

[54] COMPONENT SEQUENCING AND
TAPING MACHINE

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[51] Int. Cl. B21f 1/02, B65b 13/02
[58] Field of Search.....53/59, 118, 180, 183, 196,
53/200, 198

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[57] ABSTRACT

A component sequencing and taping machine including a rotatable taping head having a notched cylindrical portion to which adhesive tapes and components are supplied, and a non-resilient roller for applying pressure to the tapes and the component leads to press them into said notches. The machine also includes improved means for dispensing components in sequence and supplying them to the taping head, means for insuring proper orientation of components as they are removed from dispenser, and improved means for straightening leads of the components before supplying them to the taping head.

9 Claims, 16 Drawing Figures

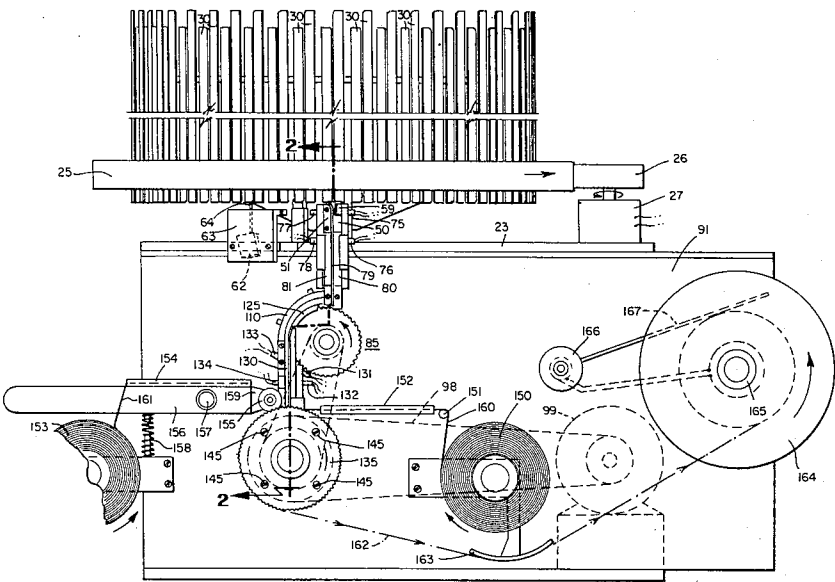
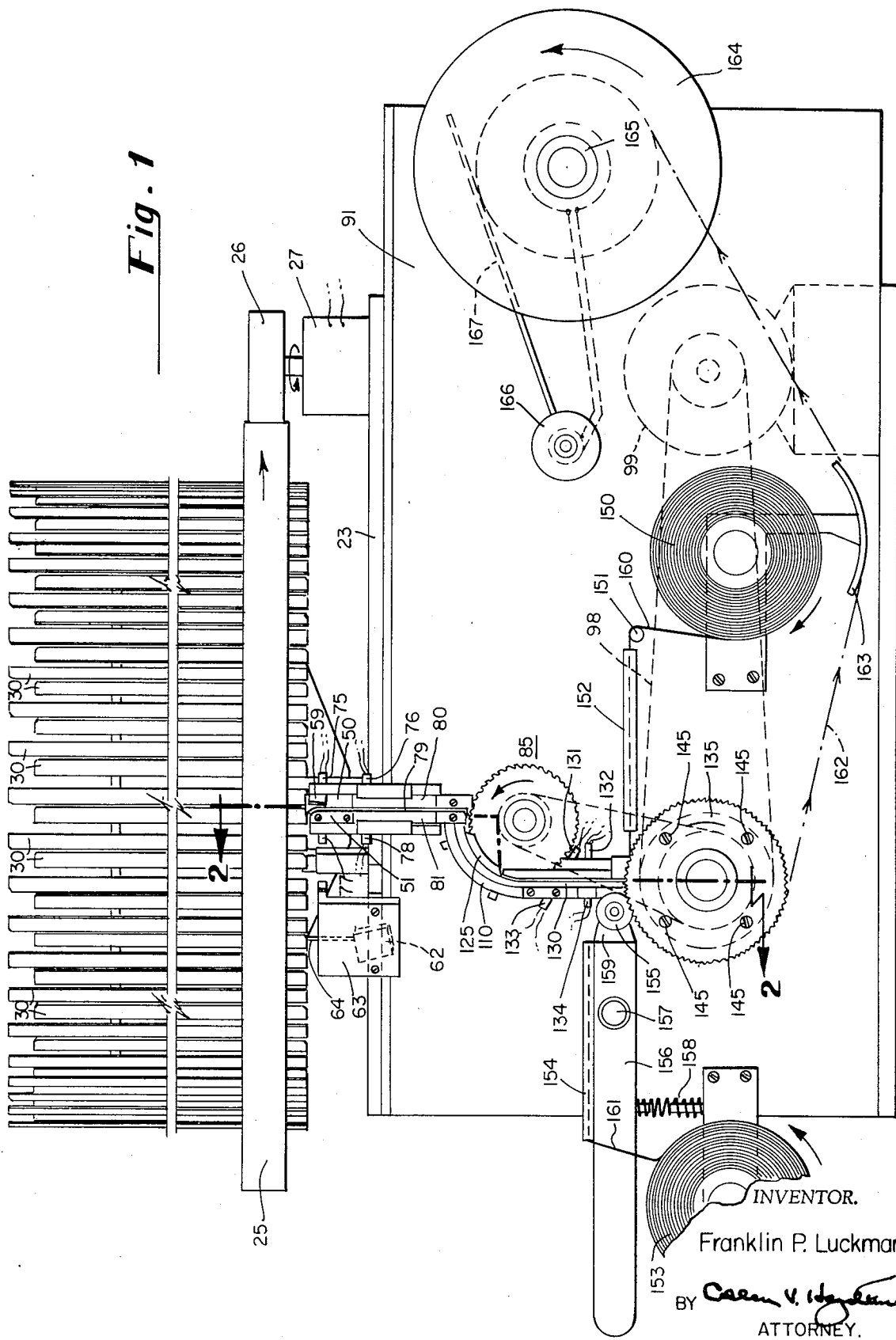


Fig. 1



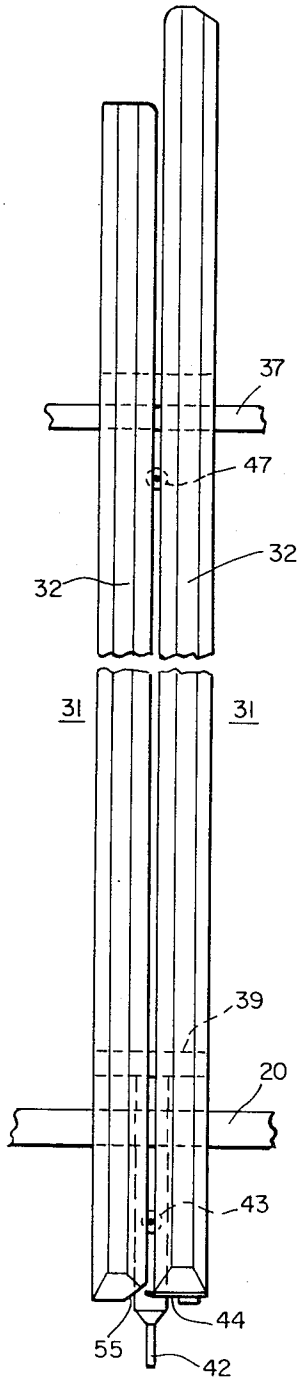


Fig. 1-A

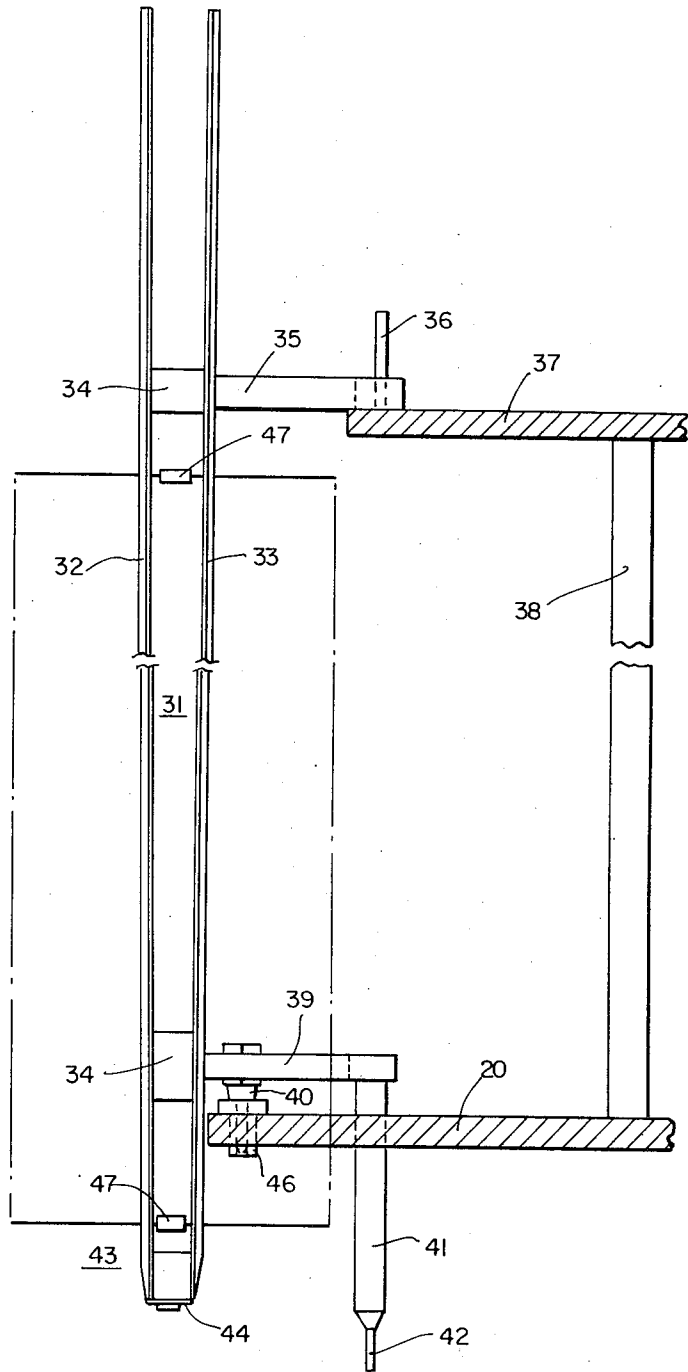


Fig. 1-B

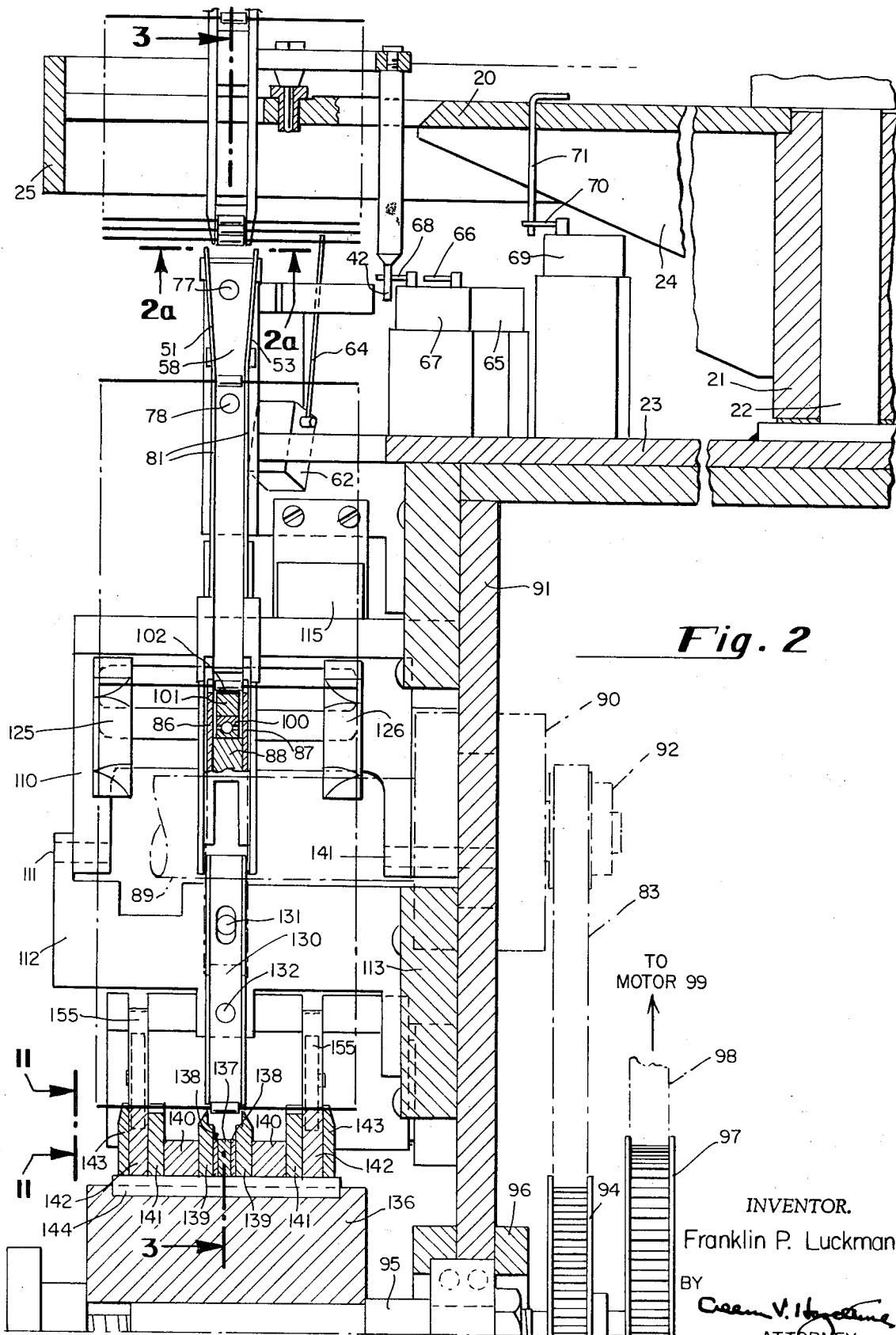
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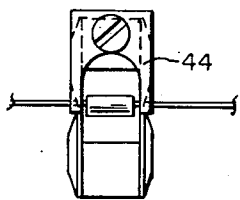


Fig. 2a

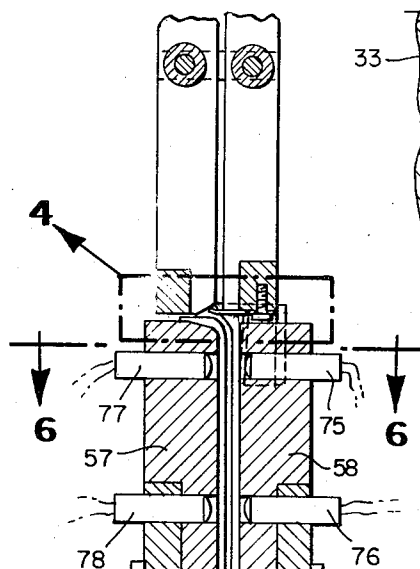


Fig. 3

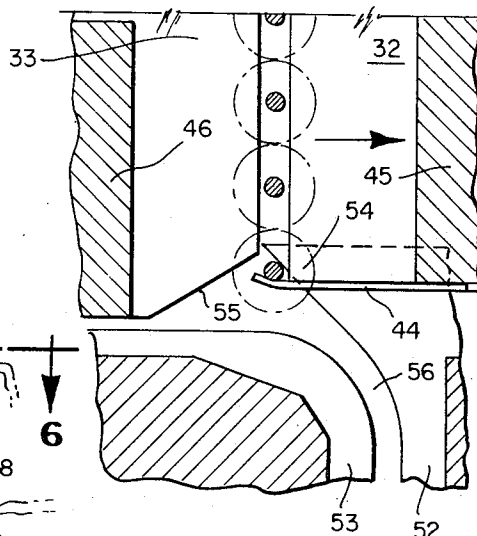


Fig. 4

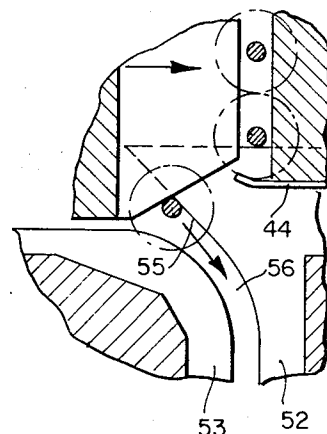
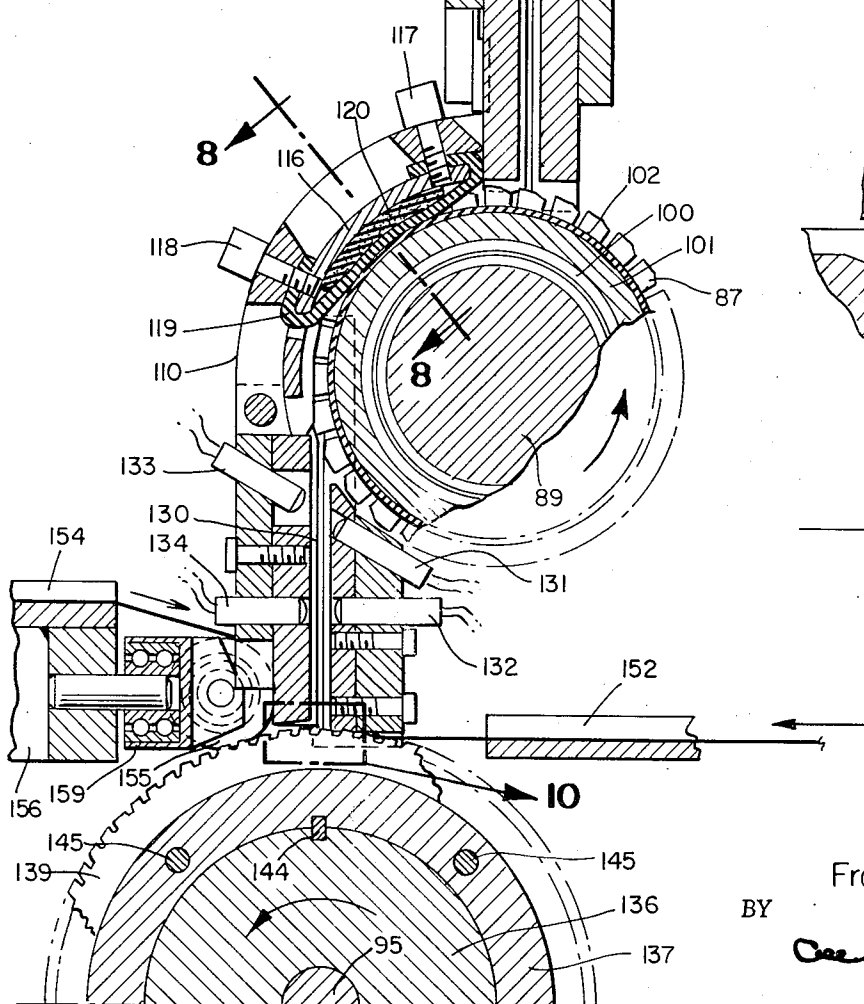


Fig. 5

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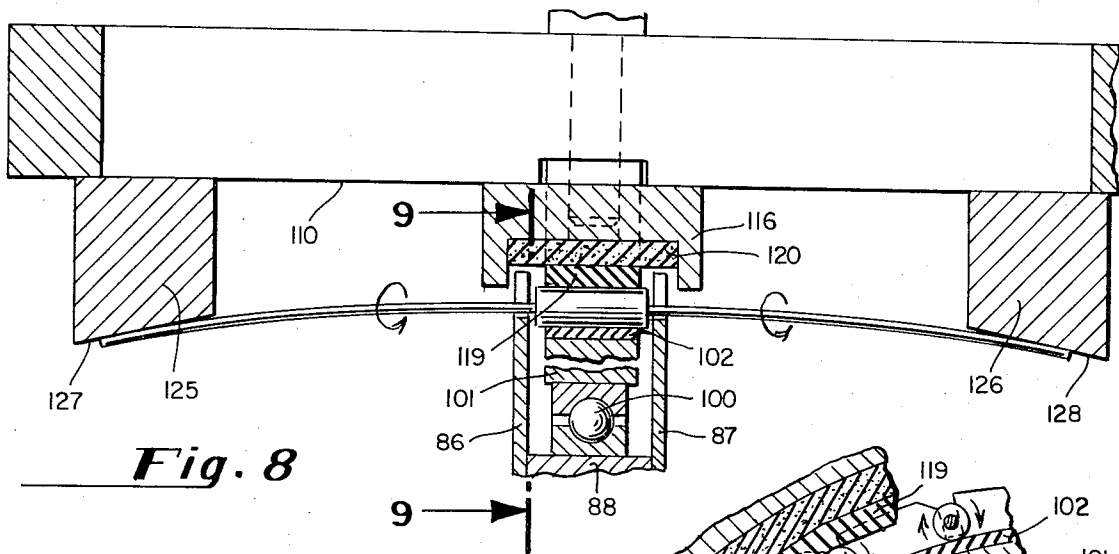


Fig. 8

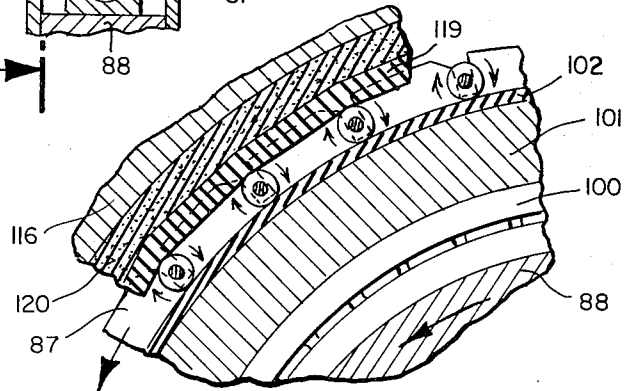


Fig. 9

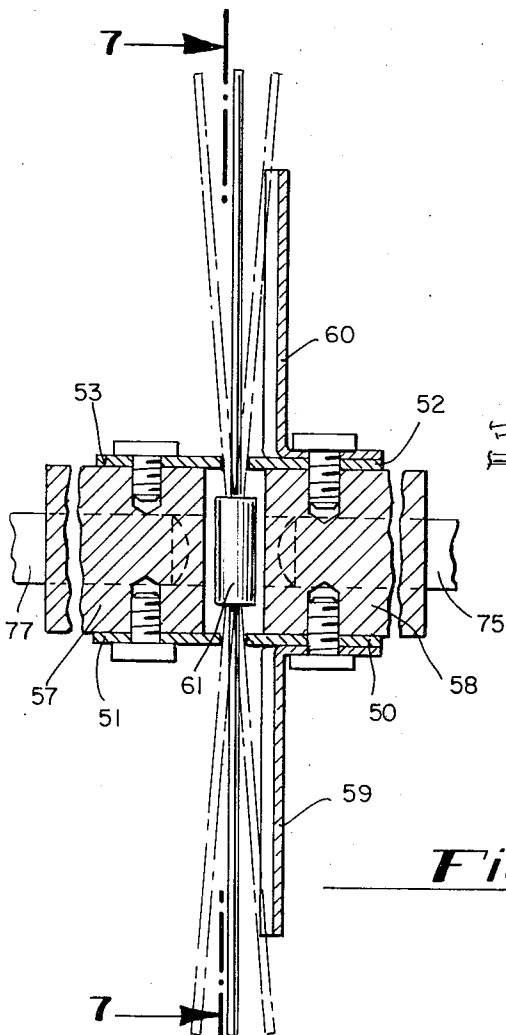


Fig. 6

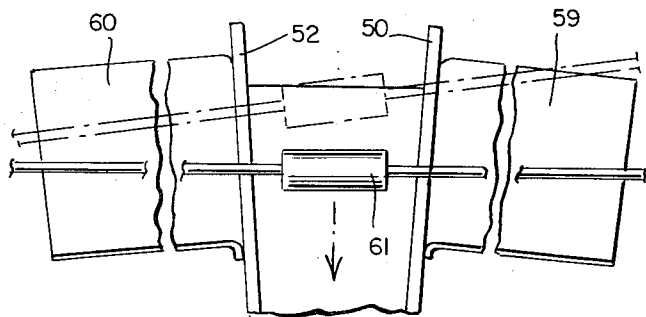


Fig. 7

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Fig. 11

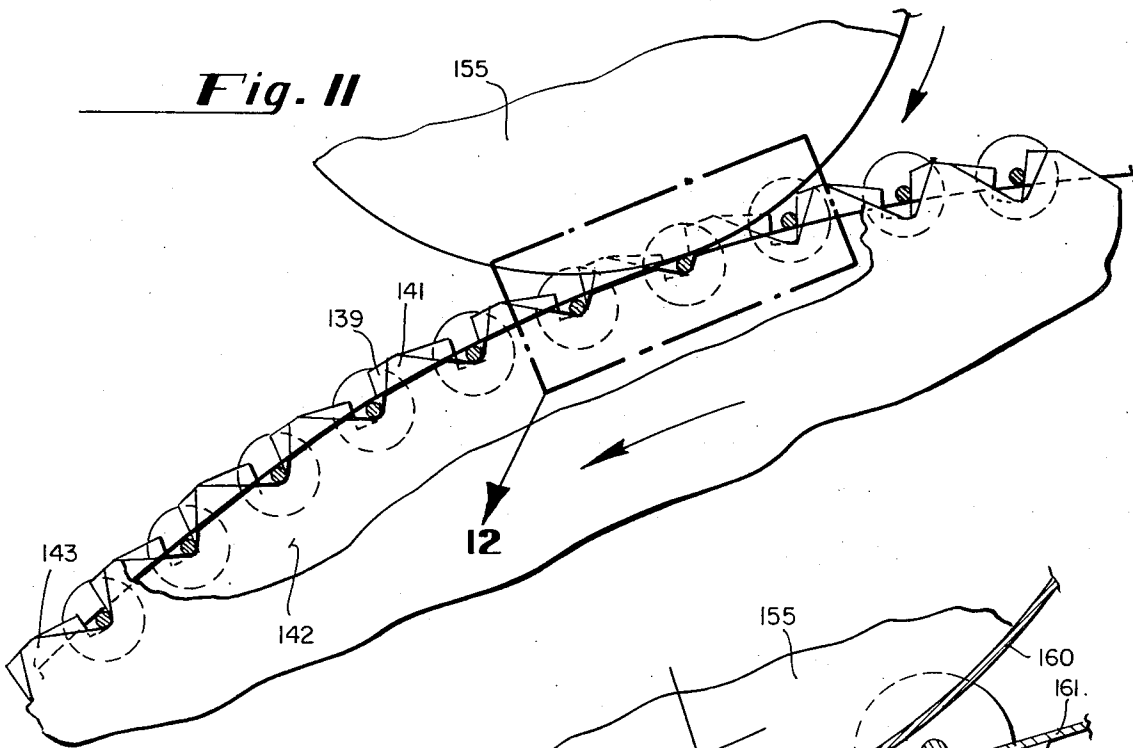


Fig. 12

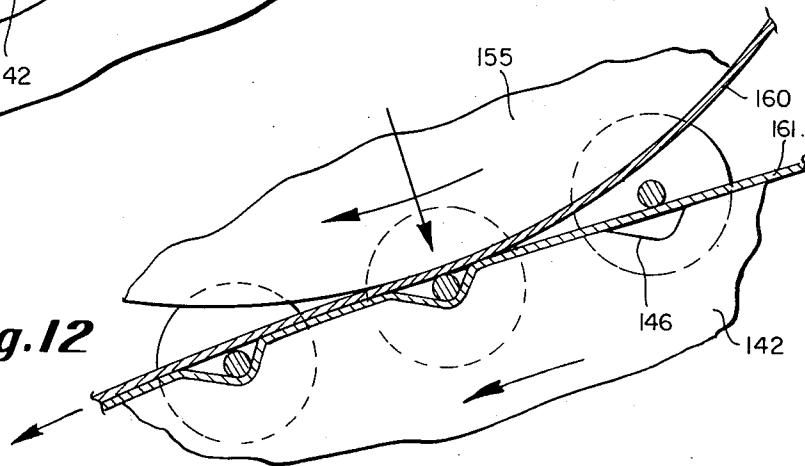


Fig. 13

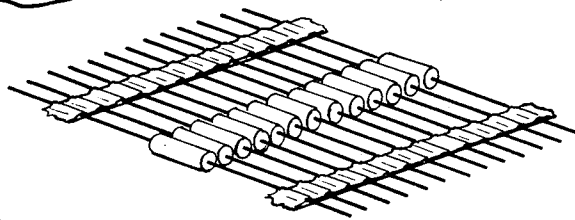
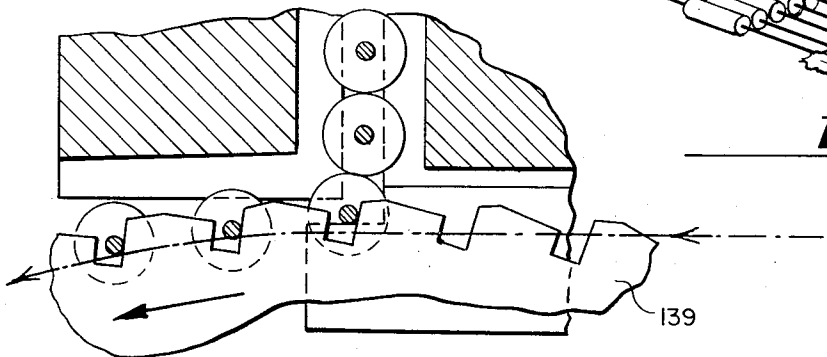


Fig. 10



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COMPONENT SEQUENCING AND TAPING MACHINE

This invention relates to an improved electrical component sequencing and taping machine for arranging electrical components in a desired sequence and applying supporting tapes thereto to provide belts of components in desired sequence for use in known forms of printed circuit board component insertion machines.

It is an object of the invention to provide a machine for performing this function which is more rapid and reliable in operation than known machines, which is more compact and convenient to operate, and which overcomes certain disadvantages of other known machines.

Specifically it is an object of the invention to provide such a machine in which the components are more securely fastened to the tape and more positively spaced.

A further object is to provide means in such a machine for assuring straightness of the leads of the individual components when they are taped together.

A still further object is to provide improved means for storing and dispensing individual components in the desired sequence and for insuring their proper orientation as they are removed from individual dispensers and supplied to the taping mechanism.

In accordance with the invention, these and other objectives of the invention are achieved by providing a rotatable taping head having a substantially cylindrical surface portion with circumferentially spaced notches for receiving the axial leads of conventional electrical components. Means are provided for feeding a first adhesive tape over said cylindrical surface with a non-adhesive side thereof contacting said surface. Means are also provided for supplying components to said head in desired sequence so that the leads thereof contact the adhesive side of the tape and so that the leads of the components are in substantial registry with the notches in the head. Means also are provided for feeding a second adhesive tape over the cylindrical surface of the taping head so that an adhesive side thereof contacts the adhesive side of the first tape and said component leads. Further means are provided for applying pressure against the non-adhesive side of the second tape to press the first tape and the component leads into the slots in the head and to press the adhesive sides of the two tapes into intimate contact. This latter means may take the form of a non-resilient roller of metal or other suitable material bearing against the cylindrical surface of the taping head, and over which the second tape is fed.

Further in accordance with the invention there is provided means for straightening the leads of the components before they are supplied to the taping head, which means comprises a further rotatable head having circumferentially spaced slots for receiving those portions of the axial leads of components adjacent the body portions of the components, a pair of deflector plates spaced axially from said head on either side thereof and lying in planes generally perpendicular to the rotational axis of said head, said plates having arcuate edges disposed to contact the component leads as said head is rotated, and means for rotating the components about their lead axes as the head rotates. The edges of the deflector plates are further positioned in relation to the axes of the components in a manner to

effect straightening of the leads thereof as said head is rotated.

Further in accordance with the invention there is provided a novel dispensing arrangement for dispensing individual components in a desired sequence. This arrangement comprises a plurality of individual dispensers disposed around the circumference of a circular rotatable platform, each being loaded with components of a particular characteristic or value, the loading of successive dispensers about the circumference of the platform being made to accord with the desired sequencing of the components in the taped belt ultimately produced. Each individual dispenser comprises a pair of parallelly disposed rail assemblies, each comprising a pair of parallelly disposed rails spaced apart a distance somewhat greater than the length of the body portions of the components to be stored in the dispenser, the rail assemblies being spaced apart a distance slightly greater than the thickness of the leads of the components and the spaces between the rails of the respective assemblies being juxtaposed to receive respectively opposite leads of the components to retain them in the dispenser while permitting them to move lengthwise in the direction of the rails. The rail assemblies are vertically disposed so that the components tend to feed downward under the force of gravity, but are retained within the dispenser units by a pair of leaf springs affixed to one of the rails of each assembly near the lower end thereof and having portions extending over the spaces between the rails so as to resist removal of the components from the lower end of the dispenser, but to permit their removal by applying sufficient force to overcome the resistance of the spring.

Also in accordance with the invention, means are provided for intercepting individual components and extracting them from the dispensers as they are rotated past said means. Such intercepting means is of generally conventional form comprising a pair of parallelly disposed pick-off plates, each having a first edge comprising a straight portion and a concavely curved portion near one end of said edge, said curved portion and an adjacent edge of said plate defining a projecting tapered portion of said plate suitable for intercepting leads of components approaching said plate in the vicinity of said curved portion and for deflecting said leads along said curved portion and onto the straight portion of said edge, and a pair of parallelly disposed guide plates, each being disposed in substantially the same plane as one of the pick-off plates in juxtaposition thereto and having an edge formed to conform substantially to said first edge of said pick-off plate but being spaced therefrom by approximately the thickness of the component leads, said juxtaposed edges of said plates defining a path to be traversed by the component leads. In particular accordance with this invention, however, means are provided for orienting components intercepted by the pick-off plates so that their axes are substantially perpendicular to said plates, such means comprising a pair of stabilizer plates disposed substantially perpendicular to and near the curved edge portions of the pick-off plates, and approximately parallel to the straight edge portions thereof, for engaging the leads of the components whenever the orientation thereof departs appreciably from the desired perpendicular relationship, and to counteract such departure.

These and other features and advantages of the invention will be understood more fully from consideration of the following detailed description of the invention with reference to the drawings, in which:

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a front elevation of a component sequencing and taping machine in accordance with the invention;

FIGS. 1-A and 1-B are respectively elevation and side views showing the details of construction and the mode of support of the component dispensers 30 shown generally in FIG. 1.

FIG. 2 is a sectional view taken on line 2—2 in FIG. 1;

FIG. 2-a is an auxiliary view taken on line 2a—2a in FIG. 2 showing the detailed construction of the lower portions of the component dispensers shown more generally in FIGS. 1 and 2;

FIG. 3 is a sectional view taken on line 3—3 in FIG. 2;

FIG. 4 is an enlarged sectional view of the portion designated 4 in FIG. 3 showing details of construction of the lower portion of the component dispenser and the component intercepting and pick-off apparatus;

FIG. 5 is a further enlarged sectional view of the portion designated 4 in FIG. 3 illustrating the mode of operation of the component pick-off apparatus;

FIG. 6 is an enlarged sectional view taken along line 6—6 in FIG. 3 and showing more clearly the structure and mode of operation of the stabilizer plates of the component pick-off apparatus;

FIG. 7 is an auxiliary view taken along line 7—7 in FIG. 6 to further illustrate the structure and mode of operation of the component stabilizer plates;

FIG. 8 is a sectional view taken along line 8—8 in FIG. 3 and illustrating the details of the lead straightening mechanism;

FIG. 9 is a sectional view taken on line 9—9 in FIG. 8;

FIG. 10 is an enlarged auxiliary view of the portion designated 10 in FIG. 3 showing more clearly the manner in which components are transferred to the taping wheel assembly;

FIG. 11 is an enlarged auxiliary view, partially cut away, taken on line 11—11 in FIG. 2 and showing in greater detail the construction of the taping head and its associated pressure roller;

FIG. 12 is an enlarged auxiliary view of the portion designated 12 in FIG. 11 and illustrating the manner in which the taping head and its associated pressure roller cooperate to apply tape to components;

FIG. 13 is a perspective view illustrating the belt of taped components produced by a machine in accordance with the invention.

Referring now to FIGS. 1 and 2, there is shown a circular platform 20 centrally supported on a hub 21 which is rotatable about an axle 22 mounted at its lower end on a supporting table 23 forming part of the machine base. Platform 20 may be rendered more rigid by means of a plurality of circumferentially spaced radial gussets 24 affixed to it and to hub 21. Fastened to the periphery of platform 20 is a circular rim 25 by means of which platform 20 may be rotated about axle 22 through the action of a drive roller 26 bearing

against rim 25 and driven by motor 27. Platform 20, hub 21, ribs 24 and rim 25 may conveniently be made of synthetic resin material, such as Plexiglas.

Mounted around the periphery of platform 20 are a plurality of individual component dispensers 30, the structural details and mode of support of which are shown in FIGS. 1-A and 1-B. Each dispenser comprises a pair of parallelly disposed rail assemblies 31, each comprising a pair of rails 32 and 33. The rails in each assembly are spaced apart by upper and lower spacers 34 a distance which, at their lower ends, is slightly greater than the length of the body portions of the components to be stored in the dispenser, and, at their upper ends, is slightly greater to facilitate loading of the components into the dispenser. The respective rail assemblies are disposed with their front and rear rails respectively lying in common planes and with the juxtaposed rail edges spaced apart a distance slightly greater than the thickness of the leads of the components to be stored, the manner of storage of the components in the dispenser being shown at 43. As shown in FIG. 1-A, the rails of one rail assembly are made somewhat shorter than those of the other rail assembly to facilitate loading of components into the dispenser. Preferably the rails 32 and 33 are made of resin having glass fibers embedded therein.

Each dispenser is supported and precisely positioned by upper and lower support brackets 35 and 39, which may be affixed to the rail assemblies at the same positions as spacers 34. The upper support bracket 35 is provided with a hole for engaging a locating pin 36 supported by a locating ring 37. Ring 37 in turn is supported from platform 20 by means of a plurality of support posts 38 which may be disposed in a circular configuration around the axis of rotation of platform 20. The lower end of each dispenser is positioned by means of a conventional banana plug 40 carried by the lower support bracket 39, the prong of the banana plug being inserted in a hole in a bushing 46 in platform 20 to provide positive positioning of the lower end of the dispenser. Lower support bracket 39 also carries a downwardly extending pin post 41, in the lower end of which is inserted a pin 42 of smaller diameter for actuating switches to control the operation of the mechanism as will be explained later. Electrical components 47, such as resistors, capacitors or diodes having oppositely extending axial leads are inserted into a dispenser from the upper end thereof with their body portions positioned between front and rear rails 32, 33 of the two rail assemblies 31 and with their leads extending horizontally through the gaps between the juxtaposed rails of the two assemblies, and may be stacked vertically from the bottom to the top of the dispenser. As shown most clearly in FIGS. 2a, 4 and 5, components normally are retained within the dispenser by the action of a gate 44 in the form of a bifurcated leaf spring, of beryllium copper for example, fastened to one of two spacers 45 between one set of front and rear rails at the lower end of the dispenser assembly. While normally gate 44 operates to retain the components within the dispenser, by applying sufficient force to deflect the free ends of gate 44 downward, individual components can readily be removed from the dispenser. In operation, platform 20, with a plurality of dispensers disposed about its periphery, is caused to

rotate counterclockwise about its horizontal axis by the action of motor 27 operating through drive roller 26 on rim 25.

With reference to FIG. 1, beneath rotating platform 20, and directly in line with the path traversed by the lower ends of the component dispensers, is a component pick-off assembly comprising front and rear pick-off plates 50 and 52, and corresponding front and rear guide plates 51 and 53. As shown most clearly in FIGS. 4 and 5, the upper edges of the front and rear pick-off plates 50 and 52 each have a projecting tapered portion which is disposed so as to engage one of the leads of the lowermost component in a dispenser as it passes over the pick-off assembly. The tapered portions 54 of front and rear pick-off plates 50 and 52 cooperate with inclined lower edges 55 of left-hand front and rear dispenser rails 33, as the dispenser moves past the pick-off assembly from left to right, to deflect the lowermost component in the dispenser downward against the resistance of gate leaf spring 44 until the component is released from the dispenser and directed into the path 56 defined by the inner edges of the front and rear pick-off plates 50 and 52 and front and rear guide plates 51 and 53. The inner edges of the front and rear guide plates 51 and 53 are shaped to conform to the shape of the inner edges of the front and rear pick-off plates 50 and 52 so as to provide a spacing between corresponding pick-off and guide plates slightly greater than the thickness of a component lead, thereby to guide the components downward away from the dispenser. Pick-off plates 50 and 52 and guide plates 51 and 53 are affixed by screws to spacer blocks 57 and 58, the upper ends of which are tapered so that the front and rear pick-off plates, at their lower extremities, are spaced apart a distance only slightly greater than the length of the component body portions, but the upper ends of the plates are somewhat more widely spaced (see FIG. 2) to provide for more ready reception of components from the component dispensers.

As the individual components are removed from the dispensers by the pick-off plates against the resistance of gate springs 44, they may tend to become slightly cocked in one direction or another as illustrated in FIG. 6. To overcome any such cocking, stabilizer plates 59 and 60 are provided affixed to front and rear pick-off plates 50 and 52. As will be seen from Figs. 1, 6 and 7 these stabilizer plates are disposed substantially perpendicular to the front and rear pick-off plates 50 and 52 near the tapered end portions 54 and lie in substantially vertical planes but with their upper edges tilted slightly away from the tapered portions of the pick-off plates. If a component is cocked as it enters the passage 56 between the pick-off and guide plates, one of its leads will be engaged by one of the stabilizer plates and it will be deflected so as to align the component with its axis substantially perpendicular to the axis of the front and rear pick-off and guide plates as indicated at 61 in FIG. 7.

Referring to FIGS. 1 and 2, a switch 62, provided with an actuating finger 64, is attached to bracket 63 in a position to the left of the pick-off assembly and so arranged in the path traversed by the lower ends of dispensers 30 that the actuating finger 64 will be deflected by the lowermost component in each

dispenser if one is present. If a dispenser is empty, the switch will not be actuated. A second switch 65 with an actuating arm 66 is positioned to be actuated simultaneously by pin 42 of the same dispenser which is then passing the actuating finger 64 of switch 62. Switches 62 and 65 are both connected in a circuit for controlling the rotation of platform 20 and for interrupting its rotation if a particular dispenser is empty. Circuits of this sort are well known and form no part of the present invention. Accordingly they will not be described herein.

As shown in FIG. 2, another switch 67, having an actuating arm 68, is positioned to be actuated by pin 42 of each dispenser as that dispenser passes the pick-off assembly. Switch 67 is connected in a circuit for actuating the taping wheel to be described hereinafter.

As further shown in FIG. 2, switch 69 may be provided, having an actuating arm 70 positioned to be actuated by a pin 71 inserted in one or more of a plurality of holes positioned in a circle around the rotating platform 20. Preferably one hole is provided corresponding to each component dispenser, and pins 71 may be inserted in selected holes to actuate switch 69 at the start of each component sequence. Thus, if the number of components in a sequence is seven, a pin may be placed in every seventh hole around the platform. Switch 69 may be connected in a circuit for actuating a counter to indicate the number of component sequences which have been completed.

Inserted in holes in the right-hand spacer block 58 are upper and lower light sources 75 and 76. Opposite these light sources, in corresponding holes in left-hand spacer block 57, are upper and lower photocells 77 and 78. These light sources and photocells are connected in suitable electrical circuits, not shown, for controlling the rate of supply of components to the pick-off assembly so as to insure an adequate supply of components to the mechanism but to prevent supplying an excess which would result in jamming of the mechanism. Such circuits will not be described herein because they are well known and do not constitute part of the present invention. Suffice it to say that if the level of components in the space between the pick-off plates rises above a level corresponding to the position of upper light source 75 and upper photocell 77, the rotation of platform 20 will be momentarily interrupted to prevent the supply of further components to the pick-off assembly until the component level has been lowered. On the other hand, should the level of components in the passage fall below that corresponding to the position of light source 76 and photocell 78, the operation of the remainder of the mechanism, including the lead straightening and taping heads will be momentarily interrupted until the level of components has risen to a point to insure an adequate supply.

Following pick-off of the components by the pick-off assembly and their passage downward through the path 56 between the pick-off and guide plates, the components continue their passage downward through a similar vertical path 79 defined by right and left-hand front and rear rail members 80 and 81 (FIGS. 1 and 2) affixed to the lower portions of spacer blocks 57 and 58 for supply to lead-straightening assembly 85.

Referring particularly to FIGS. 1, 2 and 3, the lead-straightening assembly 85 includes a pair of pick-off

and drive plates 86, 87 affixed to hub 88 of shaft 89 and driven thereby. As shown in FIG. 3, the peripheries of pick-off and drive plates 86, 87 are slotted to receive the leads of components fed downward to them from rail members 80 and 81. The teeth formed by the slots in the peripheries of plates 86 and 87 are relieved on their trailing outer edges to permit successive components supplies from above to drop into successive slots. Shaft 89 is journaled in bearing 90 supported by vertical wall 91 of the machine base. Plates 86 and 87 are driven in a counterclockwise direction as viewed in FIGS. 1 and 3. Shaft 89 is driven by pulley 92, belt 93, a second pulley 94 mounted on shaft 95 journaled in bearing 96, also supported on vertical portion 91 of the machine base, and driven in turn through pulley 97 and belt 98 from motor 99.

Between plates 86 and 87, and mounted on hub 88, is a ball bearing 100, on the outer race of which is mounted a ring 101 free to move independently of the rotation of shaft 89. Encircling the outer surface of ring 101 is a rubber band 102.

Referring now to FIGS. 1, 2, 3, 8 and 9, adjacent the upper left quadrant of the pick-off and drive plates 86, 87, as viewed in FIG. 3, is positioned a support ring 110 pivotally supported at 111 by a support arm 112 fastened to support block 113, which in turn is fastened to vertical wall 91 of the machine base. Support ring 110 is further pivotally supported at 114 on a dowel pin inserted directly into the vertical wall 91 of the machine base. Thus support ring 110 is free to be swung away from the pick-off and drive plates 86, 87, but normally is maintained in position adjacent them by a spring catch 115 affixed to support arm 82. Attached to support ring 110 by screws 117 and 118 is a retaining ring 116 which, as shown most clearly in FIG. 8, is of U-shaped cross-section with its outer edges overlapping pick-off and drive plates 86, 87 over approximately the upper left quadrant thereof as shown in FIG. 3. Retaining ring 116 also functions to hold in place, between the outer edges of pick-off and drive plates 86, 87, a two-part friction pad comprising an outer strip 119 of ordinary rubber and an inner pad 120 of foam rubber cemented thereto. The ends of the rubber strip 119 are provided with holes through which pass screws 117 and 118 for securing retaining ring 116 to support ring 110. As the components are carried past the outer rubber strip 119 of the composite pad, it engages their body portions and forces them against rubber band 102 encircling ring 101 which is free to rotate about the axis of shaft 89. As a result the components are caused to rotate around their own axes in a clockwise direction when their body portions are in contact with rubber strip 119.

Also mounted on support ring 110 (FIGS. 2 and 8) are deflector plates 125 and 126. These are spaced equidistant from the pick-off and drive plates 86, 87 on either side thereof and are provided with arcuate edges 127, 128 which are also sloped in the direction of the axis about which pick-off plates 86, 87 rotate and so as to approach said axis more closely as the distance from the pick-off plates increases. The edges 127 and 128 are so positioned with respect to the axes of the components as they are carried past deflector plates 125, 126 that the leads of the components are deflected somewhat past the axes of the components, as shown in

FIG. 8. Such over-deflection, together with the rotation of the components about their own axes as they are carried past the deflector plates, insures that after such passage, the leads of the components will be substantially straight and coincident with the axes of the bodies of the components. The amount of over-deflection of the component leads required to accomplish this result will, of course, depend upon the thickness of the leads and will differ for different sized components. The optimum amount of deflection for best straightening action can best be determined experimentally.

After traversing deflector plates 125, 126, the component leads are deflected out of the slots in pick-off plates 86, 87 into path 130 (FIGS. 1 and 3) defined by a second rail assembly and downward to taping head 135. Like the upper rail assembly 80, 81, the lower assembly may be provided with light sources 131, 132 and cooperating photocells 133, 134 connected in appropriate circuits, not shown, for controlling the level of components in the second rail assembly.

Referring to FIGS. 2 and 3, taping head 135 comprises a hub 136 having a centrally located peripheral flange 137. Hub 136 is fixed to shaft 95 and is driven thereby. On either side of flange 137 are symmetrically and successively disposed a pair of spacer washers 138, a pair of pick-off rings 139, a pair of spacer rings 140, a pair of taping wheel flanges 141, a pair of taping wheel spacers 142, and a pair of outer taping wheel flanges 143. Each of these is keyed to the driven hub 136 by a key 144, and the whole assembly may be held together by several screws 145 passing through each of the elements 138-143 and through the central flange 137 of hub 136. As shown in FIG. 10 pick-off rings 139 are provided with slots in their peripheries for receiving the leads of components supplied from lower rail assembly 130. Taping wheel flanges 141 and outer taping wheel flanges 142 are provided with serrations, as shown in FIG. 11 for guiding component leads into notches 146 (FIG. 12) in taping wheel spacers 142 for receiving both the axial component leads and one of the tapes to be applied thereto by the machine. It should be noted that pick-off rings 139 are spaced apart sufficiently to accommodate the body portions of the components supplied to the taping wheel assembly. Such spacing may be varied to accommodate different-sized components by moving or replacing the spacer washers 138.

Referring to FIG. 1, to the right of taping wheel assembly 135 are two reels 150 of adhesive tape, both mounted on a suitable shaft which may be supported by vertical wall 91 of the machine base. Tapes 160 from these reels are fed, adhesive side up, over rollers 151 through parallel grooves in guide member 152 over taping wheel spacers 142 (FIG. 2). To the left of taping head 135 are two additional reels 153 of adhesive tape. Tapes 161 from these reels are fed, adhesive side up, through parallel grooves in guide member 154 and over pressure rollers 155 onto taping wheel spacers 142 with their adhesive sides facing the adhesive sides of the tapes supplied to the taping wheel spacers 142 from reels 150. Guide member 154 is supported on support arm 150 which is suitably supported from the vertical wall 91 of the machine base so that it is free to pivot about point 157. The two pressure rollers 155 are supported, preferably on ball bearings, at opposite ends of

a pivot block 159 so as to be free to rotate. Pivot block 159 likewise is supported on support arm 156, preferably by a ball bearings, so as to be free to pivot about a substantially horizontal axis perpendicular to the axis of pressure rollers 155. Support arm 156 is spring-biased by spring 158 to force pressure rollers 155 firmly against taping wheel spacers 142, the pressure of the two rollers being equalized by the pivotal mounting of support arm 156 and pivot block 159. In taping head 135, pick-off rings 139, taping wheel flanges 141, and outer taping wheel flanges 143 preferably are of stainless steel, while spacer washers 138, spacer rings 140 and taping wheel spacers 142 may be of aluminum. Pressure rollers 155 also preferably are of stainless steel.

As previously indicated, shaft 95, on which the taping head assembly is mounted, is provided with a pulley 97 driven through belt 98 from motor 99. Motor 99 is intermittently actuated by a circuit, not shown, in response to the closing of switch 67, heretofore referred to, to advance the taping head a predetermined amount in a counterclockwise direction each time switch 67 is closed by pin 42 of a component dispenser as it passes the pick-off assembly. Similarly the pick-off and drive plates 86, 87 of lead-straightening assembly 85 is intermittently advanced in a counterclockwise direction since, as previously pointed out, they are driven by shaft 89 through pulley 92, belt 93 and pulley 94 on shaft 95. As the taping wheel assembly is rotated in a counterclockwise direction, components are fed downward through the passageway 130 in the lower rail assembly into the slots in pick-off rings 139 and inner and outer taping wheel flanges 141 and 143 so that their axial leads are in alignment with notches 146 in taping wheel spacers 142 and rest on the adhesive sides of the tapes supplied to taping wheels 142 from the right-hand tape reels 150, as shown most clearly in FIG. 12. Pressure rollers 155 operate to press the adhesive sides of tapes 160 supplied from left-hand reels 153 into contact with the adhesive sides of tapes 161 from right-hand reels 150 and, as they pass over the component leads, they press both the leads and the lower tapes, 161 supplied from right-hand reels 150 into the notches in taping wheels 142, thus securely fastening the components together into a belt as shown in FIG. 13 with the component leads secured by pairs of tapes on either side of their body portions.

As will be seen, particularly from FIG. 12, in the belt of components ultimately formed by the machine, one of the tapes is substantially flat, while the other has periodic bulges to accommodate the component leads. Because of this arrangement, in which one of the tapes is substantially flat, the components are more securely held and precisely spaced in the belt. As the belt of taped components leaves taping wheel assembly 135 it follows path 162, passes over guide 163 and is taken up on reel 164 driven by motor 165, the torque of which may be controlled by a potentiometer 166 having an arm 167 engaging the component belt on reel 162 so as to increase the torque of the motor as the belt builds up on reel 162.

It will be apparent that many changes may be made and many widely different embodiments may be constructed without departing from the scope of the invention. Hence, the accompanying drawings and descrip-

tion are intended not by way of limitation but rather as an illustration of one form of the invention, the scope of which is indicated by the following claims:

What is claimed is:

1. Apparatus for arranging electrical components in sequence and applying supporting tapes thereto, comprising:

- a. a rotatable taping head having a substantially cylindrical surface portion having circumferentially spaced notches for receiving the leads of electrical components supplied thereto;
- b. means for feeding a first adhesive tape over said cylindrical surface with a non-adhesive side of said tape contacting said surface;
- c. means for supplying components of different characteristics to said head in a desired sequence as said head is rotated so that the leads of said components contact the adhesive side of said first tape in substantial registry with the notches in said head, said means comprising a plurality of component dispensers for holding and dispensing components of different characteristics to be sequenced, pick-off means for intercepting and diverting components from said dispensers as said dispensers are moved past said pick-off means, and means for supporting said component dispensers and for moving them past said pick-off means in a desired sequence;
- d. means for feeding a second adhesive tape over said cylindrical surface so that an adhesive side thereof contacts the adhesive side of said first tape and said component leads; and
- e. means for applying pressure against the non-adhesive side of said second tape to press said first tape and said component leads into said notches and to press the adhesive sides of said tapes into intimate contact.

2. Apparatus according to claim 1 in which said means for applying pressure comprises a non-resilient roller arranged to bear against said cylindrical surface.

3. Apparatus according to claim 1 for use with electrical components having substantially cylindrical body portions and axially extending leads, in which said taping head comprises separate, spaced-apart, notched, cylindrical portions for receiving respectively opposite leads of said components, and in which said means for applying pressure comprises separate non-resilient rollers, each arranged to bear against one of said cylindrical portions, said rollers being mounted at opposite ends of a centrally pivoted support block to equalize the pressure applied by said rollers to said cylindrical portions.

4. Apparatus according to claim 1 for use with electrical components having substantially cylindrical body portions and axially extending leads, in which each of said component dispensers comprises:

- a. a pair of parallelly disposed rail assemblies, each comprising a pair of substantially parallelly disposed rails spaced apart a distance approximately equal to the length of the body portions of said components, said rail assemblies having corresponding rails juxtaposed and spaced apart a distance approximately equal to the thickness of said leads for receiving respectively opposite leads of said components to retain them in said

dispenser while permitting them to move lengthwise in the direction of said rails, and

- b. leaf spring means affixed to one end of one of said assemblies and having portions extending over the spaces between corresponding rails of the two assemblies so as to resist removal of components from that end of the dispenser, but to permit removal of components by applying to a component sufficient force to overcome the resistance of said spring means.

5. Apparatus according to claim 1 for use with electrical components having substantially cylindrical body portions and axially extending leads, in which said pick-off means comprises:

- a. a pair of parallelly-disposed pick-off plates, each having a first edge comprising a straight portion and a concavely curved portion near one end of said edge, said curved portion and an adjacent edge of said plate defining a projecting tapered portion of said plate suitable for intercepting leads of components approaching said plate in the vicinity of said curved edge portion and for deflecting said leads along said curved portion and onto the straight portion of said edge,
- b. a pair of parallelly disposed guide plates, each being disposed in substantially the same plane as one of said pick-off plates in juxtaposition thereto and having an edge formed to conform substantially to said first edge of said pick-off plate but being spaced therefrom by approximately the thickness of said component leads, said juxtaposed edges of said plates defining a path to be traversed by said component leads, and
- c. means for orienting components intercepted by said apparatus so that their axes are substantially perpendicular to said plates, said means comprising stabilizer plates disposed substantially perpendicular to and near the curved edge portions of said pick-off plates and approximately parallel to the straight edge portions thereof for engaging the leads of said components whenever the orientation thereof departs appreciably from the desired perpendicular relationship to counteract such departure.

6. Apparatus for arranging electrical components in sequence and applying supporting tapes thereto, comprising:

- a. a rotatable taping head having a substantially cylindrical surface portion having circumferentially spaced notches for receiving leads of electrical components supplied thereto, said rotatable head comprising a pair of circular plates spaced by approximately the length of said com-

ponent body portions and having circumferentially spaced matching radial slots in their peripheries for receiving leads from opposite ends of said components with the body portions of said components positioned between said plates;

- b. means for feeding a first adhesive tape over said cylindrical surface with a non-adhesive side of said tape contacting said surface;
- c. means for supplying components of different characteristics to said head in a desired sequence as said head is rotated so that the leads of said components contact the adhesive side of said first tape in substantially registry with the slots in said head, said means including means for straightening the leads of said components, said straightening means comprising a rotatable head having circumferentially spaced slots for receiving portions of said leads adjacent said body portions, a deflector plate spaced axially from said head and lying in a plane generally perpendicular to the rotational axis of said head, said plate having an arcuate edge disposed to contact said leads and deflect them as said head is rotated, and means for rotating said components about their lead axes as said head rotates;
- d. means for feeding a second adhesive tape over said cylindrical surface so that an adhesive side thereof contacts the adhesive side of said first tape and said component leads; and
- e. means for applying pressure against the non-adhesive side of said second tape to press said first tape and said component leads into said notches and to press the adhesive sides of said tapes into intimate contact.

7. Apparatus according to Claim 6 including a ring positioned between said circular plates and free to rotate independently of said plates about the same axis as said plates, the diameter of said ring being such that its periphery engages the body portions of components whose leads are positioned in the slots in said plates, and an arcuate friction pad positioned near the peripheries of said plates in the vicinity of said deflector plate for engaging the body portions of said components and pressing them against said ring as they are carried past said pad to cause them to rotate about their lead axes while said leads are in contact with said deflector plate.

8. Apparatus according to Claim 7 in which said ring is provided with a resilient peripheral surface.

9. Apparatus according to claim 6 in which the spacing between said arcuate edge surface of said deflector plate and the axis of rotation of said head increases progressively as the distance from said head increases.

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