

[54] HEAT APPLICATOR APPARATUS AND METHOD FOR FASTENER TAPES

3,512,438 5/1970 Burdge..... 83/277 X
3,620,114 11/1971 Chudyk..... 83/214 X

[75] Inventors: Roger D. Foskett, Winchester; David B. Russell, Ashland, both of Mass.

Primary Examiner—J. M. Meister

[73] Assignee: American Velcro, Inc., New York, N.Y.

Attorney—Pennie, Edmonds, Morton, Taylor & Adams

[22] Filed: Apr. 16, 1971

[21] Appl. No.: 134,816

[52] U.S. Cl..... 83/18, 83/23, 83/112, 83/152, 83/175, 83/214, 83/277

[57] ABSTRACT

[51] Int. Cl..... B26d 5/42

A method and apparatus for applying relatively small increments of hook and loop fastener tape to various web materials including means for feeding and cutting said increments from a tape source and vacuum means for transferring and holding said increments prior to heat bonding of said increments to said web material.

[58] Field of Search 83/18, 42, 23, 100, 83/409, 449, 453, 622, 175, 277, 278, 214, 153, 152, 112

[56] References Cited

UNITED STATES PATENTS

3,194,098 7/1965 Kimball et al. 83/278 X

5 Claims, 10 Drawing Figures

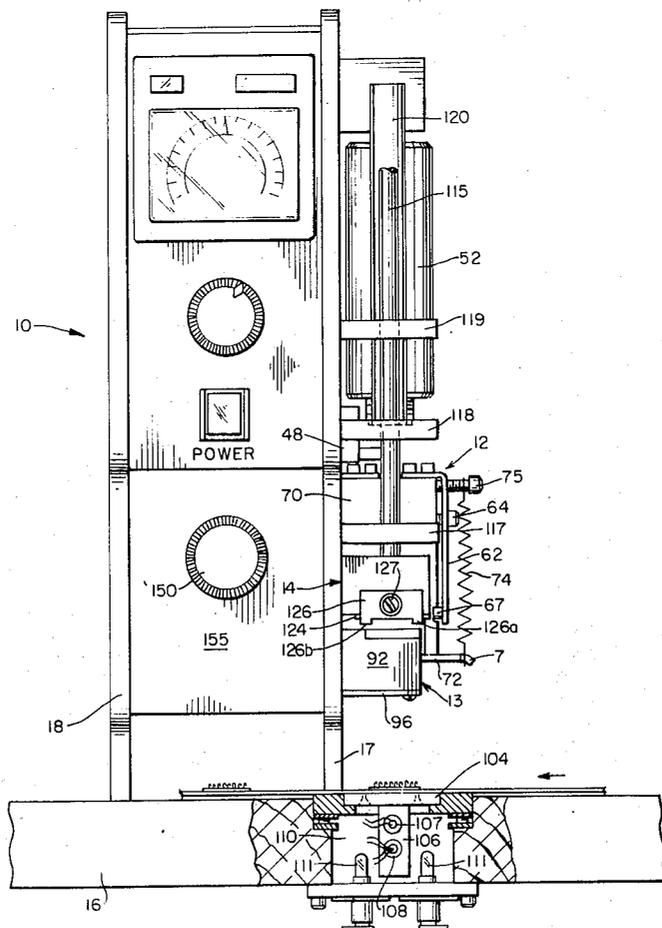
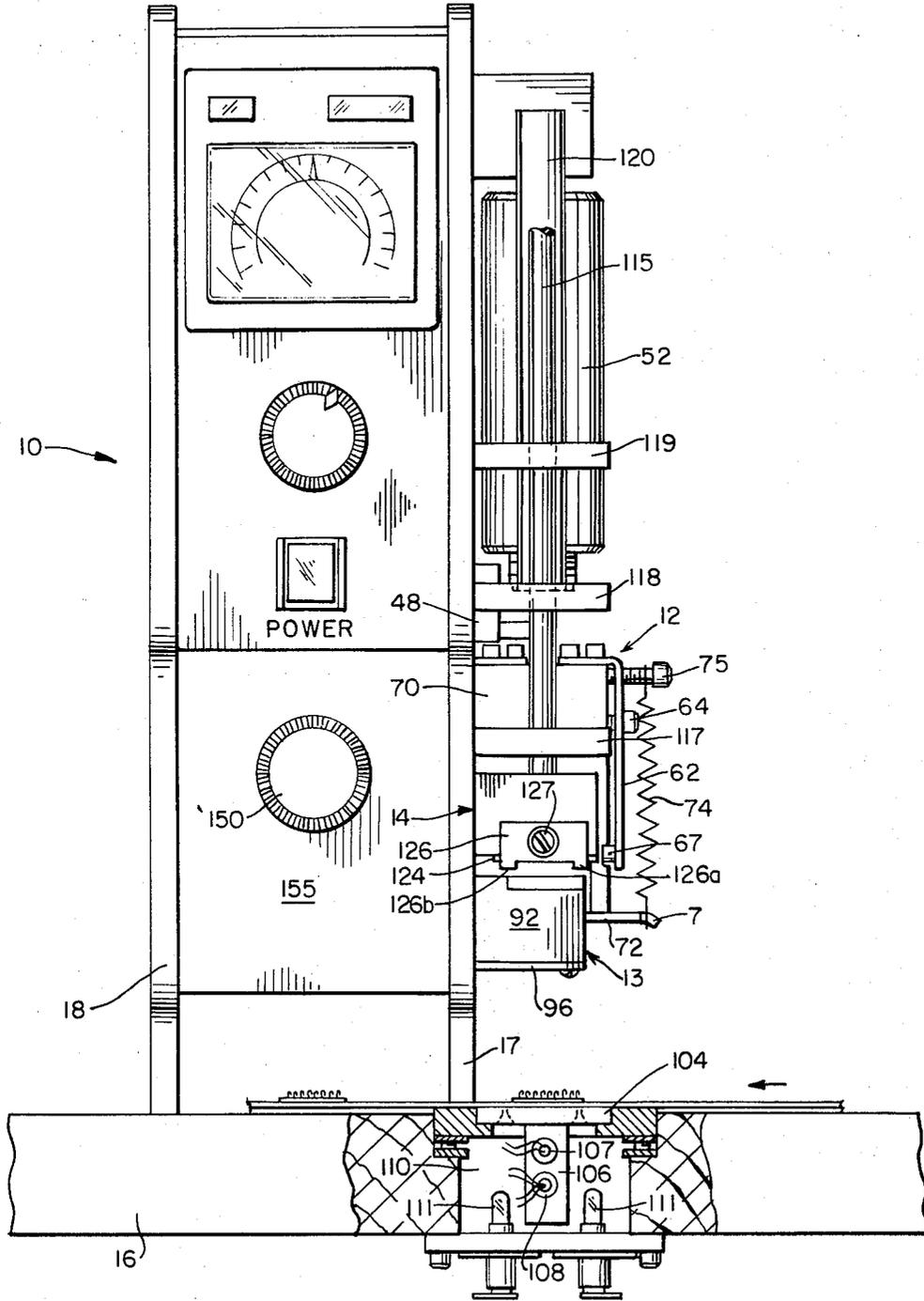


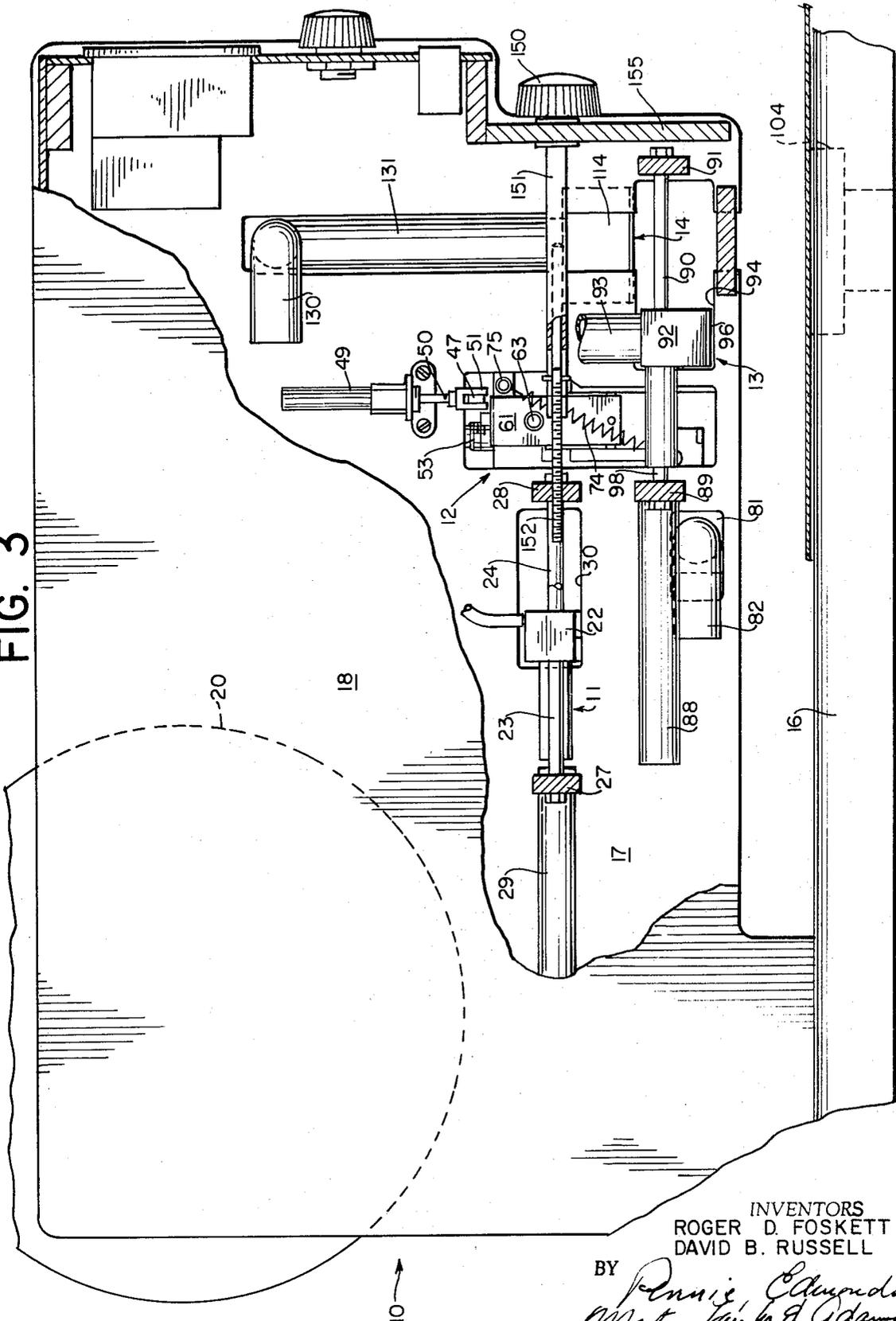
FIG. 1



INVENTORS
ROGER D. FOSKETT
DAVID B. RUSSELL

BY
Rennie Edmunds Worin
Raymond Allen Atkins
ATTORNEYS

FIG. 3



INVENTORS
ROGER D. FOSKETT
DAVID B. RUSSELL

BY *Pennie Edwards,*
Morton, Kay & Adams,
ATTORNEYS

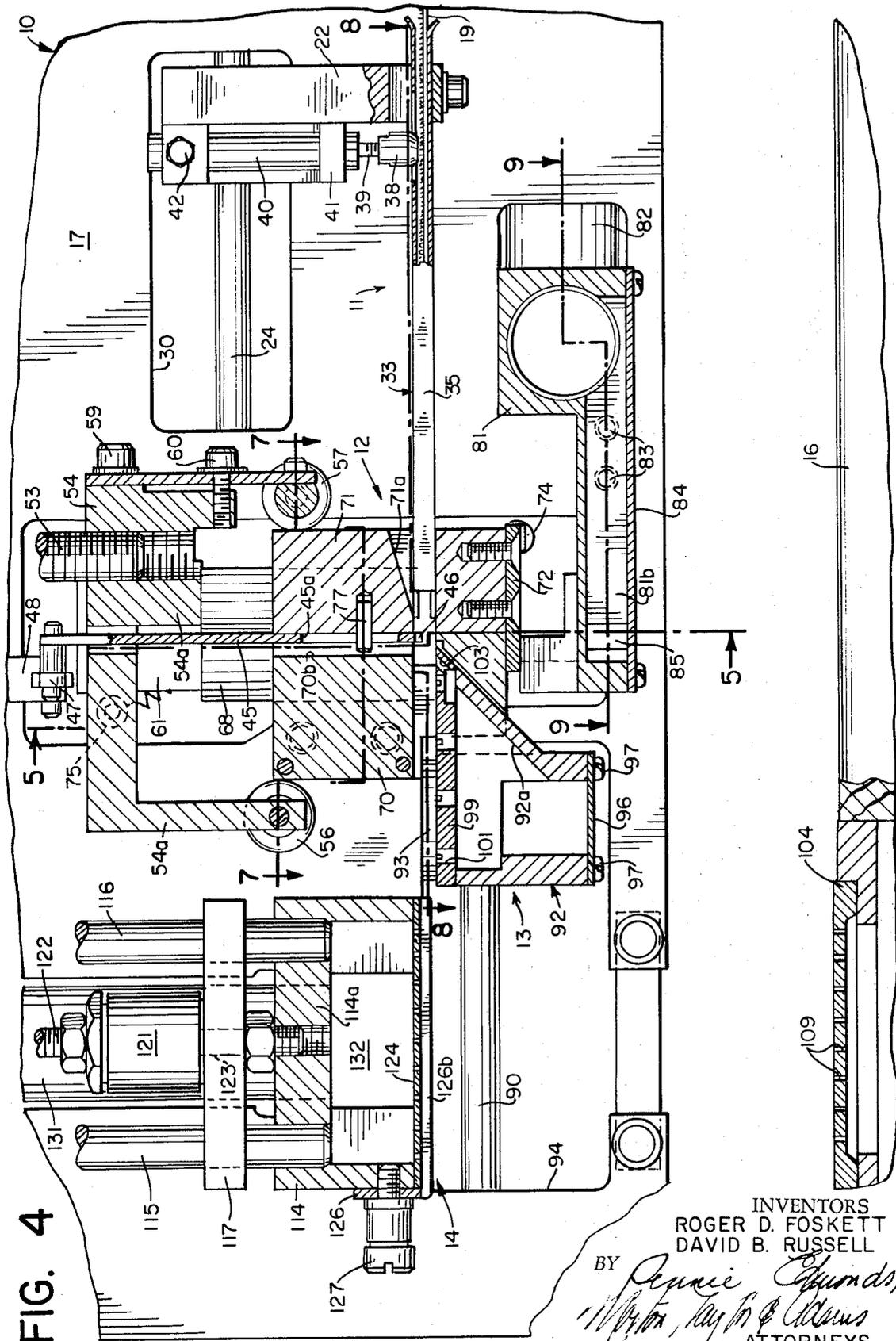
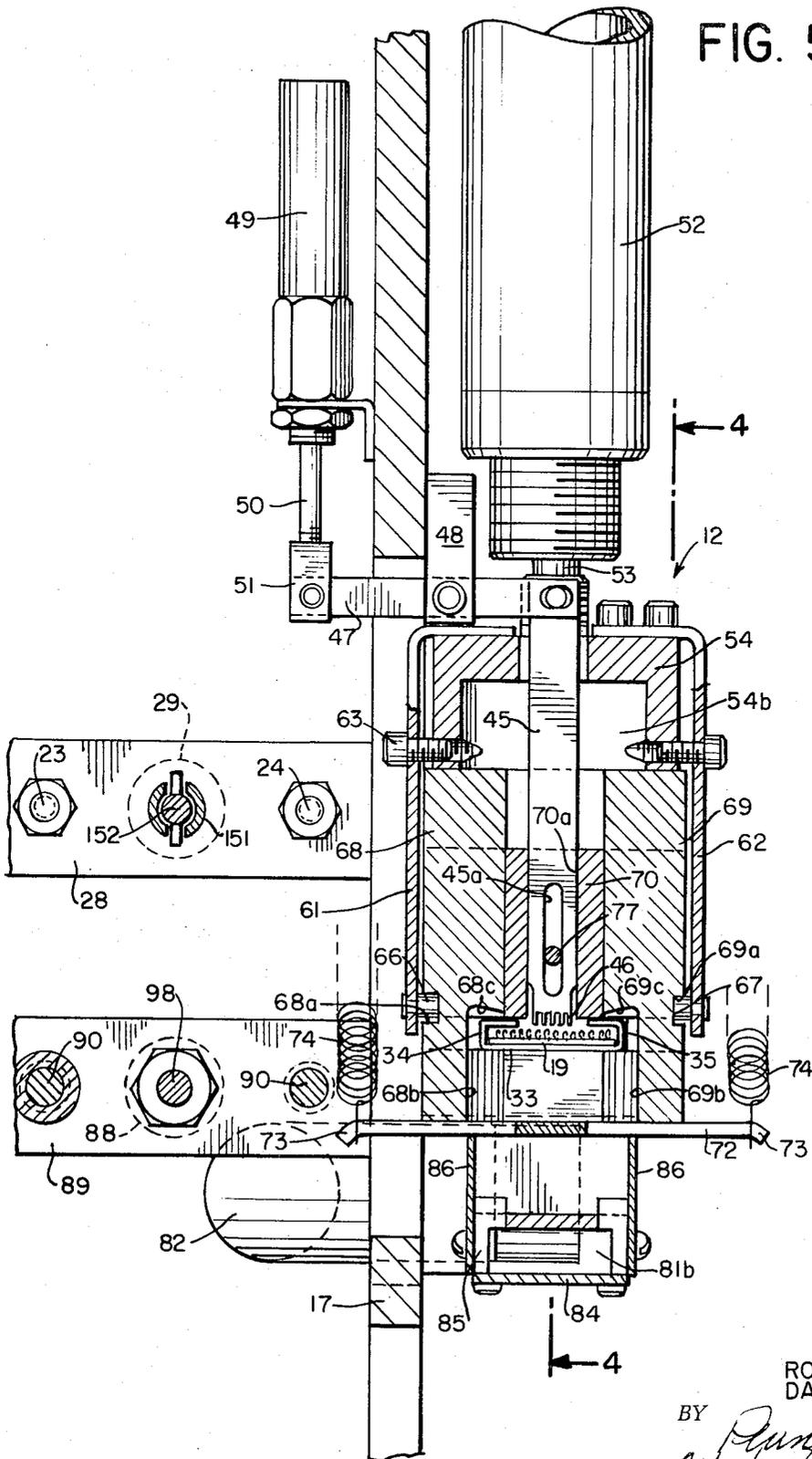


FIG. 4

INVENTORS
ROGER D. FOSKETT
DAVID B. RUSSELL

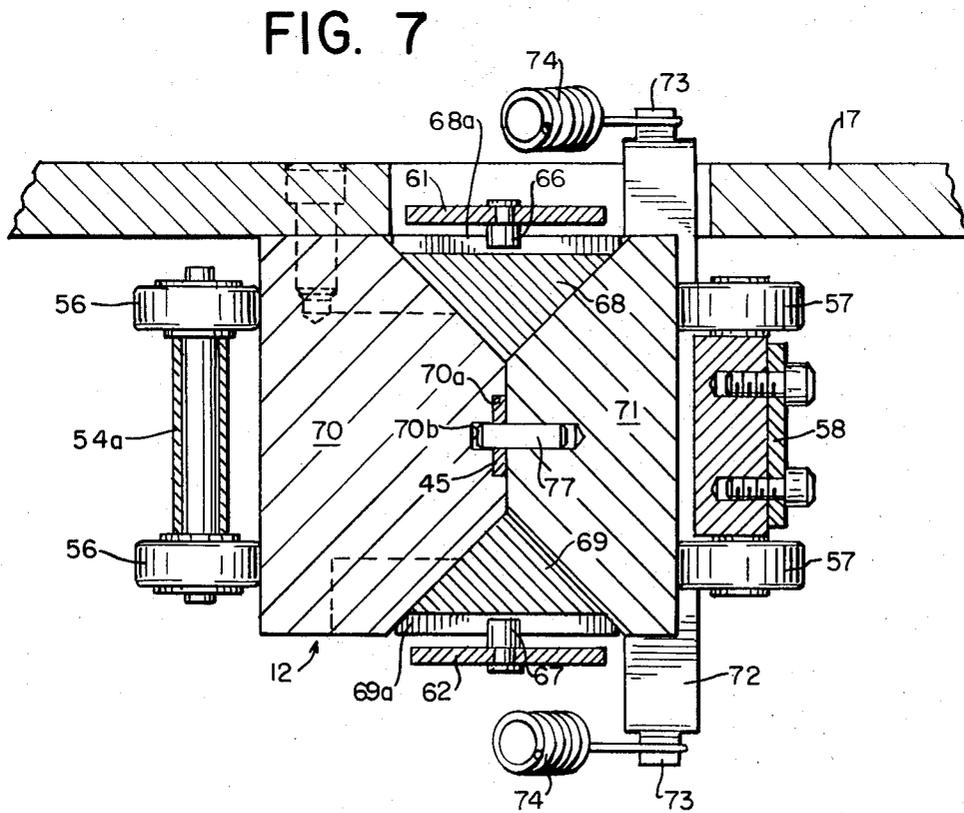
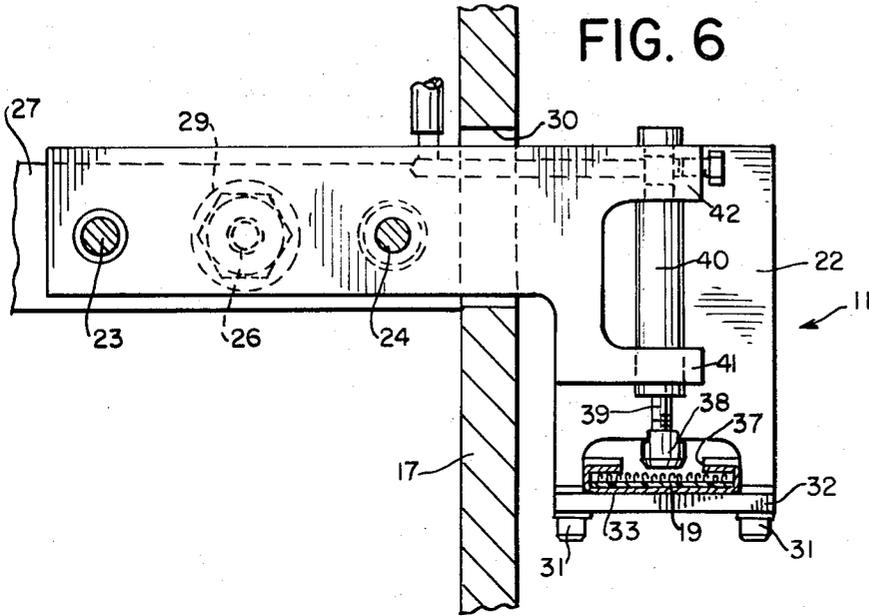
BY *Rennie Edmunds,*
Walter, Kay & Adams
ATTORNEYS

FIG. 5



INVENTORS
ROGER D. FOSKETT
DAVID B. RUSSELL

BY *Russell, Fossitt & Adams*
ATTORNEYS

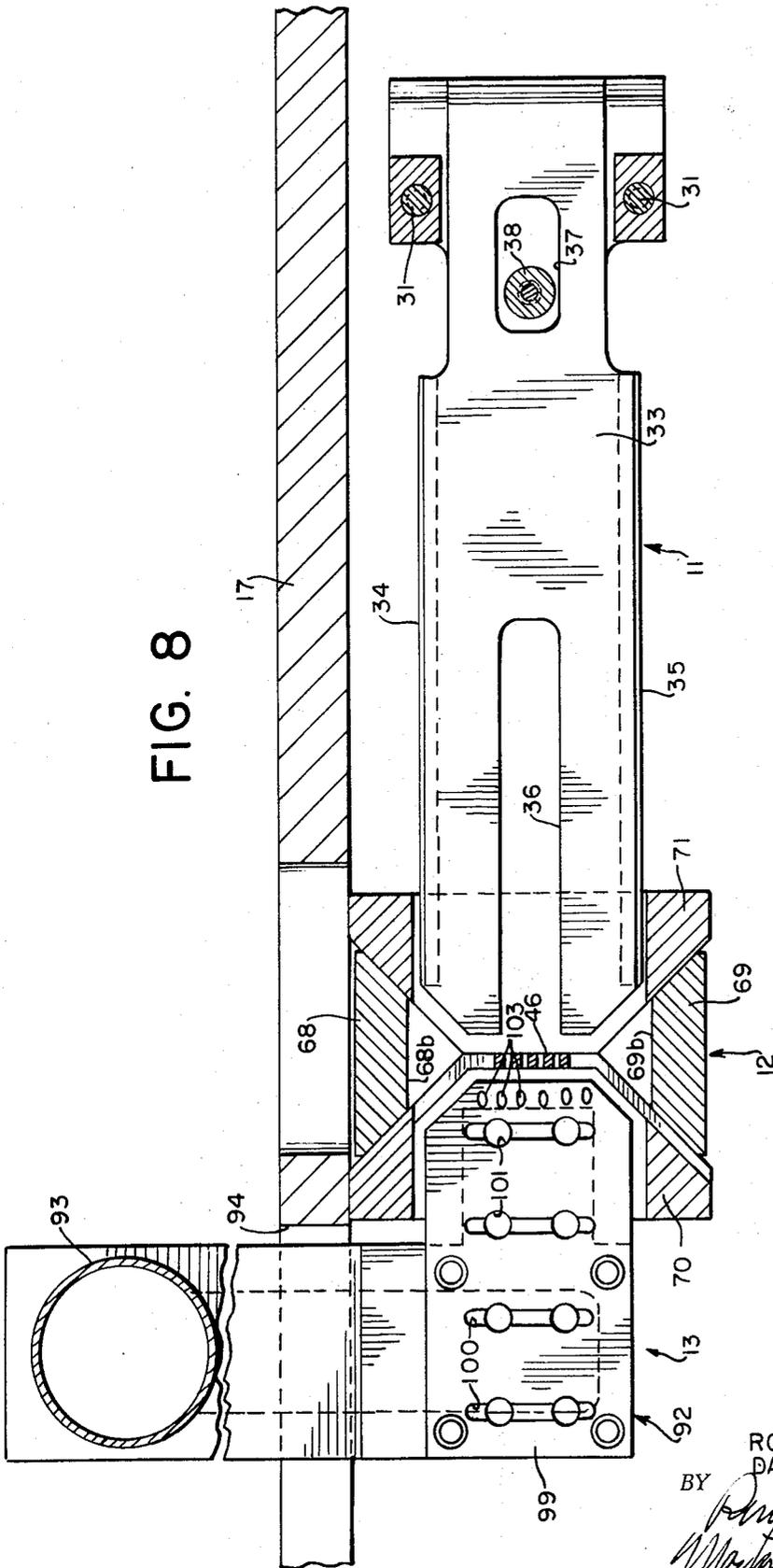


INVENTORS
ROGER D. FOSKETT
DAVID B. RUSSELL

BY

*Russell, Edwards,
Wentz, Taylor & Adams*
ATTORNEYS

FIG. 8



INVENTORS
ROGER D. FOSKETT
DAVID B. RUSSELL

BY *Rennie, Edwards,
Wright, Taylor & Adams*
ATTORNEYS

FIG. 9

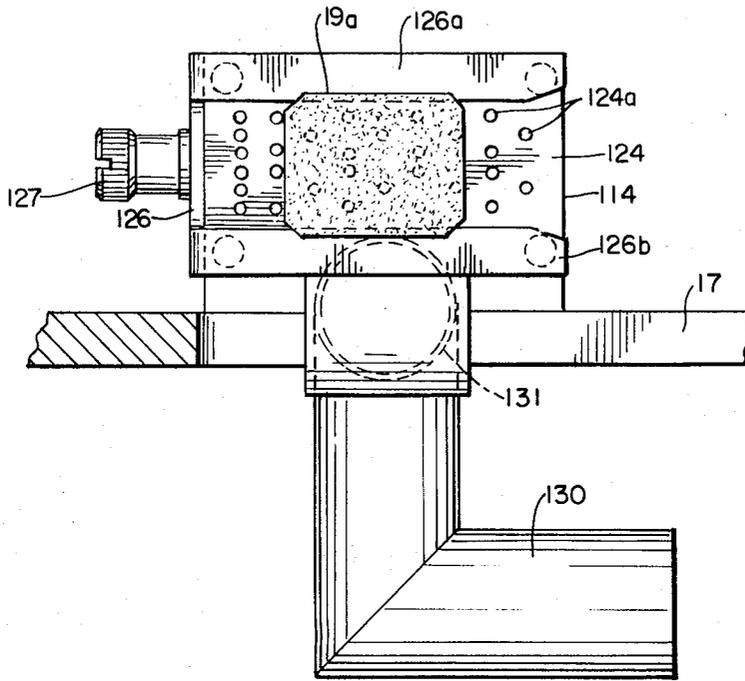
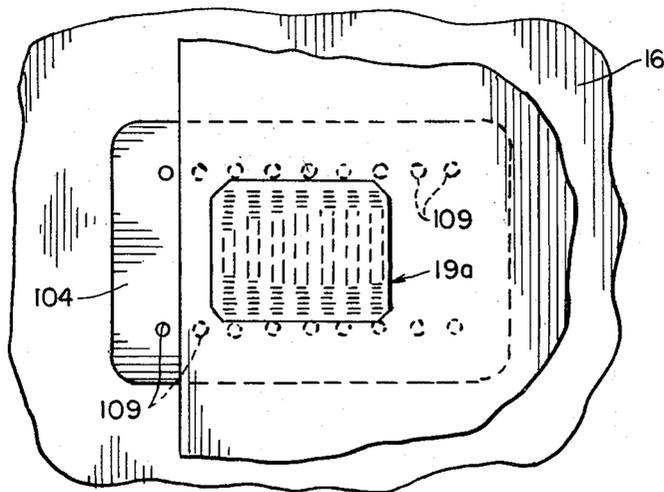


FIG. 10



INVENTORS
ROGER D. FOSKETT
DAVID B. RUSSELL
BY *Ralph C. Edwards,*
Wm. Taylor & Adams
ATTORNEYS

HEAT APPLICATOR APPARATUS AND METHOD FOR FASTENER TAPES

BACKGROUND OF THE INVENTION

It is frequently desirable to attach hook and loop fastener tape to various web materials such as, for example, garments, for utilizing hook and loop fastener closures. Heretofore, hook and loop fastener tape elements have generally been sewn to such web materials. Operations of this type although done by machine, nevertheless, must be accomplished on a slow production, piecework basis. Moreover, there are applications which could beneficially employ hook and loop fasteners applied to materials that cannot effectively be sewn, such as for example, disposable non-woven garments for medical use.

It is the purpose of the present invention to provide a method and apparatus for applying small increments of hook and loop fastener tape by heat bonding to web material of both woven and non-woven construction in an efficient, inexpensive and precise manner.

SUMMARY OF THE INVENTION

In accordance with the present invention an apparatus and method are provided for feeding increments of tape fastener to a cutting means while maintaining said increments in a flattened condition to avoid buckling or crimping. The cutting means includes a positive tape hold-down device in conjunction therewith and means for sequentially notching the corners of tape and for transverse cut-off of tape segments. A vacuum transfer device passes each tape segment to an applicator head which holds the segment by vacuum pressure prior to applying same to a web for adhesively heat bonding the segment thereto. Means are further provided for locating each segment on the web prior to application of a segment.

These and other aspects of the invention shall be explained in connection with a detailed specification and the following drawing in which:

DESCRIPTION OF THE DRAWING

FIG. 1 is a front elevation of the heat applicator apparatus of the invention with parts broken away;

FIG. 2 is a right side elevation of the apparatus of FIG. 1;

FIG. 3 is a left side elevation of the apparatus of FIG. 1 with parts broken away;

FIG. 4 is a vertical section taken along the lines of 4-4 of FIG. 5;

FIG. 5 is a vertical section taken along the lines of 5-5 of FIG. 4;

FIG. 6 is a vertical section taken along the lines of 6-6 of FIG. 2;

FIG. 7 is a horizontal section taken along the lines of 7-7 of FIG. 4;

FIG. 8 is a horizontal section taken along the lines of 8-8 of FIG. 4;

FIG. 9 is a horizontal section taken along the lines of 9-9 of FIG. 2; and

FIG. 10 is a partial plan view showing a section of tape applied to a web material.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawing and initially to FIGS. 1-3 thereof, an apparatus 10 constructed according to the invention has been illustrated. The apparatus 10

comprises generally, transport section 11, cutting section 12 tape segment transfer section 13 and heat and applicator section 14. The apparatus 10 includes a base 16 to which is secured right and left side plates 17, 18. The sections 11-13 are each secured to the right side plate 17 while portions of the heat and applicator section 14 are secured to the side plate 17 and to the base 16.

As seen in FIG. 2, a hook and loop fastener tape 19 (in the embodiment a hook fastener tape is shown), is supplied from a spool 20 mounted for rotation upon side plate 17. Spool 20 is conventionally braked to regulate tension in tape 19. Tape 19 is fed around fixed guide roll 21 mounted to plate 17 and will be fed in the direction of the arrows.

A section of tape 19 is held within transport section 11. Referring initially to FIGS. 2, 3 and 6, the transport section 11 includes a feed slide 22, the upper portion of which extends through side plate 17. The portion extending to the left (FIG. 6) of plate 17 is secured to guide rods 23 and 24 and is further attached to an actuating rod 26. Fixed plates 27 and 28 are attached to side plate 17 and rigidly secured to guide rods 23, 24. Plate 27 further mounts an actuating cylinder 29 whose piston is attached to actuating rod 26. A rectangular opening 30 is provided in plate 17 to permit reciprocation of feed slide 22 therein. A feed shoe 33 is attached to the lower end of feed slide 22 by means of bolts 31 and a fastening plate 32. Tape 19 is held in a generally flattened condition within shoe 33 which has opposing U-shaped sides 34, 35.

As best seen in FIG. 8, the forward end of shoe 33 is bifurcated, thus defining a central slot 36. The shoe 33 further defines a rectangular opening 37 which will admit the lower end 38 of plunger 39. Plunger 39 is attached to a piston (not shown) within air cylinder 49. Cylinder 40 is held by arms 41, 42 which are connected to feed slide 22. Upon actuation of cylinder 40, plunger 39 will press end 38 against the hook fastener tape 19 to secure same against shoe 33. Upon further actuation of cylinder 29 feed slide 22 will carry shoe 33 together with tape 19 toward and into the cutting section 12, the details of which will now be described.

As best seen in FIG. 5, cutting section 12 includes a feed clamp finger 45 whose lower end 46 is serrated as shown so as not to crush the hooks extending upwardly from the hook tape 19. The lower end 46 of finger 45 is permitted to engage the hook tape 19 through slot 36 in feed shoe 33 when the latter has been moved into the cutting section 12. Finger 45 is pivotly attached to a crank 47 which is rotatably supported intermediate its length by means of a bracket 48 attached to plate 17. Actuation cylinder 49 is connected by rod 50 to clevis 51 and to the crank 47. Accordingly, reciprocation of rod 50 will cause finger 45 to be raised or lowered.

Section 12 further includes an actuation cylinder 52 whose actuation rod 53 is connected to a yoke 54. Yoke 54 has at one side a depending leg 54a which mounts two guide rollers 56. Yoke 54 has a further depending part 54b whose function will be described. The opposite side of yoke 54 is connected to two additional rollers 57 by a roller mounting plate 58. Plate 58 is secured to the yoke by bolts 59 and an adjusting screw 60. Consequently, the plate 58 and thus rollers 57 can be moved toward or away from the yoke 54.

Also secured to yoke 54 (in 90° relation to rollers 56 and 57) are opposing spring plates 61, 62 which are ad-

justable toward or away from the yoke 54 by means of screws 63, 64. Plates 61 and 62 have at their lower ends retaining members 66, 67 which engage in slots 68a, 69a within notching dies 68, 69. Thus dies 68, 69 are prevented from moving laterally in the direction of plates 61, 62 and will move upwardly or downwardly with the yoke 54. Notching dies 68, 69 are relieved at sections 68b, 69b thereof to permit passage of shoe 33 into the cutting section 12, and have upwardly inclined shear surfaces 68c, 69c.

Rollers 56 and 57 (see FIGS. 4 and 7) ride upon the exterior of a fixed die 70 and a movable die 71. As seen in FIG. 7 the restraining lateral force exerted by rollers 56 and 57 and by plates 61, 62 cause the respective die elements 68, 69 and 70 to be accurately positioned against stationary die element 71 and with respect to each other. A plate 72 is attached to the lower end of movable die 71 and has extending arms 73. Arms 73 are connected to tension spring elements 74 which extend between plate 72 and yoke 54 to which they are connected at 75. The tension spring elements 74 thus exert a lifting or upward and inward force upon the movable die element 71. The fixed die element 70 has a slot 70a therein which receives the finger 45 for vertical movement thereof. A finger guide pin 77 is held by movable die element 71 and extends through a slot 45a in the finger 45 and into a slot 70b within fixed die 70.

A tape notch removal section 80 is situated below cutting section 12. Section 80 includes a main conduit member 81 which is fixed to the plate 17 by means of screws 83 and is attached to a vacuum pipe 82. Attached to conduit member 81 is an L-shaped pipe 82 which extends through an opening in plate 72 and is connected to a source of vacuum. Conduit member 81 defines a passage 81a which connects with one leg of pipe 82 and which further communicates with a passage 81b. Conduit member 81 and passage 81b are completed and enclosed by a lower plate 84. Passage 81b interconnects with two openings 85 and 86 (see FIG. 5) which are open at the top in the direction of the die section 12. Side plates 86 further are connected to conduit member 81 and extend upwardly therefrom partially to enclose the space between conduit member 81 and the lower portion of die section 12. Openings 85 and 86 are directly below the notch cutting dies 68 and 69 to receive waste material as a result of the notching operation of these dies which will be removed by suction through passages 81b, 81a and pipe 82.

Proceeding now to a description of transfer section 13, we shall refer initially to FIG. 3. An actuation cylinder 88 is secured to the rear side of plate 17 by a mounting plate 89. Guide rods 90 extend from plate 89 to a second mounting plate 91 which is also attached to plate 17. Rods 90 guide the reciprocating movement of a transfer member 92, the rear portion of which can be seen in FIG. 3 connected to a pipe 93 attached to a vacuum source. Transfer member 92 extends through a rectangular opening 94 in plate 17 and is sealed at its lower end by a plate 96 attached thereto by bolts 97. Transfer member 92 is reciprocated in opening 94 by means of rod 98 connected to actuation cylinder 88.

Referring to FIG. 4, the transfer member 92 has an upper perforated plate 99 which extends in the reverse feed direction to a position beneath stationary die member 70. Die member 70 is cut at the angle shown in order to permit the plate 99 and an angular wall section 92a of member 92 to occupy this position. As

shown in FIG. 8, plate 99 is provided with several slots 100 which have interconnecting bores 101. At the rearward edge of plate 92 are a series of openings 103. It will be understood that when a vacuum is drawn through pipe 93, suction will be felt above the plate 99 by through slots and openings 100-103.

The heating and applicator section 14 (FIGS. 1, 2 and 4) comprises a plate 104 which is secured within the base 16 by means of bolts 105. Plate 104 mounts a heating element 106 which includes a thermocouple 107 and electrical power lead 108. The plate 104 defines a series of longitudinal apertures 109 which extend from the upper surface thereof to a chamber 110 beneath the plate in which are mounted a series of bulbs 111. Apertures 109 conduct light upwardly from bulbs 111. Chamber 110 is connected to an adjacent chamber 112 whose exit 113 permits excess heat from heater 106 and bulbs 111 to flow from the chamber.

Directly above the plate 104 is the applicator head 114. Head 114 is connected to rods 115, 116 which are reciprocally slidable within mounting plates 117, 118 and 119 fastened to plate 17. Air cylinder 120 held by plates 118 and 119 is connected through rod connections 121, 122 and 123 to the upper wall 114a of head 114 as best seen in FIGS. 4 and 9. The lower end of head 114 is closed by a plate 124 having a series of apertures 124a therein. A plate member 126 is attached to one side of head 114 by means of screw 127, plate 126 being L-shaped in the section shown in FIG. 4 and having side runners 126a, 126b attached by screws 129 to the perforated plate 124. As seen in FIG. 9, a pipe 130 which is connected to a source of vacuum extends through plate 117 to a vertical pipe 131 which leads to a chamber 132 in the head 114. Rod 116 has a tripper 116a at its upper end whose function is to actuate switches 125, 135 controlling the energization of cylinder 120 as will be explained.

It will be understood that the various actuating cylinders controlling movements of members described in sections will preferably be controlled by a conventional control device known as a multi-cam programmer. A multi-cam programmer contains a series of motor driven cams which sequentially open and close valves or switches which directly or indirectly energize or de-energize the various actuating cylinders of the present apparatus. Such device forms no part of the present invention and is conventional for controlling operations of this type.

The operation of the apparatus thus far will now be described.

Initially a section of tape 19 suitably undercoated with a heat bonding adhesive will be threaded into the shoe 33 and into part of the die section 12. Cylinder 40 will be actuated to hold tape 19 in fixed relation to shoe 33 by the end 38 of plunger 39. Next, feed slide cylinder 29 will urge the feed slide 22 together with shoe 33 in the feed direction to cause a pre-determined increment of tape 19 to pass beneath the respective die elements 68-71. Finger 45 is depressed, plunger 39 retracted, and shoe 33 then returned immediately to its initial position, which maintains the tape 19 flattened in tension due to the pull of the shoe on the tape against the finger as the shoe is moved in the direction opposite to the feed direction. Cylinder 49 when actuated will depress finger 45 to hold the edge of tape 19 immediately forward of movable die 71. Cylinder 52 will be actuated to force yoke 54 downwardly. Yoke 54 first

carries notching dies 68 and 69 downwardly causing them simultaneously to notch corners of the tape. Further downward movement of yoke 54 will cause the yoke portion 54b to contact the upper surface of movable die 71 causing the die to move downwardly to cut off the tape transversely forming a segment 19a. During such movement, the lower angled end 71a of the die will contact the forward bifurcated end of shoe 33 causing this member to flex downwardly about its attachment with feed slide 22. Upon return movement of yoke 54 spring elements 74 cause return of the die elements 68, 69, 71 to the position of FIG. 4.

Raising of finger 45 will release an incremental section of tape to be vacuum held upon the upper face of transfer plate 99. Actuation of cylinder 88 will drive transfer block 92 carrying the incremental segment of tape 19a to a position beneath head 114 at which point the vacuum below plate 99 will be terminated and vacuum in chamber 132 of head 114 will cause the tape segment to pass from plate 99 to adhere to plate 124.

Cylinder 120 will drive head 114 downwardly to press the tape segment 19a against web 140. Runners 126a and 126b press the edges of tape segment 19a against the web 140 to assure an intimate bond at the edges. Plate 124 presses downwardly against the remaining upper surface of segment 19a. Cylinder 120 will cause head 114 to dwell for a pre-determined time of say three seconds while heat is applied from heater 106. Light shining through orifices 109 will show the precise positioning of the segment 19a on the web and enable the operator to accurately locate the area to which the segment 19a is to be applied. For many applications, the vacuum to be maintained in the head 114 will be terminated shortly after head 114 is fully depressed against plate 104. However, such vacuum can be maintained if desired, throughout the heat application period to cool the upper surface of segment 19a. Rod 116 has attached thereto at its upper end a tripper 116a which actuates micro-switches 125 when the head 114 is in the fully upward position. Switch 125 will terminate the pressure to actuating cylinder 120 in the upward direction. When cylinder 120 is actuated in the downward direction, a low actuation pressure will initially be admitted to cylinder 120 to drive the head 114 downwardly. For example, if the available actuating pressure is 80 p.s.i., the initial pressure admitted to cylinder 120, will for example be 10 or 15 p.s.i. When tripper 116a has descended sufficiently to actuate switch 135, the full pressure of the system will be fed into the cylinder 120. However, at this point the head 120 will be substantially at its fully lowered position. The purpose of the foregoing sequenced pressure is to prevent applying full pressure to the head when there is the possibility that the operators hand might be caught underneath.

The present invention provides a unique method and apparatus for applying short segments of tape fastener to web material by a heat-bonding technique. The segments can be changed in length by means of a simple adjustment which will now be described. Referring to FIG. 3, a knob 150 is attached to hollow rod 151 through plate 155 the rod receiving and being keyed for rotation to screw 152. Screw 152, threaded to mounting plate 28, can thus be shifted toward or away from feed slide 22 in order to limit or vary the length of travel of the slide. It is this length of travel which determines the length of each segment 19a of tape.

During feed movements of the shoe 33 and return movements thereof, the tape is prevented from buckling in the feed direction by the shoe and is held in tension by finger 45 when the feed slide 22 returns to its initial feed position. Upon release of finger 45, the tape segment can be moved under head 114 by the transfer block 92.

During cutting of each segment, the notching dies first notch the corners of the tape while the tape is held by finger 45, plunger 37 and shoe 33. This assures precision cutting of the corners. Next in sequence, the movable die 71 is urged downwardly by yoke 54 to cut-off each segment. This combination of sequential die action has been found to be quite superior to a single die cutting operation since it requires less precision in locating the tape prior to cutting and causes much less wear on the die elements. The advantages of the vacuum transfer means in conjunction with vacuum holding means of head 114 are apparent.

It will be understood that the foregoing description has related to a preferred embodiment of the invention and is therefore representative. In order to appreciate the scope of the invention, reference should be made to the appended claims.

What is claimed is:

1. A method of feeding tapes and cutting incremental segments therefrom comprising the steps of:

- a. securing the tape in a movable feeding means;
- b. transporting the tape in a feed direction in the feeding means in a manner which causes a predetermined incremental segment of the tape to pass beneath a cutting device;
- c. allowing a free end segment of the tape to extend beyond a cutting zone;
- d. securing the free end segment of the tape forward of the cutting zone in a stationary condition;
- e. returning the movable feeding means to its initial position by moving it in a direction opposite to the feed direction while causing said feeding means to maintain a tensile force on the tape while it is secured forward of the cutting zone and to maintain the tape in a flattened stationary condition;
- f. notching corner portions of said tape; and
- g. cutting said incremental segment free of said tape.

2. The method according to claim 1 wherein during cutting the steps are performed sequentially of notching corners of said tape and cutting off said segment in that order, while positively holding said tape forward of said cutting line.

3. The method according to claim 2 wherein said remaining tape prior to cutting is secured in tension in a flattened stationary condition by sliding a transporting mechanism in a direction opposite to said feed direction against the holding of said tape forward of said cutting line.

4. The method according to claim 3 which includes the further steps of transporting said incremental portion in said feed direction and transferring said segment in a direction perpendicular to said feed direction to a transferring means for transferring to an applicator head to be applied to a web.

5. The method according to claim 4 further comprising the step of feeding the tape in a feeding means in the form of a hollow shoe substantially surrounding the tape.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,772,947

Dated November 20, 1974

Inventor(s) Roger D. Foskett and David B. Russell

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

1. In column 1, line 13, "benefically" should read
~~--beneficially--~~.
2. In column 2, line 36, "cylinder 49" should read
~~--cylinder 40--~~.

Signed and sealed this 3rd day of December 1974.

(SEAL)
Attest:

MCCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents