

1 STRIPPING MECHANISM FOR ELECTRICAL COMPONENT TAPE FEEDER

 This invention relates to a mechanism for strip-
ping tape carrying an electrical component to retain the
5 component in the tape and expose the component for removal
 from the tape.

 In the assembly of micro-electronic components of
a leadless type (called chips) to printed circuit boards,
the components can be supplied in a carrier tape. The
10 carrier can comprise a tape having spaced recesses each
 holding an electronic component. The carrier tape may also
 comprise upper and lower covering strips that retain the
 components in the recesses. The carrier tape is fed
 through an apparatus which removes a covering strip (tape
15 stripper) to expose the component and the component is then
 removed from the recess for further processing during the
 component assembly to the circuit board. Examples of such
 tape feeders are illustrated in U.S. Patents Nos.
 4,307,832; 4,327,482 and 4,440,355.

20 In processing such a carrier tape, it is neces-
sary for the tape stripper to retain the exposed component
 in the tape recess until the component is removed from the
 tape.

 In the process of mounting chip components to
25 substrates, it is desirable to select a component from a
 bank of a plurality of taped component sources and deposit
 the preselected component onto a transfer mechanism which
 places the component in a conveyor for further downstream
 processing and ultimate placement on a printed circuit
30 board. This general arrangement of parts of randomly
 selecting a predetermined component from a source and
 transferring the component onto a common machine conveyor
 for transport to a placement mechanism is illustrated in
 Patent No. 2 105 224.

35 In processing components in this manner, it is
desirable to provide an apparatus that can be combined with

a plurality of apparatus of the same nature for removing components from a carrier tape and orienting the components in a conveyor for transport to further processing stations in an overall component assembly machine which mounts components on the surface of printed circuit boards. The individual apparatus are each operated in response to a programmed control so that preselected components are obtained for processing in the proper sequence.

The carrier tape may comprise a carrier strip having spaced recesses containing the components. The tape will also have an upper covering strip that is stripped from the tape to expose the component for removal from the tape.

It is an object of this invention to provide a mechanism for stripping the covering from a component carrier tape to expose the component and retain the component in the tape recess until removed.

The invention provides a stripping mechanism for removing the upper strip of an electrical component carrier tape to expose the component in the tape comprising:

a. a housing for supporting and positioning the stripping mechanism;

b. apparatus for removing the upper strip of the carrier tape;

c. upper and lower guide means positioned on said housing adapted to receive the stripped carrier tape therebetween with the component exposed for removal from the tape;

d. said upper and lower guide means coacting to retain the component in the stripped tape until removed, and;

e. means biasing said lower guide means upwardly and means biasing said upper guide means downwardly to retain the stripped tape and component therein therebetween

5 There now follows a detailed description, to be read with reference to the accompanying drawings, of a tape feeder embodying the invention. It will be realised that this feeder has been selected for description to illustrate the invention by way of example and that the invention may reside in any novel feature or combination of feature described.

10 In the accompanying drawings:

Figure 1 is a perspective view of the illustrative tape feeder;

Figure 2 is a side elevational view of a drive for a tape indexing mechanism;

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1 Figure 3 is a sectional view of apparatus for removing components from a carrier tape showing component retaining fingers in a closed position;

5 Figure 4 is a view similar to Figure 3 illustrating the component retaining fingers in an open position;

 Figure 5 is a side elevational view illustrating the carrier tape indexing mechanism and the apparatus for removing the component from the carrier,

10 Figure 6 is an exploded view of the apparatus for removing the component from the carrier tape;

 Figure 7 is a top plan view of the tape feeder illustrating means for removing an upper strip of the carrier tape to expose the component;

15 Figure 8 is an enlarged view, partially in section, of the component removal apparatus with the retaining fingers in an open position;

 Figure 9 is an enlarged view similar to Figure 8 illustrating the retaining fingers in closed position;

20 Figure 10 is a perspective view of the tape stripper and indexing mechanism that pulls the tape through the tape feeder; and

 Figure 11 is a perspective view of an upper guide of the tape stripper.

25 Attention is now directed to Figure 1 which illustrates a tape feeder 8 with a component carrier tape 10 which is fed between an indexing mechanism 12 and apparatus 14 for removing the component (c) from the carrier tape 10 and placing the component in a conveyor 16
30 for further downstream processing. The tape feeder 8 is adapted to be positioned in a bank of feeders each of which contain reels (not shown) of taped components of similar kinds that can be preselected for processing and ultimate mounting on a printed circuit board.

35 The component carrier tape 10 is fed from a supply reel (not shown) around an idler feeder pulley 18

1 mounted on the support frame 20. The carrier tape 10
comprises a tape strip 22 having spaced recesses 24 retain-
ing individual chip-type components (c). The carrier 10
also has spaced openings 26 which coact with the indexing
5 mechanism 12 which draws the carrier tape 10 through the
feeder 8.

Attention is now directed to Figures 1, 5 and 7
which illustrate mechanism 30 for removing the upper strip
32 of carrier tape 10 to expose the component (c) in the
10 tape 10. A stripper 34 is retained in frame 20 and has a
slanted opening 36 with a rearwardly extending beveled
surface 38. The strip 32 is passed over lower beveled
surface 35 through the opening 36 and across beveled
surface 38 and around pulley 40 on motor 42. The strip 32
15 is maintained in frictional contact with the pulley 40 by
the roller 44 on the L-shaped lever 46 pivoted at 48 to the
motor housing. The leg 50 of lever 46 has a roller 52 in
contact with leaf spring 54 carried on bracket 58 secured
to the motor housing. The bracket 58 has an extension 220.
20 The strip 32 is passed between extension 220 and lever 46,
as illustrated in Figure 1, to guide the strip 32 away from
the stripper 34. The spring 54 acting against roller 52
will force the lever 46 in a clockwise direction (Figure 1)
to force the roller 44 against the strip 32 so that the
25 motor will pull the strip 32 rearward to remove the strip
32 from the carrier tape 10. The extension 60 on lever 46
can be grasped to pivot the lever 46 counterclockwise
(Figure 1) to cause the spring 54 to act on roller 52
holding the roller 44 spaced from pulley 40. Then, the
30 strip 32 can be inserted between the roller 44 and the
pulley 40 while separating strip 32 from the tape 22 during
machine set up.

Attention is now directed to Figures 1 to 5, 8
and 9 which illustrate various portions of the indexing
35 mechanism 12 which draws the tape strip 22 through the
feeder. An indexing wheel 62 is mounted through one-way

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1 clutch 65 on shaft 64 carried on frame 20. The tape strip
22 rests on a lower guide 67 which passes the strip 22 over
the indexing wheel 62. The wheel 62 has a plurality of
projections 63 which are adopted to extend into the open-
5 ings 26 in the tape strip 22. The shaft 64 is increment-
ally rotated to rotate the wheel 62 to draw the strip 22
through the feeder 8. The shaft 64 is carried in a bearing
66 secured within the opening 68 in the frame 20. Secured
on the end 70 of shaft 64 is an arm 72 secured by bracket
10 73 to the rod 74 of the pneumatic drive cylinder 76 mounted
to frame 20 at 78. Air supplied to cylinder 76 will extend
rod 74 to pivot arm 72 and rotate the shaft 64. This will
rotate the indexing wheel 62 through one-way clutch 65 to
draw the strip 22 through the feeder. A stop 80 on frame
15 20 limits the movement of arm 72 and, thus, rotation of
shaft 64. Upon the release of the cylinder 76, the arm
will pivot against the stop 82 on frame 20. During this
return movement of arm 72, the indexing wheel 62 remains
stationary (unless acted upon by centering mechanism 69)
20 since this is the non-drive direction of the one-way clutch
65. The stop 82 is adjustable to adjust the throw of arm
72 to locate recess 24 through the wheel projections 63 in
the tape strip openings 26.

To maintain the tape recess 24 (and thus compo-
25 nent c) in the exact desired location on each increment of
indexing of the strip 22, a centering mechanism 69 comp-
rising wheel 79 (Figure 5) is attached to indexing wheel
62. A pair of rollers 71 are carried on arms 75 pivoted to
frame 20. The springs 77 bias rollers 71 into the grooves
30 81 in the periphery of the wheel 79 to position and lock
the wheel 79 and thus indexing wheel 62 after each indexing
movement. The rollers 71 alternate between being posi-
tioned in the grooves 81 since one-half incremental rota-
tion of wheel 79 occurs during each movement of the strip
35 22 from one recess 24 to the next of the strip 22.

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1 In the operation of the above described indexing mechanism, the spent tape from which the component has been removed is guided out of the feeder 8 by passing downwardly through a chute 84 (see Figure 1).

5 Attention is now directed to Figures 1 and 3 to 6 which illustrate the details of the apparatus 14 for removing the component (c) from the tape strip 22. A cylindrical housing 86 is part of a block 88 secured to frame 20. An outer sleeve 90 in the housing 86 is mounted
10 to a pneumatic cylinder 92 for movement up and down in the housing 86. The rod 98 of cylinder 92 is bolted at 100 to the bracket 102. The bracket 102 has an end portion 104 extending through the slot 106 in housing 86 and is secured to the sleeve 90 by bolts 108. Thus, air supplied to
15 cylinder 92 will move the rod 98 upward raising the bracket 102 and moving the sleeve 90 upward in the housing 86.

 An inner sleeve 110 is pinned at 112 inside the opening 114 in the outer sleeve 90. A spindle 116 passes through the opening 118 in an inner sleeve 110 and bearing
20 surface 120 in the outer sleeve 90. A spring 122 is positioned between the surface 124 of sleeve 90 and the cap 126, which is on bearing 204, on the shoulder 128 of the end pin 130 threaded into the spindle 116. An end plug 132 is threaded into the end 134 of housing 86 and is retained
25 by a lock nut 136. The end of the spindle 116 has a threaded nose piece 138 that is adapted to contact and pick up the component.

 The operation of the apparatus 14 for removing a component from the tape strip is as follows: The raise
30 position of the rod 98 is illustrated in Figure 3. As the rod 98 is retracted in cylinder 92, the outer sleeve 90 is lowered. At this time, the pin 140 extending from spindle 116 rides up the ramp 142 in an inner sleeve 110 and around helix 144 to rotate the spindle 90°. Upon further downward
35 movement of the sleeve 90, the end 146 of the sleeve 90

1 will contact snapring 148 on spindle 116. This will lower
the nose piece 138 out of housing 86 downward to a position
above the exposed component in the tape strip 22 (Figure
8). At this point, vacuum applied through the passage 150
5 in a spindle 116 will draw the component (c) from the tape
strip onto the nose piece 138 on the spindle 116. As the
rod 98 is extended and the sleeve 90 raised in housing 86,
the spring 122 between sleeve 90 and the cap 126 will cause
the spindle 116 to retract. Further, upward movement will
10 cause bearing 204 to abut end plug 136 and stop the upward
movement of the spindle 116. At this point, the nose piece
138 is positioned in the recess 152 in the end 154 of the
housing 86. Further, upward movement of sleeve 90 (against
the spring 122) will cause the pin 140 to ride down the
15 helix 144 rotating the spindle 90° during the removal of
the component from the tape strip. This orients the
component in the proper direction for further processing
downstream in the component handling machine of which the
tape feeder is an operative part.

20 Once the component has been removed from the tape
strip 22, and the spindle 116 raised to the position
illustrated in Figure 3, a pair of opposed fingers 156, 158
are in position to retain the component in line with the
end 160 of the enclosed conveyor 162. A blast of air
25 through line 164 will then send the component down the
conveyor 162 for further processing.

The fingers 156, 158 are secured by bolts 166 to
the ends of the opposed arms 168 each of which are pivot-
ally attached by pins 169 at 170 to flanges 172 on the
30 opposite sides of the housing 86. Each of the arms 168
have upper and lower cams 174, 176, respectively, that
extend into the upper and lower openings 178, 180, respec-
tively, of the housing 86. The cams 174, 176 coact with
the upper and lower beveled cam ends 182, 184 of the sleeve
35 90 to cause the arms to pivot to open and close the fingers

1 156, 158 during the up and down movement of sleeve 90 in housing 86.

As the sleeve 90 is lowered in housing 86 (Figure 3) the cam end 184 of sleeve 90 contacts lower cams 176 and pivots the arms to open the fingers 156, 158. This permits the spindle 116 to be lowered to the tape strip 22 so that a component can be placed on the nose piece 138. As the sleeve 90 is raised, the cam end 182 on sleeve 90 contacts upper cams 174 to pivot the arms (Figure 3) to close the fingers 156, 158 against nose piece 138 to support the component. At this point, the vacuum to the spindle can be released and the fingers 156, 158 will retain the component in alignment with end 160 of the opening 186 in the conveyor 162. The finger 158 has a recess 187 and shelf 188 cooperating with the surface 190 of finger 156 which will support the component at the desired location (see Figures 8 and 9) at the end 160 of the conveyor 162. Thereafter, a blast of air through line 164 will send the component down conveyor 162 to the next processing station of the machine.

20 Attention is now directed to Figures 10 and 11 which illustrate details of the stripper 34 which removes the cover strip 32 to expose the component (c). In the operation of the stripper 34, the component (c) is exposed prior to being removed from the tape 10 by the apparatus 25 14. During this period of time, machine vibrations or other external influences may cause the component (c) to reposition in tape recess 26 or escape from the recess 26 entirely. Thus, it is necessary to retain the component (c) in the recess 26 until removed by nose piece 138 of the 30 feeder 8.

The upper guide 224 contains the slanted opening 36 through which the strip 32 is passed, as previously described. The guide 224 has a flange 226 which sets in recess 228 in the housing 20. An opening 230 in guide 224 35 exposes the component (C) to the nose piece 138 permitting the removal of the component (c) from tape 10. A leaf

1 spring 213 secured to housing 20 by fastener 234 biases the
forward portion 236 of guide 224 downward toward the lower
guide 67. A spring 238 in sleeve 90 biases pin 240 down-
ward against the guide 224. The pin 240 has a reduced neck
5 area 242 receiving cross pin 244 in sleeve 90 to retain pin
240 in sleeve 90.

The lower guide 67 is received in slot 246 in
housing 20 (see Figure 10). The guide 67 is retained in
slot 246 by front and rear pins 248, 250. The pins 248,
10 250 are positioned in slots 252 in guide 67 to permit the
guide 67 to move up and down. Spring biased pins 254 are
positioned under the front and rear of guide 67 to bias
guide 67 upwardly (the upward spring force by pins 254 is
less than the downward force on upper guide 224 exerted by
15 pins 240).

It can thus be seen that after the strip 32 is
removed by stripper 34, the tape 10 with the exposed
component is passed between the upper and lower guides that
retain the component in the tape 10 until removed by nose
20 piece 138. The blank tape is then passed through guide 256
and down chute 84 away from the tape feeder.

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CLAIMS

1. A stripping mechanism for removing the upper strip of an electrical component carrier tape to expose the component in the tape comprising:

5 a. a housing for supporting and positioning the stripping mechanism;

b. apparatus for removing the upper strip of the carrier tape;

10 c. upper and lower guide means positioned on said housing adapted to receive the stripped carrier tape therebetween with the component exposed for removal from the tape;

15 d. said upper and lower guide means coacting to retain the component in the stripped tape until removed, and;

20 e. means biasing said lower guide means upwardly and means biasing said upper guide means downwardly to retain the stripped tape and component therein therebetween.

2. A stripping mechanism according to claim 1 wherein said apparatus for removing forms part of said upper guide means.

25 3. A stripping mechanism according to either one of claims 1 and 2, including means to guide the carrier tape away from the stripping mechanism after the removal of the component from the tape.

30 4. A stripping mechanism according to any of claims 1 to 3 wherein the said upper guide means includes means to locate the component removal means.

35 5. A stripping mechanism substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

