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 This application Jan. 27, 1970, Ser. No. 6,084

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[54] **STRAPPING APPARATUS**
12 Claims, 18 Drawing Figs.

[52] U.S. Cl..... **140/93.2,**
100/33 PB, 140/123.6

[51] Int. Cl..... **B21f 9/02**

[50] Field of Search..... **140/93,**
93.2, 93.4, 102.5, 111, 117, 122, 123, 123.5,
123.6, 149; 100/25, 26, 29, 33

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ABSTRACT: A portable strapping apparatus and method for semiautomatically applying an indeterminate length of plain flat surface plastic strapping around a bundle of electrical conductors includes a strapping material feed mechanism capable of feeding the strapping in opposite directions, a pair of jaws openable to accommodate the bundle of electrical conductors, strapping guides for guiding the strapping around the bundle of electrical conductors inside the jaws, and a cutter for cutting the strapping to separate the strapping supply from a portion of the strapping extending around the bundle of electrical conductors. The end of the strapping is twisted and together with a hollow closure fastener it forms a detent for holding the strapping during reverse feeding. After reverse feeding, a combination twister cutter cuts the strapping adjacent the closure fastener and twists it simultaneously to form a further detent. The closure fasteners, which are molded plastic of unique configuration, are fed into operative position from a magazine. The apparatus is embodied in a simple lightweight trigger operated gun.

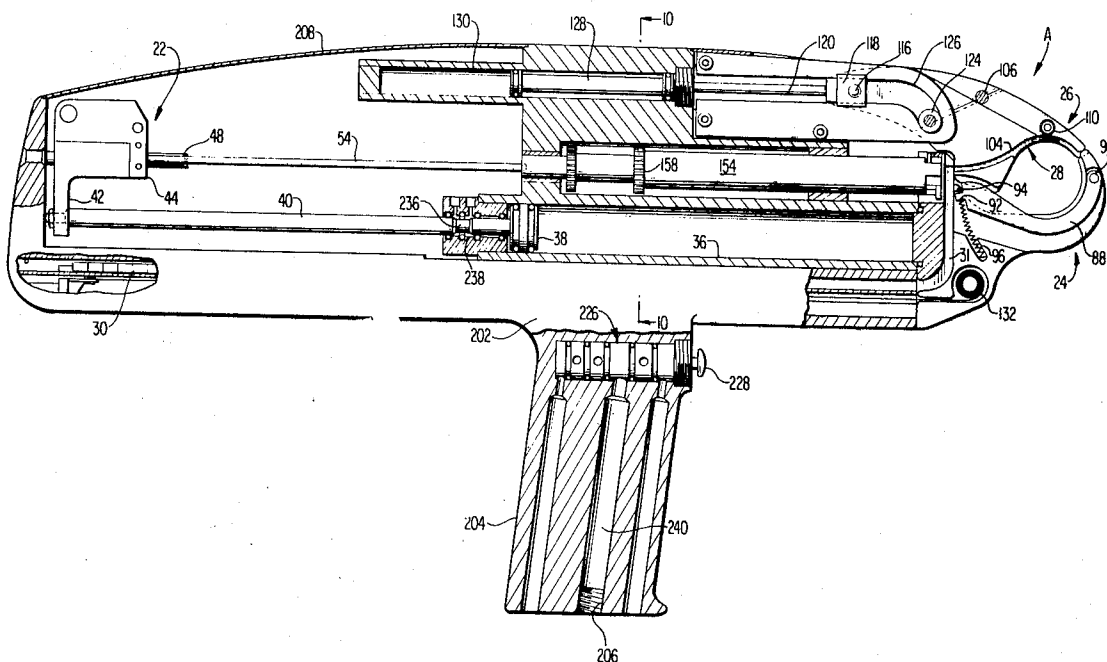
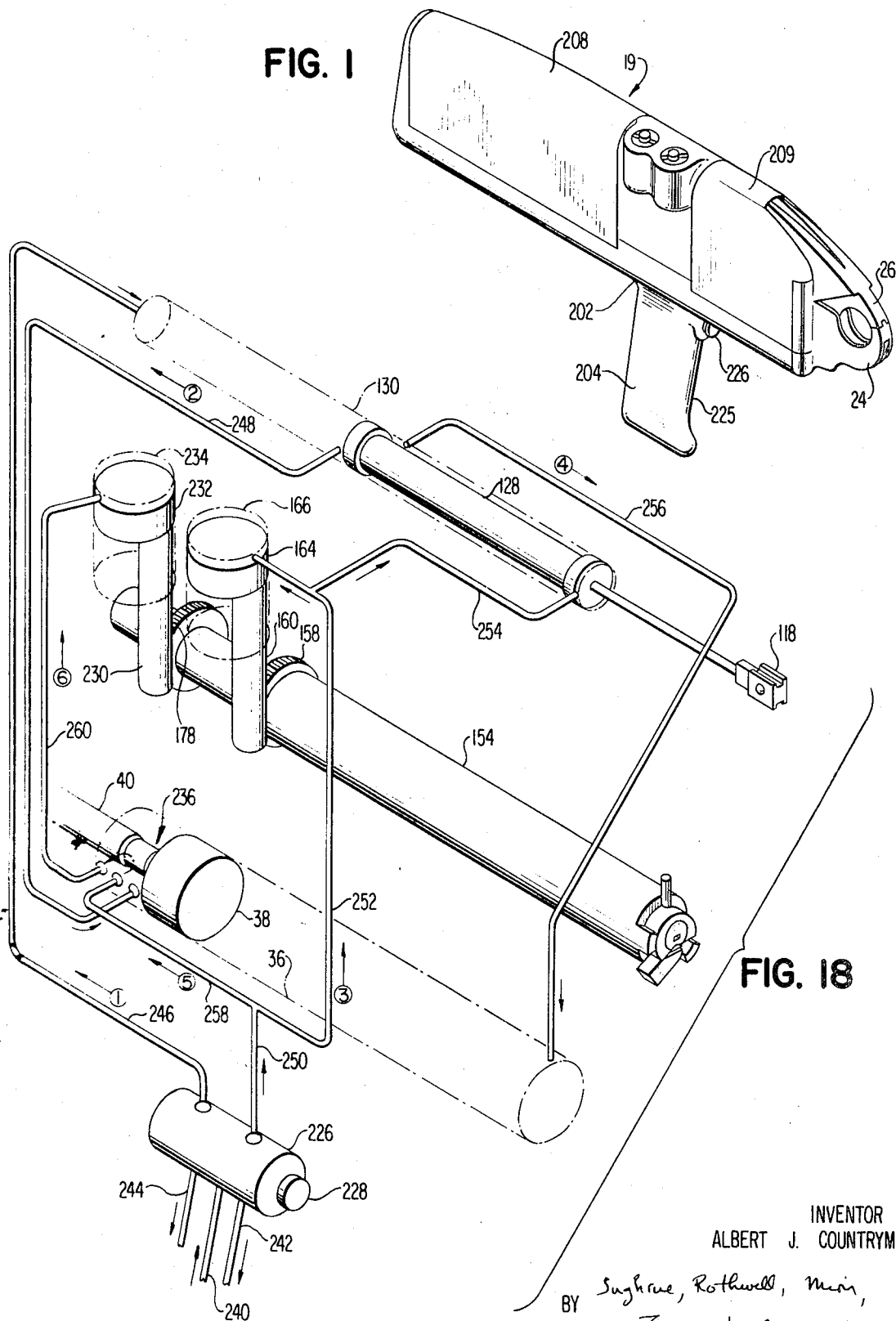


FIG. 1



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ATTORNEYS

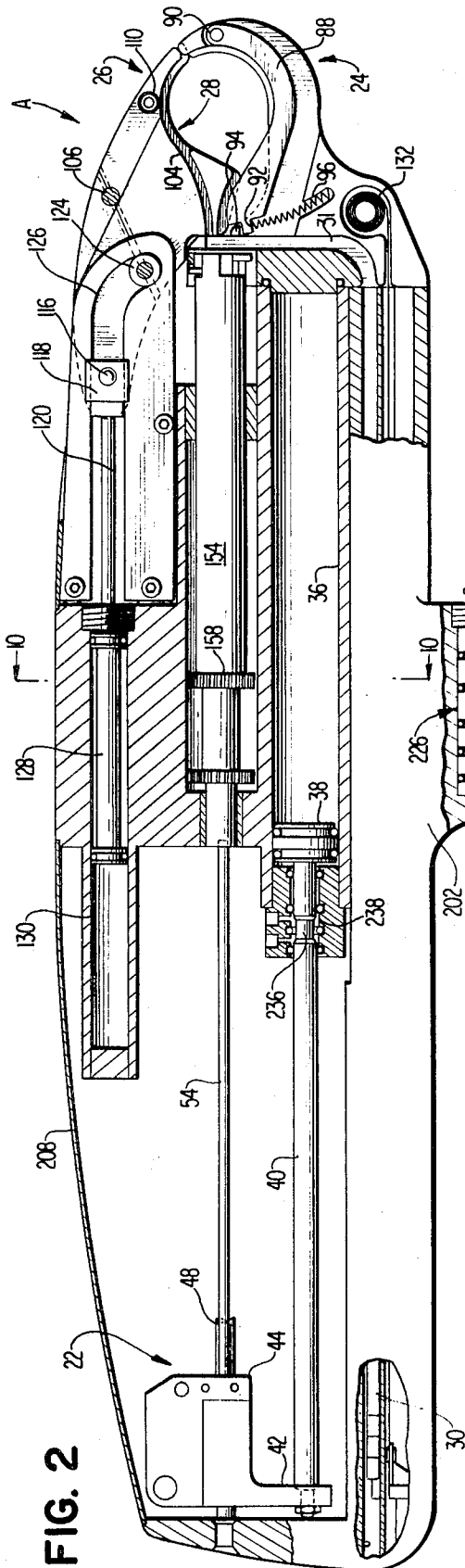


FIG. 2

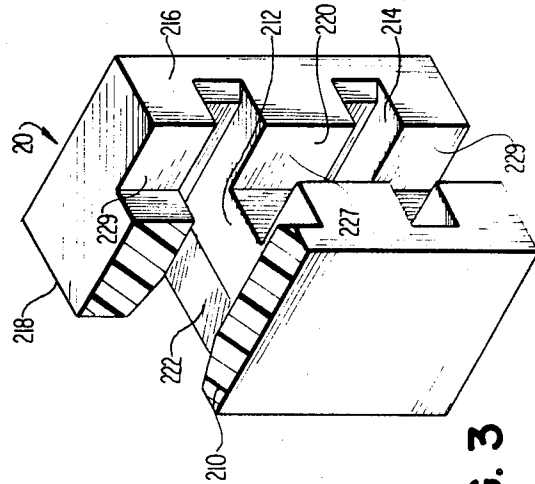


FIG. 3

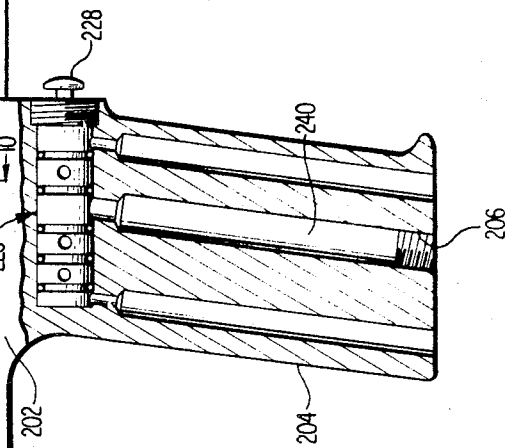


FIG. 4

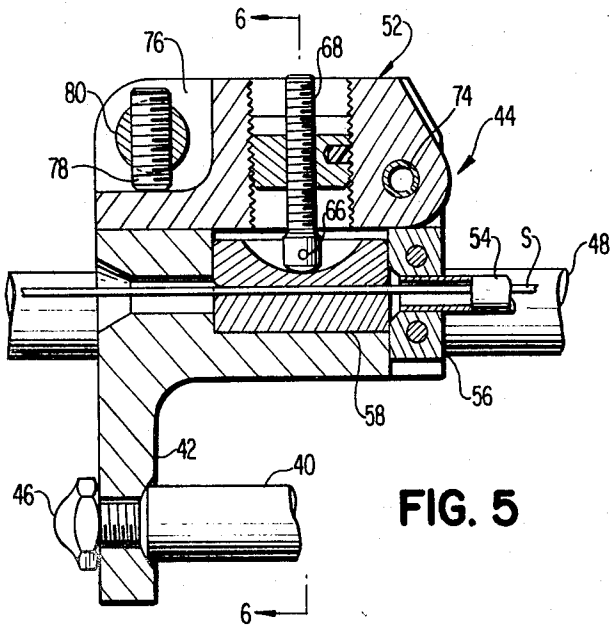


FIG. 5

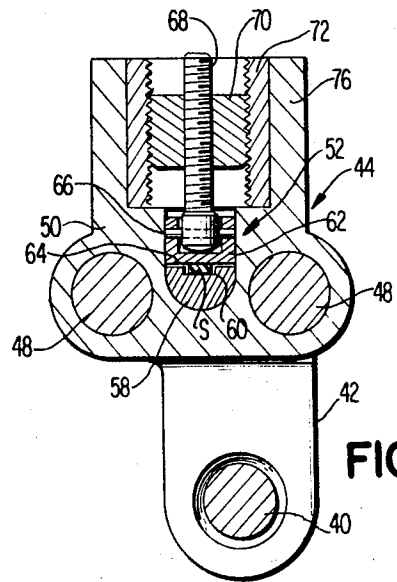


FIG. 6

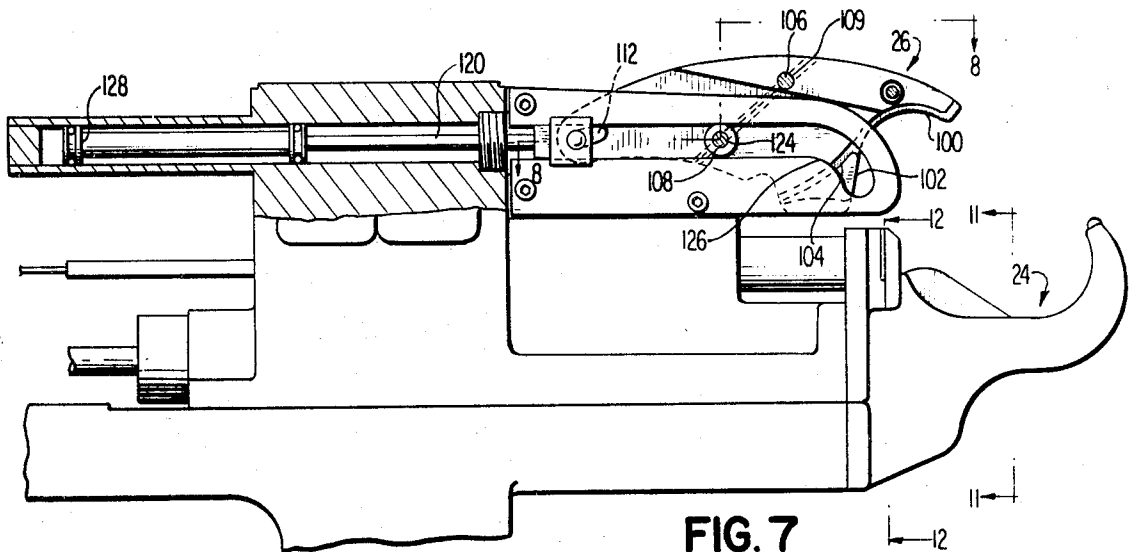


FIG. 7

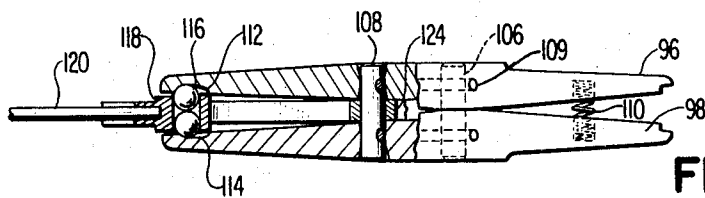


FIG. 8

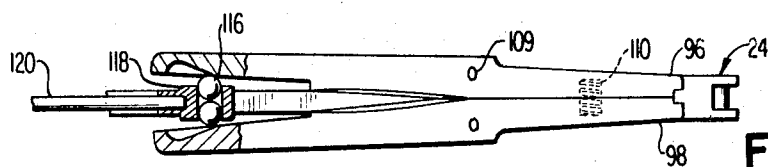


FIG. 9

FIG. 10

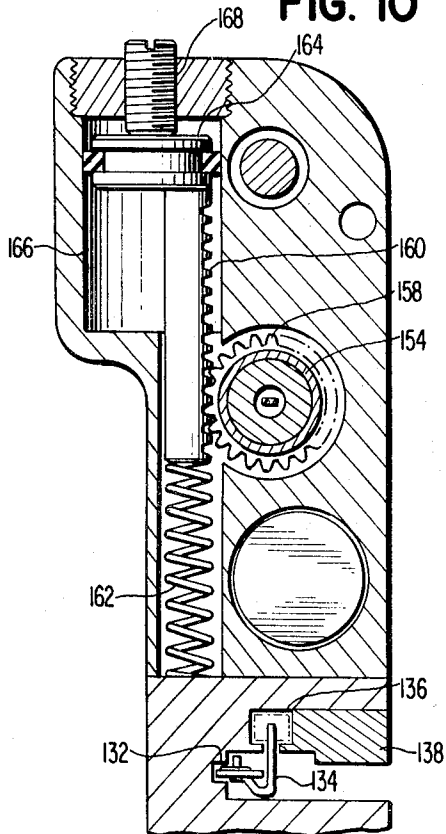


FIG. 11

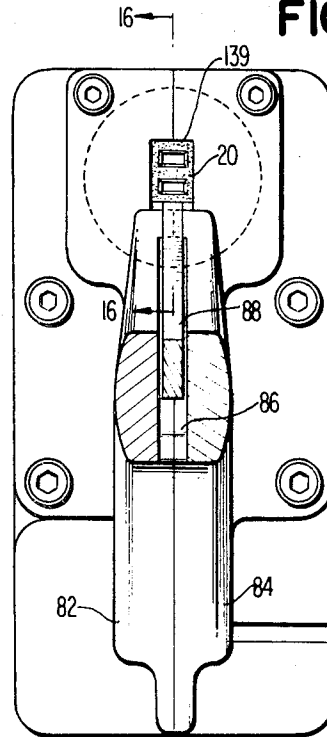


FIG. 13

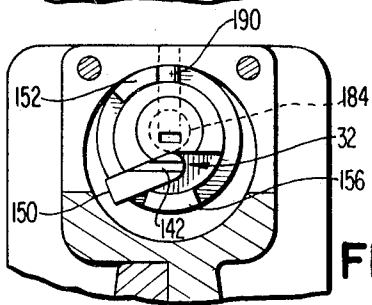


FIG. 14

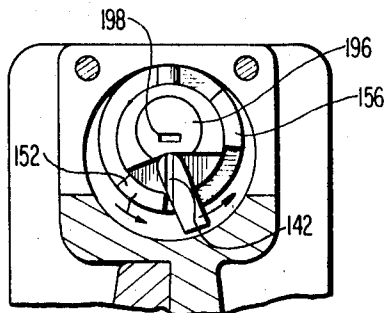
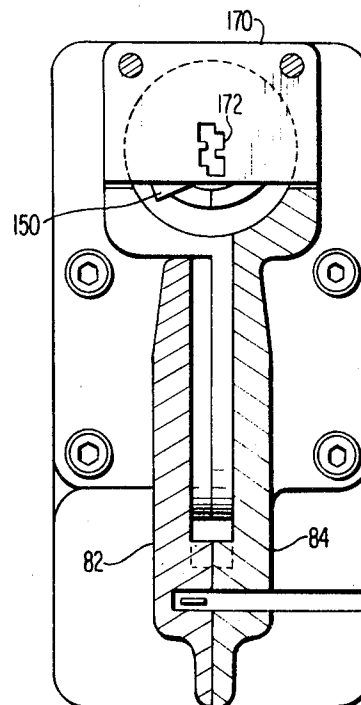
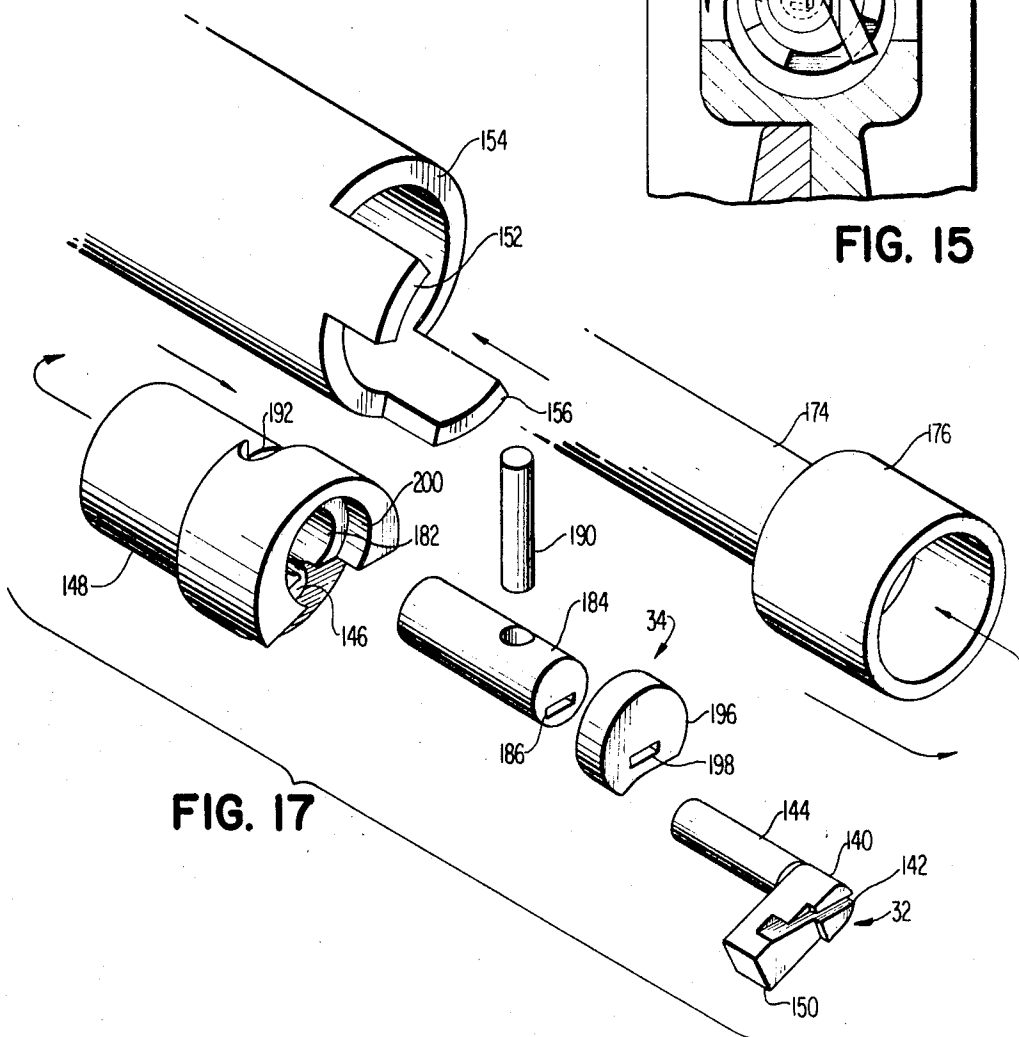
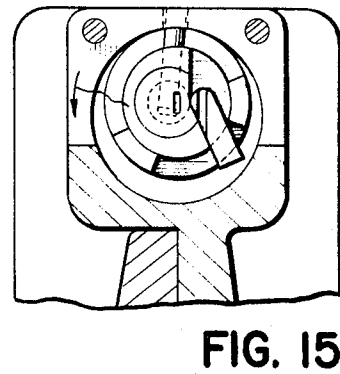
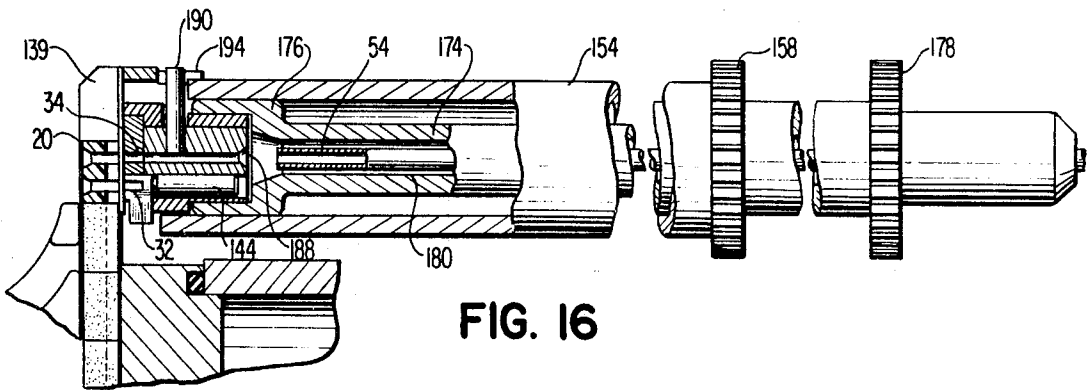


FIG. 12





STRAPPING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of prior application, Ser. No. 831,527, filed June 9, 1969, now abandoned in favor of this application.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to improvements in a strapping method and apparatus for applying a plastic strap around a bundle of electrical conductors and securing and cutting the strap. It also relates to an improved closure fastener which is used with plain surface plastic strapping.

2. Prior Art

Strapping apparatus and methods for applying the strapping to various articles are known in the art. One type of strapping apparatus is that which applies a steel strapping to boxes and other devices, the strapping apparatus usually being stationary, the box being fed to it. This type of strapping apparatus is entirely unsuitable for tying together in neat bundles a number of electrical conductors such as are common in data processing equipment, communications equipment and the like. The strapping ties and fasteners in these electrical arts should not have any metal, and should preferably be lightweight and portable to allow a worker to tie bundles at various positions on the equipment.

It is also known to provide strapping methods and apparatus for tying bundles of electrical conductors using a plastic strapping material and either a separate closure fastener or an integral fastener for connecting the ends of the tie. The integral fasteners are molded integrally on the end of a short discrete strap. Molding of the strap and integral fastener is expensive. The construction is also wasteful of strapping material because all of the straps are of finite length and the bundles of wires to be tied are of different size requiring different lengths of strapping. Even more important is the fact that the integral fastener type straps are applied manually, considerably slowing their application, and significantly adversely affecting the economics of their usage.

Another type of electrical conductor strapping device known in the art utilized metal staples as a fastener for the strapping material, but the strapping material was not securely held by such fasteners. This device was also unsuccessful due to the use of metal and an expensive, unreliable and complex design.

SUMMARY OF THE INVENTION

This invention resides in a strapping apparatus and method which is inexpensive and simple. Plain surface strapping is fed through a unique closure element and only two radial motions are required other than feeding and reverse feeding the strapping, namely a twist and a twist-cut. This invention eliminates waste of strapping as the strapping supply is cut directly adjacent the closure and the length of plastic strapping which is used for each tie around a bundle of conductors depends directly and only on the size of the bundle. The apparatus is reliable due in part to its simplicity and the fact that there is nothing required in the tool itself to clamp or otherwise hold the free end of the strapping which is captured in the closure.

These advantages accrue from the unique strapping apparatus which includes a portable gun with a strapping feed mechanism for feeding plain flat surface plastic strapping in opposite directions, a pair of jaws at least one of which is openable to accommodate a bundle of electrical conductors, strapping guides for guiding the strapping around a bundle of conductors inside the jaws, a hollow closure element, a twister for twisting the free end of the strapping after it is passed through the closure element to form a detent between the free end of the strapping so that upon reverse feeding of the strapping the only thing that is holding the strapping is the closure element in position, and a twister-cutter surrounding the

strapping adjacent the closure element on the strapping feed side for twisting the strapping and simultaneously cutting it after the reverse feeding in order to separate the bundled conductors from the tool. Pneumatic controls automatically control the operation actuated by a trigger in the gun. The strapping is fed by means of a single power cylinder slide with an adjustable pressure pad engaging the strapping. The openable jaw is split lengthwise so that it may function as a strapping guide and will be easy to break away from the tape. The twister-cutter is in the same plane as the twister at the face of the closure element to eliminate waste of strapping and to be certain of detenting upon back feed.

This invention also provides a method of binding bundles of electrical conductors with plastic strapping utilizing the captured end technique by twisting the free end of the plastic strapping in a plane at the closure fastener face and transverse to the axis of the strapping, then backfeeding of the strapping to tighten it around the bundle of conductors, and finally twisting and simultaneously cutting the fed end of the strapping adjacent the closure fastener.

The invention also includes a unique closure fastener in the form of a hollow molded plastic member which is easy to mold. The fastener is of generally block shape form with two passages extending through it. These passages are shaped as a section of the strapping to accommodate the strapping fed around the bundle and back through the fastener. On the side of the closure which is positioned away from the bundle there is a transverse slot extending across the face of the closure element at 90° to the hollow tubular passages for the strapping. This slot is for accommodating the twisted ends of the strapping and holding the strapping by its ends after it is placed around the conductors.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the apparatus of this invention in the form of a gun.

FIG. 2 is a longitudinal sectional elevation view of the apparatus of this invention.

FIG. 3 is a perspective view of the closure fastener of this invention with portions broken away for clarity.

FIG. 4 is a sectional view of the closure fastener with strapping therein extending around and binding conductors.

FIG. 5 is a detail side sectional elevation of a portion of the strapping feed arrangement.

FIG. 6 is a sectional view taken along line 6—6 of FIG. 5.

FIG. 7 is a side elevation view partially in section of detail of the gun including the jaws.

FIG. 8 is a sectional view taken along line 8—8 of FIG. 7.

FIG. 9 is a plan view looking in the direction of arrow A in FIG. 2.

FIG. 10 is a sectional view taking along line 10—10 of FIG. 2.

FIG. 11 is a sectional view taken along line 11—11 of FIG. 7.

FIG. 12 is a sectional view taken along line 12—12 of FIG. 7.

FIG. 13 is a front elevational view similar to FIG. 12 but with a backing plate removed showing the operation at the start of twisting.

FIG. 14 is a view similar to FIG. 13 showing the position of the components during twisting.

FIG. 15 is a view similar to FIGS. 13 and 14 showing the position of the components during twisting and cutting.

FIG. 16 is a longitudinal sectional elevation detail view of the components within the gun constituting the twister and cutter with a closure fastener in operative position.

FIG. 17 is an exploded perspective view of the principal elements of the twister and twister-cutter.

FIG. 18 is a fluid circuit diagram with the mechanical components of the apparatus shown in perspective.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Introduction

A strapping apparatus 19 shown for example in FIG. 1 is utilized for semiautomatically placing plain surface flat surface plastic strapping S of rectangular section, see FIG. 4, around a bundle of electrical conductors C such as are common in communication, data processing and like complicated equipment. The strapping is automatically held at both ends Se in a unique molded plastic strapping fastener 20, see FIGS. 3 and 4. The strapping ends Se are twisted so that they may be retained by the strapping fastener 20. The strapping is of a plastic material which is flexible but will take a permanent set when overtwisted axially. One such plastic material which is suitable is sold by E. I. du Pont de Nemours Corp. under the trademark "DYMETROL nylon."

General

The strapping apparatus 19 which is also used in practicing the method of this invention will be easier to understand with reference to general component assemblies such as a strapping feed mechanism 22, FIGS. 2, 5 and 6, which feeds the strapping S in predetermined lengths from a roll of strapping (not shown) to a pair of relatively operable jaws including lower jaw 24 and an operable upper jaw 26. The upper jaw 26 may open as shown in FIG. 7 to accommodate a bundle of electrical conductors C and then close to the position shown in FIGS. 1 and 2.

Strapping guide means 28 guide the strapping around the inside of the jaws. A strapping fastener 20 is fed into operative position shown in FIGS. 11 and 16 from a magazine 30 through a fastener-feed passage 31. When a closure fastener is in operative position, the strapping S is fed through one passage in the strapping fastener, around the conductors C, guided by the guide means 28 inside the jaws 24 and 26, back through another passage the strapping fastener and into the end of a twister 32 where the free end of the strapping is twisted so that it may form a detent with the strapping fastener during reverse feed. Thus the strapping S when reverse fed by the strapping feed mechanism 22 is tightened around the bundle C while the free end of the strapping Se is held by the strapping fastener 20. After tightening around the bundle, the strapping S is then cut and simultaneously twisted at the face of the strapping fastener 20 opposite the bundle by a twister-cutter 34. Automatic controls of FIG. 18 provide for sequential operation of the strapping feed mechanism (forward), twister, strapping feed mechanism (reverse), twister-cutter and jaw opening.

Strapping Feed

The strapping feed mechanism shown in FIGS. 2, 5 and 6 includes a cylinder 36 in which a piston 38 reciprocates under force of fluid pressure. A piston rod 40 is attached to the piston at one end and at the other end to a leg 42 of a slide 44 by means of nut 46, see FIG. 5. The slide 44 is slidably mounted for longitudinal reciprocal movement on a pair of slide guide rods 48. The slide includes a body 50 mounting an adjustable pressure pad assembly 52. This pressure pad assembly applies pressure to the flat surfaces of plane surface flat strapping S to drive the strapping in forward and reverse directions but to slip on the surface of the strapping when the strapping is held at its free end.

A guide tube 54 for the strapping S is attached to a block 56 connected to the slide body 50.

The pressure pad assembly includes a stationary wear plate 58 in the housing 50. This wear plate includes a slot 60 of less depth than the thickness of the strapping S functioning as a track for the strapping. An upper pressure pad 62 has a flat bottom surface 64 for contacting the upper surface of the strapping S. This pressure pad is connected by pin 66 to an adjusting screw 68 which in turn is threaded within an adjustable dual threaded nut 70 having its outer threads engaged with internally threaded housing 72. The arrangement of the threads both internally and externally on nut 70 is such that rotation of the threaded nut 70 produces a differential movement providing for very fine adjustment of the pressure applied to the surfaces of the strapping S by the pressure pads.

The housing 72 is pivotally mounted by pivot shaft 74 within walls 76 of the slide housing 50 so that quick pressure release

can be obtained. This quick pressure release is obtained by unscrewing set screw 78 threaded through crossbar 80 between the walls 76 so that the housing 52 may be pivoted about shaft 74 thus quickly relieving the pressure for loading or unloading operations of the strap or for other reasons.

Jaws

The lower stationary jaw 24 is best shown in FIGS. 2, 7 and 11. It includes a pair of split jaw sections 82 and 84 which are secured together to define a slot 86 in which a movable guide track lever member 88 is positioned. The surface of the guide track 88 is below the surface of the split sections 82 and 84 to define a depression to guide the plastic strapping. The guide lever 88 is pivoted at pivot point 90 and includes a finger 92 biased against a stop 94 by a spring 96.

The upper and movable or openable jaw 26 is best shown in FIGS. 7, 8, 9 and 2. As shown in FIGS. 8 and 9 it includes a pair of longitudinally split sections 96 and 98 having inner surface slots 100 defining a portion of the groove or track for the strapping S. A land 102 is also provided to further define the track by guide slot 104, see FIGS. 2 and 7.

The split jaw sections 96 and 98 pivot about a vertical pivot to open and close the front end of the jaws as shown by comparing FIGS. 8 and 9. The jaws are individually pivoted on pins 109, 109 which in turn are held in pins 106 and 108 so the jaw sections may pivot from the split open position shown in FIG. 8 wherein they are biased apart by spring 110 to the closed position shown in FIG. 9 where they are closed for the purpose of forming a guide track and then back to the split open position of FIG. 8.

For causing the pivotal movement, the jaws have a cam surface 112 and 114 in jaws 96 and 98 on the rear inside face thereof. This cam surface is engaged by balls 116 captured in yoke 118 attached to piston rod 120. A bushing 124 which surrounds the pin 108 is guided in a track 126 so as to guide the upper jaw 26 from jaw open to closed position. The piston rod 120 is connected to a dual headed piston 128 reciprocable within housing cylinder 130. As can be seen upon, movement of the piston on the left shown in FIG. 7 to the right as shown in FIG. 2, the entire upper jaw assembly 26 moves forwardly and downwardly being guided by bushing 124 in track 126 to the jaw closed position shown in FIG. 2. The camming of the jaw sections 96 and 98 closed does not start until the bushing 124 is at the end of the track 126 and jaws are in closed position relative to each other as shown in FIG. 2. Then with further longitudinal movement of jaw 26 stopped, the piston 128 during the end portion of its stroke causes the balls 116 to close the jaw sections 96 and 98.

Closure Fastener Feed

The feeding mechanism for feeding closure fasteners 20 is quite simple. The housing mounts a constant tension spring 132 such as a "Negator" which has one end connected to a follower 134, see FIGS. 2 and 10. The follower 134 projects upwardly into an enclosed track 136. One side of the track is formed by member 138. Follower 134 can move out of the way to allow loading of an entire magazine or large batch of closure fasteners 20 simultaneously. After the closure fasteners are loaded, they are biased by the spring 132 and follower 134 toward the jaw end of the gun. The biased fasteners pass upwardly in guide path 31 so that the uppermost fastener 20 is in operative position for a fastening or tying operation, this position being the position shown for example in FIGS. 11 and 16. A stop 139 defines the operative position of fastener 20.

Twister

After the closure fastener 20 has been fed into operative position, FIG. 16, and the strapping S has been fed by the strapping feed mechanism 22 in a forward direction through the closure fastener, around the bundle of conductors C guided by guide means 28 inside jaws 24 and 26, back through a lower hole in the closure fastener, then the free end of the strapping is twisted by twister 32. The twister 32 includes a twister head 140, see FIGS. 16 and 17, having a twisting slot 142 therein and mounted on a mounting shaft 144. Shaft 144

is journaled in a hole 146 in member 148. This hole is off center with respect to member 148. The twister head 140 has an extension or outer end 150 which functions as a handle for turning the twister from the position shown in FIG. 13, the end receiving position, to the position shown in FIG. 14, the twisted position. A tang 152 on an outer cylindrical member 154 contacts the extension 150 to rotate the twister head about the axis of shaft 146 from the position of FIG. 13 somewhat through the position of FIG. 14 in order that the end of the plastic strapping be twisted 90° as shown in FIG. 4. The cylindrical member 154 also has another tang 156 for returning the twister to its original position.

For rotating the outer tubular member 154 there is a pinion 158 secured thereto, see FIGS. 2, 10 and 16. This pinion is in mesh with a rack 160 and normally biased to the FIG. 13 position by spring 162. The rack is driven downwardly as viewed in FIG. 10 by a piston 164 in cylinder 166 at a predetermined time in the cycle on the application of fluid pressure to the top of piston 164. An adjustable stop 168 determines the starting position, i.e., the position of the outer tubular member shown in FIG. 13.

Twister-Cutter

The twister-cutter is shown in FIGS. 15, 16 and 17. In front of both twister and twister-cutter there is a backup plate 170 having a hole 172 therethrough of the shape shown in FIG. 12. The twister-cutter includes an inner tubular member 174 having a cup-shaped head 176 at one end thereof for receiving member 148. The other end of inner tubular member 174 includes another pinion 178 similar to pinion 158 which is operated by another rack and spring biased piston assembly identical to that shown in FIG. 10, see FIG. 18.

The inner tubular member 174 has a hollow passage 180 of a diameter sufficient to accommodate the strapping guide tube 54 when the slide 44 slides to its forwardmost position. Within member 148 there is an upper eccentric bore 182 for receiving a stationary member 184. Member 184 has a slot 186 extending therethrough to accommodate the strapping fed therethrough. A funnel-shaped opening 188, FIG. 16, is at the rear end of the passage 186 for guiding the strapping during threading operation. Member 184 is held stationary by means of pin 190 extending upwardly through hole 192 in member 148 and held by tangs 194 of the stationary housing. Thus, while inner member 174 rotates member 148 the stationary member 184 will not rotate. A rotating die 196 having a cutting slot 198 therein is mounted in bore 200 countersunk from the face of member 148. Thus rotation of the tubular member 174 rotates member 148 and twister-cutter die 196 as shown in FIG. 15. Rotation of the twister-cutter through 90° cuts the strapping at the face between member 184 and die 196 and twists the cut end 90°. In practice the twister and twister-cutter will rotate more than 90° to twist the ends of the "Dymetrol" plastic strapping 90°.

Strapping Fastener

The strapping fastener 20 is best shown in FIGS. 3 and 4. It is molded from a block 210 of plastic material having electrical insulating properties and is formed with a pair of spaced slots 212 and 214 extending through the block from one face 216 to an opposite face 218. These slots are rectangular in section and are slightly larger in sectional shape than the cross section through the strapping S so that the slots 212 and 214 accommodate the strapping being fed through them. The strapping is fed first from face 216 through slot 212 positioned above slot 214, around the guiding means 28 to guide the strapping around the bundle of conductors C back through slot 214 from face 218 and then directly into the twister 32. Because the slots are slightly larger than the section of strapping S and the section of strapping S is rectangular in section, the slots are also rectangular in section having a width greater than their height.

The block is also formed with a single transverse slot 220. The slot 220 includes a central portion 227 between slots 212 and 214 and end portions 229. The slots 212 and 214 are a distance apart greater than the width of the slots so that when

the strapping ends Se are twisted as shown in FIGS. 3 and 4, they may rest in the slot 220 without interfering with each other. Tapered walls 222 at the bottom of slots 212 and 214 are provided to accommodate the strapping as shown in FIG. 4 and to better guide the free end of the strapping into slot 214.

Housing in Gun Form

The apparatus 19 shown in FIG. 1 includes a housing casting 202 with a handle 204 having passages 206 therein for supply and exhaust of air and includes sheet metal covers 208 and 209. A three-way pneumatic control valve 226 is controlled by a bias trigger 228 to control operation of the gun.

Controls and Pneumatic Circuit

Inner tubular member 174 has its pinion 178 operated by a rack 230 biased against piston 232 and cylinder 234 as shown in FIG. 18. A valve 236 is provided at the end of cylinder 36 by lands 238 and a reduced diameter portion of piston rod 40. When the piston rod 40 is in the FIG. 2 position the two passages are connected, but in any other position they are blocked. This valve 236 is shown schematically in FIG. 18.

Air under pressure is connected to inlet passage 240 in the handle 204 and if trigger 228 is pulled, passes through conduit 246 to the end of cylinder 130 driving piston 128 forwardly and closing the upper jaw assembly 26 around the bundle of conductors. Simultaneously, the air in pistons 166 and 234 bleeds off through lines 252 and 258 through valve 226 and exhaust port 242 to atmosphere. Spring bias then returns the pistons to their home position. The extreme forward movement of piston 128 uncovers the entrance to line 248 in cylinder 130 and air pressure passes through line 248 to the rear end of cylinder 36 driving piston 38 forwardly. This feeds a length of strapping around the conductors and back through the closure fastener in operative position. When the operator sees that the strapping has been fed around the closure fastener the trigger 228 is released. This causes the air pressure in line 240 to pass through the valve 226 to line 250 where it branches through line 252 and drives piston 164 in cylinder 166 downwardly operating the outer tubular member 154 and twisting the free end of the strapping. Simultaneously, the air pressure through branching line 254 drives piston 128 back toward its original position in cylinder 130 to open the upper jaw assembly 26. When piston 128 is sufficiently back to its original position, the opening to line 256 is uncovered and air pressure is applied to the forward end of cylinder 36 driving piston 38 back to its original position. When piston 38 moves back toward its original position this constitutes the backfeeding of the strapping the valve 236 opens so pressure through branching line 258 can pass through line 260 to the top of cylinder 234 to drive piston 232 downwardly rotating pinion 178 and operating the inner tubular member 174 and the twister-cutter. With the twister-cutter operated, the tie is completed and the gun is ready to be moved to another location to start another tie. The component parts are all back in the original position described.

Overall Operation and Method

While the overall operation of the invention should be apparent from the foregoing, a brief resume will be given in connection with describing the method. The deformable plastic strapping S from a roll or other large body of strapping material is positioned to be fed by the feed mechanism i.e., is strung through the machine, and a group of strapping fasteners 20 are placed in magazine 30 with the spring follower 134 biasing the forwardmost of the fasteners through path 31 into operative position shown in FIG. 16. At this time, the jaws 24 and 26 are open and the gun is placed around a bundle of conductors C.

To start the strapping operation, the operator pulls trigger 228 which according to the control circuit described causes piston 128 to move forwardly first closing the jaw 26 on the jaw 24 and then closing the jaw sections 96 and 98 from the position of FIG. 8 to the position of FIG. 9 to close and furnish a portion of the guide path 28. As the jaws are closed, the piston 38 is fed forwardly and the strapping gripped fric-

tionally by the slide 44, FIG. 5, is fed in a forward direction in an amount equal to the stroke of the piston. The forward end of the strapping will be guided by guide means 28 around the bundle of conductors and back through the lower slot 214 in the fastener 20. The operator then releases trigger 228 which first operates the twister 32 causing twister slot 142 to move through at least 90° from the position shown in FIG. 13 to the position shown in FIG. 14 twisting the lower free end Se of the strapping. The piston 128 is then moved by pneumatic pressure at the same time back to its original position and the piston 38 is driven rearwardly to cause reverse feeding of the strapping S. The lower free end of the strapping Se is, however, twisted and will be held in the detent slot to the fastener 20 which is in operative position. The remaining portion of the strapping will be pulled tight around the bundle of conductors C as the slide 44 moves back to its original position, the tightening being due to the friction and sliding of the strapping between the wear plates 58 and 62 of the slide. When the slide is back in original position, FIG. 2, the twister-cutter 34 is operated to move the die 196 to the position shown in FIG. 15 in which the upper end of the strapping Se is cut from the indeterminate length of strapping being fed and is twisted 90° so that it will also be in slot 220 of the fastener 20. The tie has then been completed in a quick, easy and expeditious manner.

While the invention has been described in connection with tying bundles of electrical conductors, it is apparent that it may be utilized to tie anything needing tying which can be placed inside the jaws.

I claim:

1. Strapping apparatus for semiautomatically applying an indeterminate length of plain flat surface plastic strapping around a bundle of electrical conductors and securing the strapping by a closure fastener, the strapping apparatus comprising: a strapping feed mechanism for feeding strapping in opposite directions, a pair of jaws at least one jaw being movable to open with respect to the other jaw and accommodate the bundle of electrical conductors, strapping guide means inside the jaws for guiding the strapping around the bundle of electrical conductors, means to position a closure fastener in operative position to receive strapping being fed, a twister for twisting the free end of the strapping in a plane transverse to the axis of the strapping so that the strapping end and the closure fastener form a detent for holding the free end of the strapping during reverse feeding, and a twister-cutter positioned adjacent the closure element for twisting and cutting the fed end of the strapping.

2. Strapping apparatus as in claim 1 further comprising a pneumatic control circuit for semiautomatic operation including pneumatic cylinders controlling operation of the strapping feed mechanism, movable jaw, the twister, and the twister-cutter.

3. Strapping apparatus as in claim 2 wherein the control circuit includes means for reversing the strap feeding mechanism and then operating the twister-cutter after reverse feeding has been completed.

4. A strapping apparatus as in claim 2 wherein the control circuit includes means for operating the feeding mechanism cylinder for feeding strapping in a forward direction only after the movable jaw is closed.

5. A strapping apparatus as in claim 2 wherein the control circuit includes a manually operated valve for initiating the operation of pneumatic cylinders in a predetermined sequence.

6. A strapping apparatus as in claim 1 wherein the means to position the closure fastener in operative position includes feeding means for feeding the closure fastener into operative position from a magazine of such fasteners.

7. Strapping apparatus as defined in claim 1 wherein the strapping feed mechanism includes a power cylinder slide and an adjustable pressure pad engaging the strapping.

8. A strapping apparatus as in claim 1 wherein the twister and the twister-cutter are an assembly including a pair of separately rotatable tubular members, one within the other.

9. A strapping apparatus as in claim 8 wherein the inner rotatable tubular member includes a member having a die slot in a face thereof adjacent the closure fastener element, a slotted stationary die member positioned inside the tubular member having a die slot to accommodate the strapping fed therethrough, the inner tubular member being rotatable to twist and sever the strapping at the die slots.

10. A strapping apparatus as in claim 8 wherein the outer tubular member operates a slotted twister member on rotation of the outer tubular member to twist the free end of the strapping.

11. A strapping apparatus as in claim 1 wherein the movable jaw is split longitudinally so that the jaw halves may be closed to form a portion of the guide means or opened to free the jaw from the strapping.

12. A strapping apparatus as in claim 11 wherein each of the jaw halves include cam surfaces for operating the closing of the jaws and a spring is provided to normally bias the jaws open.

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