timing belt 79 has a smooth flat surface 80 and evenly spaced projections 81 that mesh with toothed roll 68 and the belt 79 is driven by this roll. The belt 79 passes upwardly and over an endless steel belt 82 which is supported on rolls 83, 84, 85, 86, 87, 88, 89 and kept taut by an adjustable idler roll 91 so as to present a horizontal surface 92 under the die 50. The timing belt 79 is tensioned independently of the belt 82 by means of another adjustable idler roll 93. To support the rolls 83–89 a vertical plate 94 is welded to angle brackets 96, 97, 98, 99 which, in turn, are welded to the plate 64. The die 50 is suspended by means of threaded studs 101, 102 from a mounting plate 103. The plate 103 is also bored to support two centering pins 104, 105 which guide compression springs of which a near spring 106 can be seen in the drawing acting against a shoulder 107 in the die 50. The plate 103 is hingedly mounted to a yoke 108 by means of a double eye block 109 which can pivot on two pins 111, 112 inserted in the yoke. The die 50 can be lifted from the surface 80 of the belt 79 by swinging up the plate 103. The yoke 108 is rotatably mounted on a support rod 113 held by brackets 114, 115 that are bolted to the plate 64. One edge 116 of the plate 103 forms a circular arc with its center at the center of the rod 113. And this permits the entire plate 103 to be pivoted around the rod 113 thus changing the angle of the die 50 relative to the line of advance of the belt 79. The plate 103 can be locked at the desired angle by two nuts 117, 118 mounted on a stud 119 which is mounted, in turn, to a hinge block 121 hinged by means of a pin 122 to a yoke 123 bolted to the plate 94.

I have invented a new method and apparatus for covering and advancing strand with a tape for which I desire an award of Letters Patent.

I claim:

1. Apparatus for wrapping a tape having a longitudinal edge around an advancing strand comprising:

(A) a die defining a tubular passage substantially surrounding a length of said strand,

(B) a slot in said die communicating tangentially with said passage and providing access for said tape to said strand, said slot being defined by an edge of at least one flat surface, and

(C) tape drive means external to said die, frictionally engaging one side of said tape to maintain the opposite side against said flat surface and advance said tape in the line of advance of said strand and simultaneously urging said tape through said slot tangentially into said passage, whereby the longitudinal edge of said tape is advanced in an inward spiral around said strand longitudinally of said strand.

2. Apparatus for wrapping a tape having a longitudinal edge around an advancing strand comprising:

(A) a die defining a tubular passage substantially surrounding a length of said strand,

(B) a slot in said die communicating longitudinally with said passage and providing access for said tape to said strand, said slot being defined by an edge of at least one flat surface,

(C) a belt frictionally engaging said tape on one side to maintain the opposite side against said flat surface,

(D) means advancing said belt against said die obliquely along said slot, said belt advancing said tape in the line of advance of said strand and simultaneously urging said tape through said slot tangentially into said passage, whereby the longitudinal edge of said tape is advanced in an inward spiral around said strand longitudinally of said strand.

3. Apparatus for wrapping a tape having a longitudinal edge around an advancing strand comprising:

(A) a die defining a tubular passage substantially surrounding a length of said strand,

(B) a slot in said die communicating longitudinally with said passage and providing access for said tape to said strand, said slot being defined by an edge of at least one flat surface,

(C) at least one roller frictionally engaging one side of said tape to maintain the opposite side against said flat surface,

(D) means supporting said roller against said die oblique to said slot, and

(E) means driving said roller,

(F) said roller advancing said tape in the line of advance of said strand and simultaneously urging said tape through said slot tangentially into said passage whereby the longitudinal edge of said tape is advanced in an inward spiral around said strand longitudinally of said strand.

4. Apparatus for wrapping a plurality of tapes having longitudinal edges around a like plurality of parallel advancing strands comprising:

(A) a plurality of dies defining tubular passages, each substantially surrounding a length of one of said strands,

(B) a slot in each of said dies communicating longitudinally with one of said passages and providing access for one of said tapes to the strand within the passage, each slot being defined by an edge of at least one flat surface,

(C) means mounting said dies in parallel coplanar arrangement,

(D) a broad belt frictionally engaging each of said tapes slidably against a flat surface of said die and

(E) means advancing said belt against each of said dies obliquely to said slots, said belt advancing said tapes in the direction of advance of said strands and simultaneously urging said tapes through said slots tangentially into said passages, whereby the longitudinal edges of said tapes are advanced in an inward spiral around said strands longitudinally of said strands.

5. Apparatus for wrapping a plurality of tapes having longitudinal edges around a like plurality of parallel advancing strands comprising:

(A) a die defining a plurality of tubular passages each substantially surrounding a length of one of said strands,

(B) a plurality of slots in said die each communicating longitudinally with one of said passages and providing access for one of said tapes to the strand within the passage, each slot being defined by an edge of at least one flat surface,

(C) a broad belt frictionally engaging one side of said tapes to maintain their opposite side against the flat surfaces,

(D) means advancing said belt against said die obliquely to said slots, said belt advancing said tapes in the direction of advance of said strands and simultaneously urging said tapes through said slots tangentially into said passages, whereby the longitudinal edges of said tapes are advanced in an inward spiral around said strands, longitudinally of said strands.

6. Apparatus for wrapping a tape having a longitudinal edge around an advancing strand comprising:

(A) a die defining a tubular passage substantially surrounding a length of said strand,

(B) a slot in said die communicating tangentially with said passage and providing access for said tape to said strand, said slot being defined by an edge of at least one flat surface;

(C) a belt frictionally engaging said tape on one side to maintain the opposite side against said flat surface,

(D) means advancing said belt against said die along said slot at an oblique angle to said slot, said belt advancing said tape in the line of advance of said strand and simultaneously urging said tape through said slot tangentially into said passage, whereby the longitudinal edge of said tape is advanced in an inward spiral around said strand longitudinally of said strand, and

(E) means for adjusting said angle.

7. Apparatus for wrapping a tape having the longitudinal edge around an advancing strand comprising:

(A) a die defining a tubular passage substantially surrounding a length of said strand,

(B) a slot in said die communicating tangentially with said passage and providing access for said tape to said strand, said slot being defined by an edge of at least one flat surface,

(C) a broad belt frictionally engaging one side of said tapes to maintain their opposite side against the flat surfaces,

(D) means advancing said belt against said die obliquely to said slot, said belt advancing at an oblique angle to said tape in the direction of advance of said strand and simultaneously urging said tape through said slot tangentially into said passage, whereby the longitudinal edge of said tape is advanced in an inward spiral around said strand longitudinally of said strand, and

(E) means for adjusting the line of advance of said belt relative to the line of advance of said strand.

8. The method of wrapping a tape around an advancing strand comprising the steps of:

(A) advancing said strand through a tubular passage having a longitudinal slot,

(B) advancing said tape at a very acute angle to said strand,

(C) frictionally engaging the surface of said tape externally of said passage slidably against a flat surface of said die and thereby urging it edgewise, tangentially through said slot, so that it spirals inwardly around said strand having the edge of said tape parallel to the axis of said strand.

9. The method of claim 8 wherein said tape is urged by frictional engagement over a continuous length thereof, as by a moving belt.

10. The method of claim 8 wherein said tape is urged by frictional engagement along by at least one line thereof as by one or more rollers.

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