

APPARATUS FOR SECURING ELECTRONICCOMPONENTS TO A TAPE

5 This invention relates to an apparatus for securing electronic components to a tape. Such apparatus provides a taped electronic component series, wherein from an electronic component assembly having a plurality of lead wire-equipped electronic components held on a long-sized support member such as ground paper, said electronic components are
10 extracted.

In producing a taped electronic component series, first, as shown in Fig. 2A, lead wires 3 are inserted into ground paper 2 having cuts 1 formed therein, and in this state, electronic component elements 4 are
15 connected to the respective lead wires 3 to complete electronic components 5 on the ground paper 2, thereby providing an electronic component assembly 6. Subsequently, electronic components 5 are extracted from the electronic component assembly 6 to produce a
20 taped electronic component series 7 shown in Fig. 2B. In this case, electronic components 5 are placed on a long-sized tape body 8 at a regular pitch and an adhesive tape 9 is applied thereto to fix the electronic components 5 in position.

25 In this connection, in producing the taped electronic component series 7 from the electronic

component assembly 6, it has been common practice to use a chuck or the like to extract the electronic components 5 one by one and then tape them together.

5 However, since electronic components 5 are extracted one by one from the electronic component assembly by a chuck or the like and then placed on the tape body 8, it has been impossible to perform taping at high speed.

10 Accordingly, the invention aims to provide an apparatus for securing electronic components to a tape, which apparatus is capable of high speed operation.

15 In one aspect therefor the present invention provides an apparatus for automatically securing electronic components to a tape wherein from an electronic component assembly in which a plurality of lead wire-equipped electronic components are supported, at their lead wires, at a predetermined pitch on a long-sized support member, the electronic components are extracted, are transferred onto a long-sized tape body and are fixed in position by an adhesive tape, said apparatus comprising: a first rotary drum provided around its outer peripheral edge with lead wire retaining portions, disposed at a first pitch corresponding to the pitch between the electronic components on the support member, support member pressing means for pressing the support member

20

25

of the electronic component assembly against the outer peripheral surface of said first rotary drum, a plurality of electronic component extracting means rotating together with the first rotary drum but
5 adapted to change their distance to one end surface of said first rotary drum, said electronic component extracting means being formed around its outer peripheral edge with lead wire retaining portions for retaining the lead wires of electronic components,
10 said lead wire retaining portions being disposed at the same pitch as the lead wire retaining portions of the first rotary drum, first urging means for urging said electronic component extracting means to abut against said one end surface of the first rotary drum,
15 first cam means for moving said electronic component extracting means away from said one end surface of the first rotary drum in order to extract the electronic components on the first rotary drum by said electronic component extracting means, a second rotary drum
20 provide around its outer peripheral surface with lead wire retaining portions in which the lead wires of electronic components can fit, said lead wire retaining portions being disposed at a second pitch and side by side with the lead wire retaining portions
25 of the first rotary drum, a third rotary drum having lead wire retaining portions in which the lead wires of electronic components can fit, said lead wire

retaining portions being disposed to overlap the lead wire retaining portions of the second rotary drum, a plurality of electronic component positioning means rotating together with the third drum but adapted to change their distance to one end surface of the third rotary drum, said electronic component positioning means (311) having an outer peripheral edge shape such that their outer peripheral edges, when put together, substantially conform to the outer peripheral edge of the third rotary drum, their respective peripheral edges having lead wire retaining portions having the same pitch as the lead wire retaining portions of the third rotary drum, second urging means for urging said electronic component positioning means to abut against one end surface of the third rotary drum, second cam means for moving the electronic component positioning means away from the third rotary drum in order to correctly position the electronic components on the tape body by the lead wire retaining portions of the electronic component positioning means, tape body feeding means for feeding the tape body onto the outer peripheral surface of the third rotary drum, and adhesive tape feeding means for feeding an adhesive tape onto the surface of the tape body held on the outer peripheral surface of the third rotary drum.

In another aspect the invention provides an apparatus for securing electronic components to an

elongate component carrying tape in which apparatus components are delivered on a temporary carrier to a first rotary drum comprising axially movable segments arranged to separate the components from the temporary carrier, the first drum further comprising a plurality of component retaining portions for guiding the separated components to a second rotary drum comprising a plurality of component receiving portions for receiving components from said first rotary drum and for delivering said components to a third rotary drum comprising a plurality of axially movable segments for positioning said components thereon, which segments are moved by an associated cam, the third drum also receiving a first tape body to which at least a respective portion of each of said components is placed, the third drum thereafter receiving a second tape body which is adhered to said first tape body to secure said portion of each component therebetween.

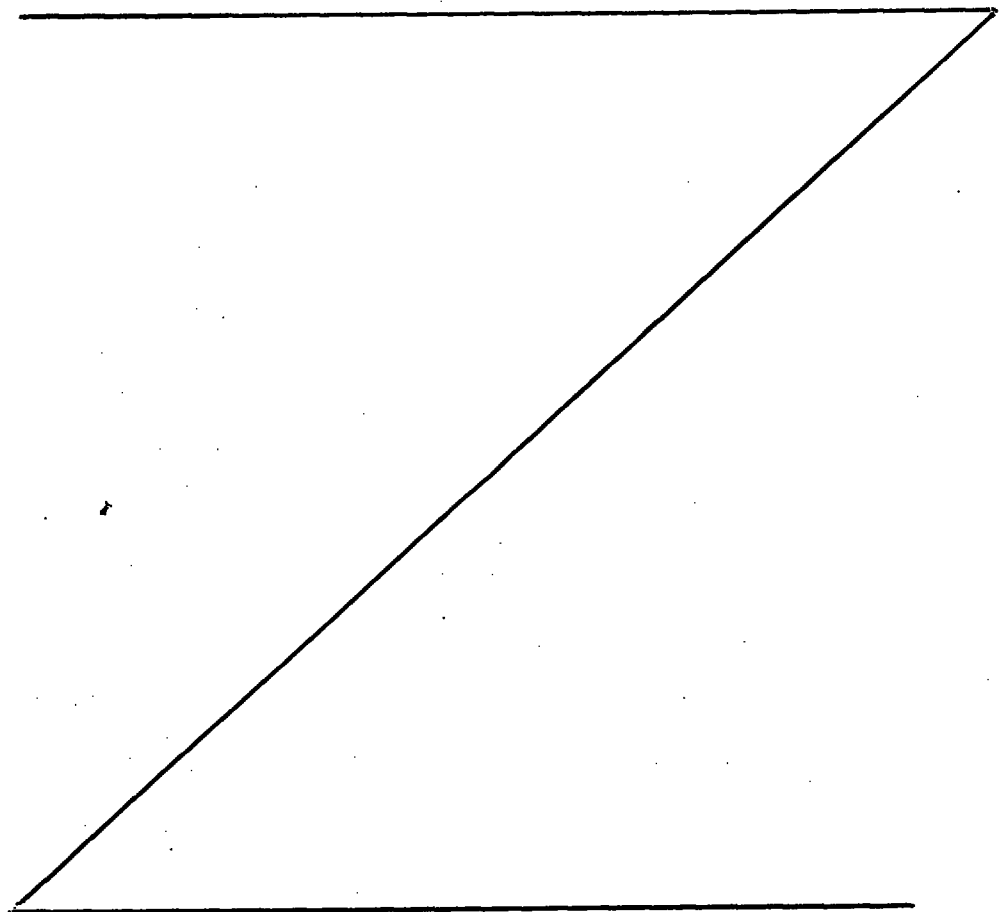
As will become clearer from a detailed description to be given hereinbelow an embodiment of the invention provides to an apparatus for extracting electronic components from an electronic component assembly shown in Fig. 2A and tape them together as shown in Fig. 2B, and comprises a first rotary drum for receiving electronic components on its outer peripheral surface and in which the operation of

extraction of electronic components from an electronic component assembly is performed, a second rotary drum for receiving the electronic components extracted from the first rotary drum, and a third rotary drum which receives the electronic components from the second rotary drum and which allows taping to be performed on its outer peripheral surface.

In the presently preferred apparatus, as will be described in greater detail hereinafter, the operation of extracting and taping electronic components from an electronic component assembly is performed not by using a chuck as in the prior art but by utilizing the first through third rotary drums. That is, the electronic component assembly, as it is, is fed to the outer peripheral surface of the first rotary drum; on the first rotary drum, the electronic components are extracted by the electronic component extracting means; the electronic components are transferred to the third rotary drum via the second rotary drum; and on the outer peripheral surface of the third rotary drum, they are placed on a tape body being fed while an adhesive tape is applied thereto, thereby providing a taped electronic component series. Accordingly, taping can be performed at very high speed as compared with the case wherein a prior art taping apparatus equipped with a chuck or the like is utilized.

Therefore, electronic components can be taped

continuously at high speed. Further, by changing either the pitch between the lead wire retaining portions on the first rotary drum, that is, the first pitch, or the pitch between the lead wire retaining portions on the second rotary drum, that is, the second pitch, it is possible to tape electronic components at a pitch which differs from the pitch between electronic components on the electronic component assembly; by suitably selecting the relation between the first and second pitches, electronic components can be taped at various pitches.



The foregoing and other objects, features, aspects and advantages of the present invention will become more
5 apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a sectional view of a taping apparatus
10 according to an embodiment of the invention;

Fig. 2A is a plan view showing an electronic component assembly;

Fig. 2B is a plan view showing a taped electronic component series;

15 Fig. 3 is a front view schematically showing the arrangement of the Fig. 1 embodiment;

Fig. 4 is a front view showing how electronic components are fed to a first rotary drum;

Fig. 5 is fragmentary sectional view showing an
20 electronic component on the outer peripheral surface of the first rotary drum;

Fig. 6 is a front view showing movable plates constituting electronic component extracting means;

Fig. 7 is a fragmentary sectional view for explaining how an electronic component is transferred from the first rotary drum to the second rotary drum;

Fig. 8 is an enlarged front view showing pawls formed around the outer peripheral edge of the second rotary drum;

Fig. 9 is a front view for explaining a guide attached to the periphery of each rotary drum;

Fig. 10 is a fragmentary enlarged front view showing the connecting region between the second and third rotary drums;

Fig. 11 is a front view for explaining electronic component positioning plates; and

Fig. 12 is a side view for explaining a second cam.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figs. 1 and 3 are a schematic side sectional view and a schematic front view, respectively, of a taping apparatus according to an embodiment of the invention. In addition, in Fig. 1, some elements which do not appear in the section are sometimes omitted from illustration.

The taping apparatus in this embodiment comprises a first rotary drum 10, a second rotary drum 20 and a third rotary drum 30, these rotary drums having lead wire retaining portions disposed to overlap each other, as will be later described. The first rotary drum 10 is fed with

an electronic component assembly 6 shown in Fig. 2, and on
the peripheral surface thereof, electronic components 5
are extracted from ground paper 2. Further, extracted
electronic components 5 are given to the second rotary
5 drum 20 and then transferred to the third rotary drum 30.
On the third rotary drum 30, said electronic components 5
are assembled to provide a taped electronic component
series 7 shown in Fig. 2B.

The first through third rotary drums will now be
10 described in order starting with the drum 10.

The first rotary drum 10 is provided for rotation by
a shaft 101 and is driven by an unillustrated rotary drive
source in a clockwise direction as indicated by an arrow A
in Fig. 3. As shown in Fig. 3, above the rotary drum 10,
15 there is a rail 102 disposed with its end closed to the
outer peripheral surface of the first rotary drum 10. The
rail 102 serves to feed an electronic component assembly 6
shown in Fig. 2A; said electronic component assembly 6,
which has electronic components 5 attached to ground paper
20 2, is fed from said rail 102 onto the outer peripheral
surface of the first rotary drum 10.

The outer peripheral surface of the first rotary drum
10 is formed with pawls 103 and 104, as shown in Fig. 1.
The pawls 103 and 104 are formed so that as shown in Fig.
25 4 with reference to the pawls 103, such pawls 103 and 104

are disposed at a first pitch along the outer peripheral edge of the first rotary drum 10. The pawls 103 and 104, as is clear from Fig. 4 showing the pawls 103, have a shape similar to a quasi-cycloidal curve. The purpose is to make it easier for lead wires 3 to fit in lead wire receiving recesses 105 and 106 formed on both sides of each of the pawls 103. That is, in this embodiment, by providing said pawls 103 and 104, lead wire receiving recesses 105 and 106 serving as lead wire retaining portions are formed on both sides of each of the pawls 103 and 104.

On the other hand, a groove 107 is formed between the pawls 103 and 104, as shown in Fig. 1, said groove 107 being adapted to receive the ground paper 2 of the electronic component assembly 6. This state is shown in a fragmentary sectional view in Fig. 5.

Referring back to Fig. 3, the first rotary drum 10 is topped with a roller 111 pressing the drum 10. The roller 111 serves to press the ground paper 2 of the electronic component assembly 6 fed from the rail 102 between it and the groove 107 of the first rotary drum 10. Further, besides the roller 111, there is a second roller 112 positioned laterally away from the first rotary drum 10, with a pressing belt 114 of elastic material being entrained around the rollers 111 through 113. The

pressing belt 114 serves to hold on the outer peripheral surface of the first rotary drum 10 the electronic component assembly 6 fed to the outer peripheral surface of the first rotary drum 10. Therefore, the electronic component assembly 6 is transported clockwise (as indicated by the arrow A) together with the first rotary drum 10 while it is held on the outer peripheral surface of the first rotary drum 10.

Referring to Fig. 1, disposed forwardly of the first rotary drum 10 are movable plates 121 serving as a plurality of electronic component extracting means. The movable plates 121, as shown in Fig. 6, are formed by dividing a circle corresponding to the first rotary drum 10 into 12 equal parts, each movable plate 121 being fixed by shafts 122 to a plate 123 disposed on the opposite side of the first rotary drum 10. The shafts 122 are inserted in the first rotary drum 10 and are movable axially of the first rotary drum 10. Further, a coiled spring 126 serving as first urging means urges each plate 123 rearwardly of the first rotary drum 10. That is, the coiled springs 126 urge the movable plates 121 against the front end surface of the first rotary drum 10.

On the other hand, disposed rearwardly of each plate 123 is a follower member 124 which is engaged with a cam 125 fixedly installed to surround the shaft 101. That is,

the cam 125 is shaped so that it projects forward progressively as the lower region is approached.

Therefore, the plates 123 and hence movable plates 121 are constructed so that they move forward against the coiled
5 springs 126 as the lower region is approached.

In this connection, the outer peripheral edge of each movable plate 121, as shown in Fig. 6, is formed with pawls 131 at the same pitch and in the same manner as the pawls 103 and 104 formed around the outer peripheral edge
10 of the first rotary drum 10. Therefore, the lead wires 3 will be received in the lead wire retaining portions 132 and 133 formed on both sides of the pawls 131. Further, when the movable plates 121 are positioned in the lower region of the first rotary drum 10, they are pushed
15 forward by the action of the cam 125, so that the electronic component elements 4 (Fig. 2A) of the electronic components 5 are extracted forward from the electronic component assembly 6 held on the outer peripheral surface of the first rotary drum 10, with the
20 result that the lead wires 3 extend between the lead wire retaining portions 132, 133 on both sides of the pawls 131 and the lead wire retaining portions (lead wire receiving recesses 105, 106, shown in Fig. 4) on both sides of the pawls 103 associated with the first rotary drum 10. This
25 state is shown in Fig. 7.

While electronic components 5 are extracted from the electronic component assembly 6 in the manner described above, the ground paper 2 is automatically discharged out of the apparatus so that it may not reach the peripheral surface of the second rotary drum 20, as shown by an arrow P in Fig. 3.

Electronic components 5 extracted in the manner shown in Fig. 7 are transferred to the second rotary drum 20 below the first rotary drum 10. That is, the second rotary drum 20 is also formed around its outer peripheral edge with pawls 201 having a lateral surface shape defined by a quasi-cyloidal curve, as shown in Fig. 8, and lead wire retaining portions 203 are formed between the pawls 201. Further, in the same manner as the pawls 201, the second rotary drum 20 is formed with pawls 202 (see Fig. 7). The lead wire retaining portions 203 are positioned side by side with the lead wire retaining portions (lead wire receiving recesses 105 and 106) of the first rotary drum 10, and electronic components 5 carried to the lower region of the first rotary drum 10 are transferred to the lead wire retaining portions 203. The second rotary drum 20 is arranged so that it is rotated in a counterclockwise direction, i.e. in the opposite direction to the first rotary drum 10, as indicated by an arrow B in Fig. 3. In addition, as shown in Fig. 9, disposed on the left side of

the second rotary drum 20 is a guide 225 along the path of travel of electronic components 5 to prevent the falling of electronic components 5 which are held in said lead wire retaining portions 203 around the second rotary drum 20.

Further, as shown in Fig. 3, disposed below the second rotary drum 20 is a sensor 226 for detecting the presence or absence of electronic components 5. The sensor 226 detects whether or not electronic components 5 are received in all of the lead wire retaining portions 203 around the outer peripheral edge of the second rotary drum 20. If there is a portion having no electric component 5 received therein, the rotary drive of the third rotary drum 30 is stopped, whereby a taped electronic component series having no missing electronic component is obtained without fail.

Disposed below the second rotary drum 20 is the third rotary drum 30. In this case, as shown in Fig. 1, the outer peripheral edge of the third rotary drum 30 is formed with pawls 301 and 302 overlapping the pawls 201 and 202 of the second rotary drum 20. The pawls 301 and 302 also have a lateral surface shape defined by a quasi-cycloidal curve, and have lead wire retaining portions 303 (Fig. 10) on both sides thereof. Thus, as shown in Fig. 10, electronic components 5 (only the lead

wires 3 thereof shown in Fig. 10) carried in by the second rotary drum 20 are transferred in that the lead wires 3 are received in the lead wire retaining portions 303 formed on both sides of the pawls 301.

5 Referring back to Fig. 1, the third rotary drum 30 is provided for rotation by the shaft 304 and, as is clear from Fig. 3, is driven for rotation in the direction of arrow C i.e., clockwise. Further, disposed at the upper right of the third rotary drum 30 is a guide 307 as shown
10 in Fig. 9. The guide 307 serves to prevent transferred electronic components 5 from falling down, performing the same function as that of the guide 225 described above.

Further, disposed forwardly of the third rotary drum 30, as shown in Fig. 1, are electronic component
15 positioning adjusting plates 311. The positioning adjusting plates 311 are formed by dividing a cylinder into four equal parts, as shown in Fig. 11, and are fixed to the respective one end of shafts 312 (Fig. 1) inserted into the third rotary drum 30. The other end of each
20 shaft 312 has a keep plate 313 fixed thereto, and a coiled spring 314 is installed around the shaft 312 between said keep place 313 and the rear surface of the third rotary drum 30. The coiled spring 314 urges the keep plate 313 to the right as viewed in Fig. 1, and hence the
25 positioning adjusting plate 311 is urged by the coiled

spring 314 to abut against the front surface of the third rotary drum 30.

On the other hand, a follower 318 is fixed to the front portion of each positioning adjusting plate 311, said follower 318 being engaged with the cam 321 fixed to the frame 320. That is, the cam 321 opposed to the follower 318 has a shape shown in Fig. 12, such that the cam surface projects forward as the lower region is approached. Thus, the four positioning plates 311 are constructed so that as they are progressively positioned in the lower region of the third rotary drum 30, they are delivered forward.

Further, the outer peripheral edge of each positioning adjusting plate 311 is also formed with pawls 322 of the same pitch and the same shape as the pawls 301 and 302, and lead wire retaining portions 323 (Fig. 11) between said pawls 322. Thus, an electronic component 5 (not shown in Fig. 1) held on the outer peripheral surface of the third rotary drum 30 is delivered to a predetermined position in that a pawl 322 of the positioning adjusting plate 311 abuts against the electronic component element 4 (Fig. 2A) and moves it forward. Therefore, by suitably selecting the amount of forward movement of the positioning adjusting plates 311,

the position of the electronic component 5 relative to the third rotary drum 30 can be correctly adjusted.

On the other hand, as is clear from Fig. 3, disposed below the third rotary drum 30 is a roller 41 constituting tape body feeding means, and a tape body 8 is fed to the outer peripheral surface of the third rotary drum 30, more correctly, to the recess between the pawls 301 and 302 shown in Fig. 1 via said roller 41. Therefore, the tape body 8 will be fed to the third rotary drum 30 in advance, and the lead wires 3 of electronic components 5 will be placed on the upper surface of said tape body 8.

Further, disposed at the lower right of the third rotary drum 30 are rollers 51 and 52 forming adhesive tape feeding means, as shown in Fig. 3. The adhesive tape 9 coming in via the roller 51 is applied to the tape body 8 held on the outer peripheral edge of the third rotary drum 30 by the roller 52 pressed against the outer peripheral surface of the third rotary drum 30. Thus, the lead wires 3 of electronic components 5 are nipped between the tape body 8 and the adhesive tape 9 and a taped electronic component series 7 shown in Fig. 2B is thus completed.

In addition, it is preferable that the positioning adjusting plates 311 described above be delivered most forwardly between a region of contact between the third rotary drum 30 and the pressing roller 52 and a region

where the taped electronic component series 7 separates from the third rotary drum 30 (a region of contact between the third drum 30 and the roller 54). Thus, the cam 321 is shaped such that the cam surface projects most forwardly in the regions indicated by Q and R in Fig. 3.

Disposed below the roller 54 is a feed roller 55, so that a taped electronic component series 7 as obtained is discharged through said feed roller 55 out of the apparatus.

In the above embodiment, the pitch in the pawls 103 and 104 formed around the outer peripheral edge of the first rotary drum 10, that is, the pitch (first pitch) between lead wire retaining portions (lead wire receiving recesses 105 and 106) on both sides of said pawls 103 and 104 differs from the pitch (second pitch) between lead wire retaining portions 203 formed on both sides of the pawls 201 and 202 formed around the outer peripheral edge of the second rotary drum 20; thus, it is arranged that in transferring electronic components 5 from the first rotary drum 10 to the second rotary drum 20, the pitch between electronic components 5 is also changed at the same time. If such change in the pitch between electronic components 5 is not required, the pitches in the lead wire retaining portions formed around the outer peripheral edges of the rotary drums 10 and 20 will be made equal to each other

and so will be the peripheral speeds of the rotary drums 10 and 20. At any rate, by suitably selecting the first and second pitches, and by adjusting the rotative speeds of the rotary drums 10 and 20, it is possible to easily
5 obtain taped electronic component series 7 having electric components 5 disposed at various pitches differing from the pitch between the electronic components 5 in an electronic component assembly 6.

Further, since said sensor 226 is installed, in the
10 case where electronic components 5 are not retained in all of the lead wire retaining portions 203 around the outer peripheral surface of the second rotary drum 20, that is, in the case where there is a lead wire retaining portion having no electronic component 5, the third rotary drum 30
15 is stopped for a certain period of time and driven again according to the output from the sensor 226, whereby a taped electronic component series 7 having no missing electronic component 5 can be positively obtained.

Although the present invention has been described and
20 illustrated in detail, it is clearly understood that the same is by way of illustration and example only and is not to be taken by way of limitation, the scope of the present invention being limited only by the terms of the appended claims.



CLAIMS:

1. An apparatus for automatically securing electronic components to a tape wherein from an electronic component assembly in which a plurality of lead wire-equipped electronic components are supported, at their lead wires, at a predetermined pitch on a long-sized support member, the electronic components are extracted, are transferred onto a long-sized tape body and are fixed in position by an adhesive tape, said apparatus comprising:

a first rotary drum provided around its outer peripheral edge with lead wire retaining portions, disposed at a first pitch corresponding to the pitch between the electronic components on the support member,

support member pressing means for pressing the support member of the electronic component assembly against the outer peripheral surface of said first rotary drum,

a plurality of electronic component extracting means rotating together with the first rotary drum but adapted to change their distance to one end surface of said first rotary drum,

said electronic component extracting means being formed around its outer peripheral edge with lead wire retaining portions for retaining the lead wires of



electronic components, said lead wire retaining portions being disposed at the same pitch as the lead wire retaining portions of the first rotary drum,

5 first urging means for urging said electronic component extracting means to abut against said one end surface of the first rotary drum,

10 first cam means for moving said electronic component extracting means away from said one end surface of the first rotary drum in order to extract the electronic components on the first rotary drum by said electronic component extracting means,

15 a second rotary drum provide around its outer peripheral surface with lead wire retaining portions in which the lead wires of electronic components can fit, said lead wire retaining portions being disposed at a second pitch and side by side with the lead wire retaining portions of the first rotary drum,

20 a third rotary drum having lead wire retaining portions in which the lead wires of electronic components can fit, said lead wire retaining portions being disposed to overlap the lead wire retaining portions of the second rotary drum,

25 a plurality of electronic component positioning means rotating together with the third drum but adapted to change their distance to one end surface of the third rotary drum,



said electronic component positioning means (311) having an outer peripheral edge shape such that their outer peripheral edges, when put together, substantially conform to the outer peripheral edge of the third rotary drum, their respective peripheral edges having lead wire retaining portions having the same pitch as the lead wire retaining portions of the third rotary drum,

second urging means for urging said electronic component positioning means to abut against one end surface of the third rotary drum,

second cam means for moving the electronic component positioning means away from the third rotary drum in order to correctly position the electronic components on the tape body by the lead wire retaining portions of the electronic component positioning means, tape body feeding means for feeding the tape body onto the outer peripheral surface of the third rotary drum, and

adhesive tape feeding means for feeding an adhesive tape onto the surface of the tape body held on the outer peripheral surface of the third rotary drum.

2. An apparatus for automatically taping electronic components as set forth in claim 1, wherein said first and second pitches differ from each other.



3. An apparatus for automatically taping electronic components as set forth in claim 1, further including a sensor associated with the lead wire retaining portions around the outer periphery of the second rotary drum for
5 detecting the presence or absence of an electronic component on the outer peripheral surface of the second rotary drum.

4. An apparatus for securing electronic components to an elongate component carrying tape in which apparatus
10 components are delivered on a temporary carrier to a first rotary drum comprising axially movable segments arranged to separate the components from the temporary carrier, the first drum further comprising a plurality of component retaining portions for guiding the
15 separated components to a second rotary drum comprising a plurality of component receiving portions for receiving components from said first rotary drum and for delivering said components to a third rotary drum comprising a plurality of axially movable segments for
20 positioning said components thereon, which segments are moved by an associated cam, the third drum also receiving a first tape body to which at least a respective portion of each of said components is placed, the third drum thereafter receiving a second tape body
25 which is adhered to said first tape body to secure said



portion of each component therebetween.

5 5. An apparatus as claimed in claim 4, in which a sensor is provided for sensing the absence of a component from the second drum and for halting the rotation of the third drum in response thereto, thereby to provide evenly spaced components to said component carrying tape.

6. An apparatus substantially as described hereinabove with reference to the accompanying drawings.
