Aug. 22, 1967 H. BURR 3,337,386

WIRE COVERING AND TUBE FORMING DIE

Filed July 17, 1964 3 Sheets-Sheet 1

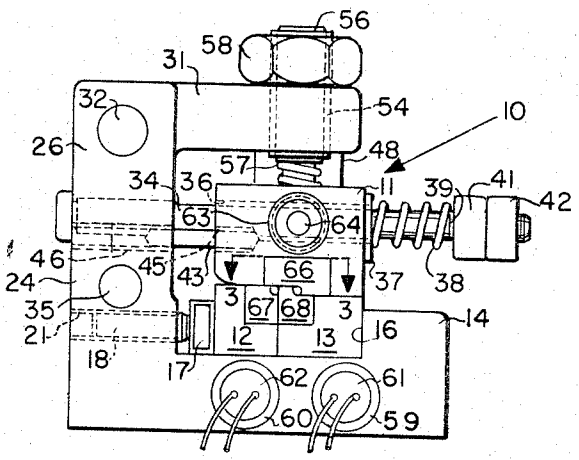


Fig. 1

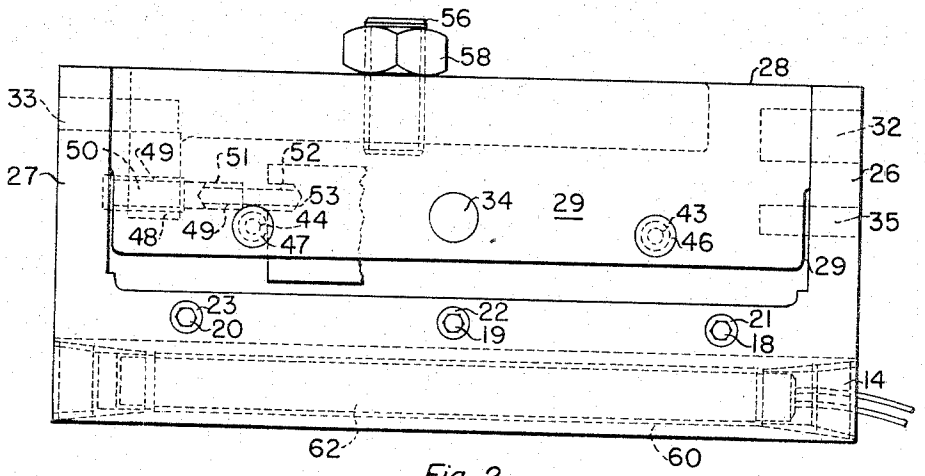


Fig. 2

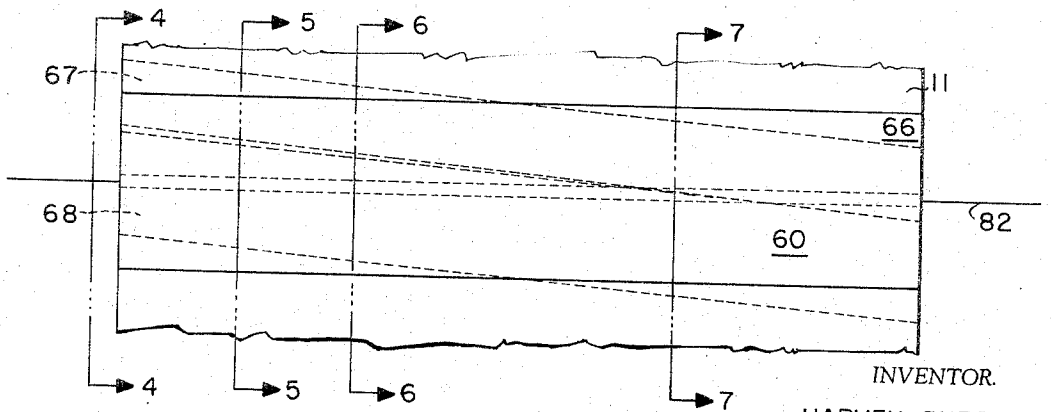


Fig. 3

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WIRE COVERING AND TUBE FORMING DIE

Filed July 17, 1964 3 Sheets-Sheet 2

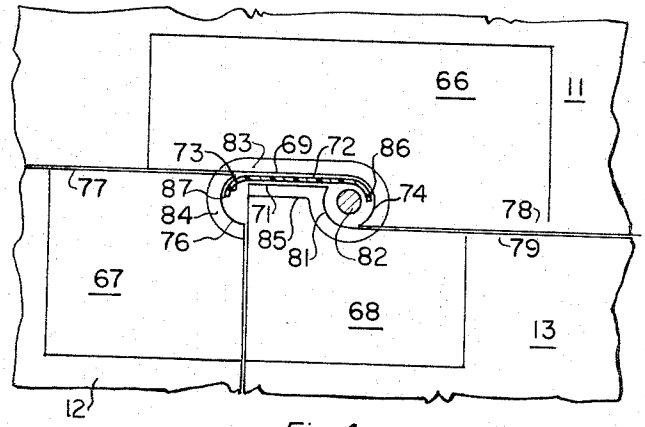


Fig. 4

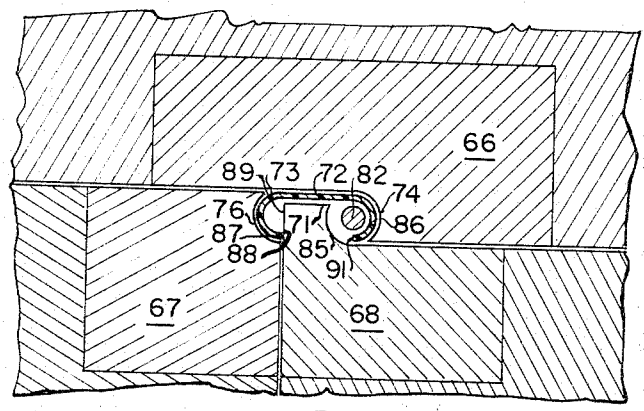


Fig. 5

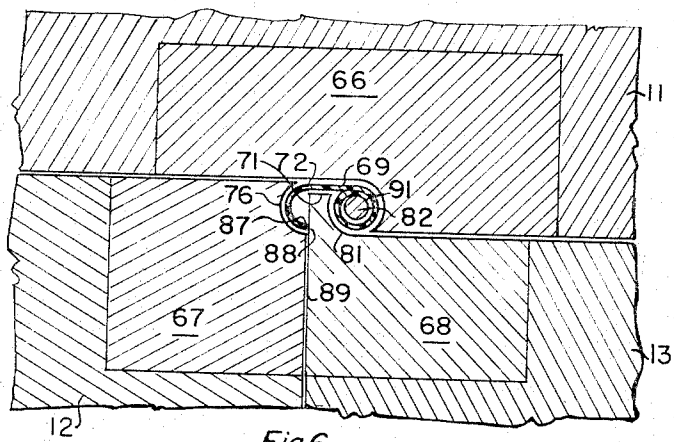


Fig. 6

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WIRE COVERING AND TUBE FORMING DIE

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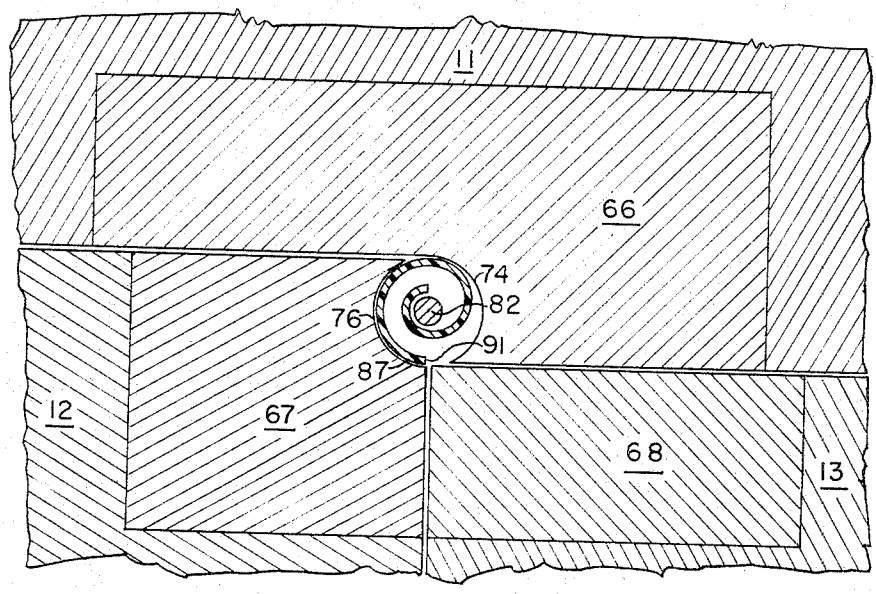


Fig. 7

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United States Patent Office 3,337,386 Patented Aug. 22, 1967

3,337,386

WIRE COVERING AND TUBE FORMING DIE

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Filed July 17, 1964, Ser. No. 383,335
6 Claims. (Cl. 156—585)

ABSTRACT OF THE DISCLOSURE

A heated die is used to apply a spiral wrap of paper insulation around a telephone wire such as is used in telephone cables of the type described in application Ser. No. 314,401, now Patent 3,300,714. The die cavity is formed so that the paper is not urged around the wire by pressure against its longitudinal edge but is urged by frictional engagement with a lengthwise groove in the die.

My invention relates to a die for continuously forming a strip of indefinite length into a tube having a substantial longitudinal overlap and particularly to a die for forming said tube around an advancing strand.

In the manufacture of insulated electric wires, such as telephone wires, it has been suggested in Patents 2,810,011 and 2,947,652 to wrap a single strip of paper insulation longitudinally around two wires to form a telephone pair that remains connected together by a paper web. For a number of reasons, however, it is desirable to apply the paper to a single wire instead of a pair. An important one of these reasons is the fact that it is easier to splice separately covered wires since they don't have to have the web slit with a razor blade as the webbed pairs do when they are spliced. Another reason for preferring separate wires is that they are more readily twisted together without disturbing the insulation.

No means have been available, however, for applying a longitudinal wrap around a single wire, as opposed to a pair of wires. When two wires are covered they complement each other in that the frictional resistance to folding the paper around one wire acts as the force urging the paper around the other wire. There is no such counterforce when only a single wire is being wrapped. Consequently, when efforts were made to bring pressure against the free edge of the paper to urge the other edge around the single wire that was found to so stretch and warp the free edge that it would not lie flat. In this respect it should be noted that in the field of application of my invention the strips to be handled are very thin and delicate. For example No. 26 A.W.G. wire is wrapped with a strip only 3/16 inch wide and 1.5 thousandths of an inch thick. In order to minimize cost and electrical capacitance between the two conductors there must be a minimum of paper and a maximum of air filling the space between them. Still there must be enough paper to provide a longitudinal overlap sufficient to avoid any bare spots when the pairs are twisted, and the cable is stranded, and this is not the case if the edge of the paper is warped and does not lie flat, but is, in effect, wasted. If the edge of the paper is warped it has the further disadvantages of increasing the tendency of the paper insulation to unravel during splicing, and decreasing the longitudinal stiffness of the paper wrap. This stiffness is important when tubular connectors are used of the type that is crimped down over insulated conductors.

A telephone conductor insulated by means of my apparatus has a tubular wrap of insulation with its edge extending substantially parallel to the conductor. This is opposed to known spirally-wrapped conductors in which the insulation is applied with a helical edge. My conductors have the advantage of longitudinal stiffness compared to helically wrapped conductors for the application of the

above-mentioned tubular connectors, and, of course, there is much less tendency of my conductors to open at an overlapped edge and expose bare conductor when a cable is bent.

I have invented a die that is capable of applying a longitudinal wrap over a single wire in a very satisfactory manner. This has been accomplished by providing a curved side wall with its concave side facing the wire. This wall forms an acute angle with the line of advance of the wire and blends into the passage in the die through which the wire has been passing and forms part of that passage.

There is a longitudinal ledge against which the edge of the paper abuts, but only after it has made a half turn around the side wall curvature. Thus, the paper urged toward the wire, not only by the pressure against the edge of the strip, but by the frictional resistance against the curved side wall. Dies of this type are heated to set the paper in the desired shape as it passes through, and my die has the advantage that the edge of the paper which is initially farthest from the wire, rather than warping, it actually preset in a smooth arc that causes it to wrap permanently around the wire at the exit end of the die. Although my die has particular utility for wrapping paper strip longitudinally around an advancing wire it can also be used to form a tube in the adbsence of any wire and will have utility for strips other than paper strips.

It have invented a die having an entrance end and an exit end for continuously forming an advancing strip, such as a paper strip, into a tube of indefinite length with a substantial overlap. My die may be used to wrap a strip of insulation around an advancing strand, and it comprises two parallel walls defining a slot for the strip that diminishes in width from the entrance end toward the exit end of my die. It comprises a first and a second curvilinear side wall coextensive with the slot along its length with both side walls concave toward each other. My die also comprises a third curvilinear side wall concave toward the first side wall and forming a tubular passage in combination with the first side wall, which may be a strand-confining passage. My die also comprises a flat, strip-abutting side wall facing the second side wall. The third side wall and the flat side wall converge and terminate short of the exit end of the die and the first side wall and second side wall converge and combine to form a tubular passage within the die. My die may comprise a first block having a first flat surface portion and a second block having a second flat surface portion with the slot being formed by a combination of these two portions. There are then means aligning these two blocks while permitting them to separate during the passage of thickened portions of strip through the die. There may also be a third block facing the first block with the first curvilinear side wall formed in the first block, the second curvilinear side wall formed in the third block, and the third curvilinear side wall formed in the second block, and means for heating the die.

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

In the drawing:

FIGURE 1 is an end view of the apparatus of my invention.

FIGURE 2 is a side view of the apparatus of my invention.

FIGURE 3 is a top view of the hardened die inserts of my invention.

FIGURE 4 is an enlarged view of the entrance end of the die of FIGURE 3.

FIGURE 5 is an enlarged view of a section through the lines 5—5 of FIGURE 3.

FIGURE 6 is an enlarged view of a section through the lines 6—6 of FIGURE 3.

FIGURE 7 is an enlarged view of a section through the lines 7—7 of FIGURE 3.

Referring now to the drawing and particularly to FIGURES 1 and 2, a strip-applying die indicated generally by the numeral **10** is comprised of a first block **11** which is uppermost and two lower blocks comprised of a second block **12** and a third block **13**. This is the arrangement of the blocks that I have found to be most convenient but it will be understood that the blocks **12** and **13** might be placed uppermost and the block **11** underneath within the scope of my invention, or the die assembly might be rotated 45 or 90 degrees or some other angle. It will be further understood that the blocks **12** and **13** might be combined into a single block within the scope of my invention although the machining of such a single unit would be more difficult and expensive.

The blocks comprising the elements of my die **10** are aligned by means of a holder **14** which clamps the blocks **12**, **13** between a shoulder **16** and a backing plate **17** urged by set screws **18**, **19**, **20** threaded into holes **21**, **22**, **23** in an upright extension **24** of the holder **14**. The holder **14** has two end posts **26**, **27** pivotally mounting a gate **28** having a vertical back plate **29** and horizontal extension **31** integrally formed with the back plate. The gate **28** is rockingly suspended from the posts **26**, **27** on two pins **32**, **33** and can be locked by a pin **35**. A long stud **34** is threaded through the center of the back plate **29** and in a loose fit through a bore **36** through the block **11**. The stud **34** is also passed through a washer **37** which is retained against the block **11** by a compression spring **38**. The end of the stud **34** is threaded through a length **39** to hold locking nuts **41**, **42** to adjustably retain the spring **38**. By these means it will be seen that the block **11** is urged to the left as viewed in the drawing. Movement to the left is restrained, however, by two pins **43**, **44** which fit into recesses in set screws **46**, **47** threaded into the back plate **29** and matching recesses **45** in the block **11** so that the position of the block **11** can be adjusted by turning the set screws.

The blocks **12**, **13** are locked firmly between the shoulder **16** and plate **17** but the block **11** is retained by spring compression and would be free to move forward slightly due to the frictional force of an advancing paper strip. To prevent this movement the horizontal extension **31** of the gate **28** is provided with a downwardly extending lug **48** having a tapped hole **49** for a set screw **50** with a hollow head **51** into which is fitted a pin **52**. The pin **52** fits into an opening **53** and prevents forward movement of the block. The horizontal extension **31** has a tapped hole **54** for a threaded stud **56** which retains a compression spring **57** against the block **11**. The stud **56** can be locked in any desired position by means of a locknut **58**. The holder **14** has bores **59**, **60** for respective heater elements **61**, **62** and the block **11** has a bore **63** for a thermostat **64** of known type.

The working surfaces of my die **10** are subjected to constant abrasion by a heated strip of paper or other material and I prefer to provide the die blocks with hard carbide inserts for the working surfaces although it will be understood that my invention is by no means limited to the use of such inserts. Thus the block **11** has an insert **66** extending along its length and the blocks **12** and **13** have respective inserts **67**, **68**.

The novelty and utility of my invention can best be understood by reference to FIGURES 3, 4, 5, and 6. From FIGURE 4 which shows the entrance, or upstream end of my die in enlarged view, the insert **66** of the block **11** is seen to have a lower flat surface **69**, which can be conveniently referred to as a "first" flat surface, and the insert **68** to have an upper flat surface **71**, which can be conveniently referred to as a "second" flat surface, which, in combination, form a slot **72** for a strip of paper **73**. Coextensive with the first surface **69** there is ground into the insert **66** a first curvilinear side wall **74** which is preferably semicircular. A second similar

semicircular side wall **76** is ground in the upper right hand corner of the insert **67** in such a manner that it also can be made coextensive with the surface **69**, and when the blocks **11**, **12**, **13** are assembled as shown, the side wall **76** forms an opposite extension of the slot **72** from the side wall **74**. The flat surface **69** is continuous to the left edge of the block **11** (as viewed in the drawings) and rests directly on an upper surface **77** of the block **12**. In order, however, to provide space for the slot **72** the surface **71** is lower than the surface **77** and does not, of course, help support the block **11**. The right side of this block as seen in the figures) has a flat surface **78** which is supported on an upper surface **79** of the block **13**. The vertical distance between the surfaces **69** and **79** equal the diameter of the semicircles formed by the curvilinear walls **74** and **76**.

The surface **79** curves upwardly to form a third curvilinear wall **81** in the insert **68** and the walls **74**, **81** combine to form a lengthwise passage in my die **10** for a wire or other strand **82**. Bell mouths **83**, **84**, **85** are provided at the entrance ends of the respective inserts **66**, **67**, **68** to facilitate threading the paper into the die and to ease the admission of lumps and lapped splices in the strip as it is continuously pulled through the die along with the strand **82** by capstan or other known take-up means, not shown.

It can be seen in FIGURE 4 that when the paper strip **73** first enters the die, the greatest portion of its width is flat due to the fact that the slot **72** has a width at the entrance at least equal in extent to a major portion of the width of the strip. The strip is curved slightly in a curl **86** around the outside of the strand **82** against the wall **74** and it is curved an approximately equal amount in a curl **87** against the curvilinear wall **76**. However, a die may be constructed within the scope of my invention in which the slot **72** is wide enough to accommodate a strip without curling the edges. FIGURE 5 shows a section through the die at a point downstream of the entrance. Here the surface **71** has narrowed considerably from its width at the entrance with the result that the slot **72** is narrower at this section. The curls **86**, **87** have been forced by the narrowing of the slot into full semicircles around the curvilinear walls **74**, **76**. At this point, however, a left edge **88** of the strip **73** has abutted against a flat surface **89** of the block **13** which, in its upper portion, constitutes a flat side wall facing the curvilinear wall **76**. As the paper continues to advance, since it cannot curl any further along the wall **76**, the curl **86** grows larger at an increased rate and an edge **91** of the strip curves along the curvilinear wall **81** to complete the circle around the strand **82** (FIGURE 6). As the strip continues to advance, the edge **91** pushes around the wire **82**.

The thermostat **64** maintains the die at a temperature generated by the heaters **61** and **62** sufficient to drive steam from the paper in its passage through the die which has the effect of lubricating it. It is important to note, however, that the resistance against the insertion of the edge **91** is not transmitted directly to the edge **88**, abutting the flat wall **89**, but pushes the entire curl **87** against the curvilinear wall **76**. This has a capstan effect so that very little force is actually transmitted to the edge **88** and the latter is not warped or distorted, because the end pressure is not sufficient to create such warping. Although it does take considerable pressure to force the edge **91** around the strand, this pressure is mostly supplied by the friction of the curl **87** against the wall **76**.

By the time the strip has reached the section shown in FIGURE 7 the edge **91** has been forced half-way again around the strand **82** so that it is now at a point beneath the strand. However, the walls **89** and **81** of the insert **68** have been converging and have now disappeared so that the strand passage is now comprised of the walls **74** and **76** instead of the walls **74** and **81**. The curl **87** now surrounds the strand so that there are two complete turns of strip around the strand, although it will be understood

that a lesser or greater overlapping of the strip may be made within the scope of my invention. The covered strand completes its passage through the die in this form in which it is permanently set by the ironing effect of the high temperature.

In the operation of my invention my die **10** is originally opened by removing the locking pin **35** and swinging up the gate **28** on the pins **32, 33**. By this means the block **11** is separated from the blocks **12, 13**. The strand **82** is connected to a known type of take-up, not shown, and laid on the block insert **68** against the curved wall **81**. The strip **73** is positioned by hand on the flat surface **71** and the leading end of the strip is rolled around the strand by hand so that it conforms to the lower portion of the die. The block **11** is then lowered into place by swinging down the gate **28** and the pin **35** is reinserted. The die is brought up to temperature by means of the heater elements **61, 62** and the take-up is started, drawing both the strand **82** and the strip **73** through the die, from which the strand emerges with the strip longitudinally wrapped around it.

When an imperfection or a splice in the strip **73** enters the die **10** the block **11** lifts slightly against the spring **57**. This is possible because the stud **34** has some freedom of movement in the oversized bore **36**. However, when the imperfection or lump has passed through and the block **11** returns to rest on the blocks **12, 13** it is in perfect alignment due to the construction of my die, described hereinabove, including the pins **43, 44** and **52**.

The die of my invention has proven eminently successful for covering telephone conductor wire with paper insulation and I have found that the following dimensions and thicknesses of strip are to be preferred for this purpose:

Wire size, A.W.G.	Paper width, inches	Paper thickness, inches
26	3/16	.0015
24	1/4	.002
22	5/16	.0025
19	7/16	.0035

When telephone wires insulated by means of my improved die were twisted into pairs and compared to standard pairs that had been insulated with a spiral wrap they were found to have only ¼ of the resistance unbalance of the spiral wrap conductors and to be entirely free from areas of exposed copper.

I have invented a new and useful die for which I desire an award of Letters Patent.

I claim:

1. A die having an entrance and an exit end for continuously forming an advancing strip into a tube of indefinite length having a substantial longitudinal overlap, comprising:

(A) two parallel walls defining a slot for said strip,
  (a) said slot diminishing in width from the entrance end toward the exit end of said die,
(B) a first curvilinear side wall coextensive with said slot along the length thereof,
(C) a second curvilinear side wall coextensive with said slot along the length thereof,
  (a) said side walls being concave toward each other,
(D) a third curvilinear side wall
  (a) concave toward said first side wall
  (b) forming a tubular passage in combination therewith, and
(E) a flat, strip-abutting, side wall
  (a) facing said second side wall,
(F) said third side wall and said flat side wall converging, and terminating short of the exit end of said die,

(G) said first side wall and said second side wall converging, and combining to form a tubular passage within said die.

2. A die having an entrance end and an exit end for continuously forming a advancing strip into a tube of indefinite length having a substantial longitudinal overlap, comprising:

(A) a first block having a first flat surface portion,
(B) a second block having a second flat surface portion,
  (a) said first and said second portions combining to form a slot diminishing in width from the entrance end toward the exit end of said die,
(C) means aligning said first block and said second block
  (a) while permitting said blocks to separate during the passage of thickened portions of strip through the die,
(D) a first curvilinear side wall coextensive with said slot along the length thereof,
(E) a second curvilinear side wall coextensive with said slot along the length thereof,
  (a) said side walls being concave toward each other,
(F) a third curvilinear side wall
  (a) concave toward said first side wall
  (b) forming a tubular passage in combination therewith, and
(G) a flat, strip-abutting side wall
  (a) facing said second side wall,
(H) said third side wall and said flat side wall converging, and terminating short of the exit end of said die,
(I) said first side wall and said second side wall converging, and combining to form a tubular passage within said die.

3. A die having an entrance end and an exit end for continuously forming an advancing strip into a tube of indefinite length having a substantial longitudinal overlap, comprising:

(A) a first block having a first flat surface portion,
(B) a second block having a second flat surface portion,
  (a) said first and second portions combining to form a slot diminishing in width from the entrance end toward the exit end of said die,
(C) means aligning said first block and said second blocks
  (a) while permitting said blocks to separate during the passage of thickened portions of strip through the die,
(D) a first curvilinear side wall
  (a) formed in said first block,
  (b) coextensive with said slot,
  (c) along the length thereof,
(E) a third block facing said first block,
(F) a second curvilinear side wall
  (a) formed in said third block,
  (b) coextensive with said slot along the length thereof,
  (c) said side walls being concave toward each other,
(G) a third curvilinear side wall
  (a) formed in said second block,
  (b) concave toward said first side wall,
  (c) forming a tubular passage in combination therewith, and
(H) a flat, strip-abutting, side wall
  (a) formed in said second block,
  (b) facing said second side wall,
(I) said third side wall and said flat side wall converging, and terminating short of the exit end of said die,
(J) said first side wall and said second side wall converging, and combining to form a tubular passage within said die.

4. A die having an entrance end and an exit end for continuously wrapping a paper strip with a substantial longitudinal overlap around an advancing strand, comprising:

(A) two parallel walls defining a slot for said strip,
  (a) said slot diminishing in width from the entrance end toward the exit end of said die,
(B) a first curvilinear side wall coextensive with said slot along the length thereof,
(C) a second curvilinear side wall coextensive with said slot along the length thereof,
  (a) said side walls being concave toward each other,
(D) a third curvilinear side wall
  (a) concave toward said first side wall
  (b) forming a tubular, strand-confining, passage in combination therewith, and
(E) a flat, strip-abutting, side wall
  (a) facing said second side wall,
(F) said third side wall and said flat side wall converging, and terminating short of the exit end of said die,
(G) said first side wall and said second side wall converging, and combining to form a tubular passage within said die, and
(H) means for heating said die.

5. A die having an entrance end and an exit end for continuously wrapping a paper strip with a substantial longitudinal overlap around an advancing strand, comprising:

(A) a first block having a first flat surface portion,
(B) a second block having a second flat surface portion,
  (a) said first and second portions combining to form a slot diminishing in width from the entrance end toward the exit end of said die,
(C) means aligning said first block and said second block
  (a) while permitting said blocks to separate during the passage of thickened portions of strip through the die,
(D) a first curvilinear side wall coextensive with said slot along the length thereof,
(E) a second curvilinear side wall coextensive with said slot along the length thereof,
  (a) said side walls being concave toward each other,
(F) a third curvilinear side wall
  (a) concave toward said first side wall,
  (b) forming a tubular, strand-confining, passage in combination therewith, and
(G) a flat, strip-abutting, side wall
  (a) facing said second side wall,
(H) said third side wall and said flat side wall converging, and terminating short of the exit end of said die,

(I) said first side wall and said second side wall converging, and combining to form a tubular passage short of the exit end of said die, and
(J) means for heating said die.

6. A die having an entrance end and an exit end for continuously wrapping a paper strip with a substantial longitudinal overlap around an advancing strand, comprising:

(A) a first block having a first flat surface portion,
(B) a second block having a second flat surface portion,
  (a) said first and said second portions combining to form a slot diminishing in width from the entrance end toward the exit end of said die,
(C) means aligning said first block and said second block
  (a) while permitting said blocks to separate during the passage of thickened portions of strip through the die,
(D) a first curvilinear side wall
  (a) formed in said first block,
  (b) coextensive with said slot,
  (c) along the length thereof,
(E) a third block facing on said first block,
(F) a second curvilinear side wall
  (a) formed in said third block,
  (b) coextensive with said slot along the length thereof,
  (c) said side walls being concave toward each other,
(G) a third curvilinear side wall,
  (a) formed in said second block,
  (b) concave toward said first side wall,
  (c) forming a tubular, strand-confining, passage in combination therewith, and
(H) a flat, strip-abutting, side wall
  (a) formed in said second block,
  (b) facing said second side wall,
(I) said third side wall and said flat side wall converging, and terminating short of the exit end of said die,
(J) said first side wall and said second side wall converging, and combining to form a tubular passage short of the exit end of said die, and
(K) means for heating said die.

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