

APPARATUS FOR TAPING ELECTRONIC PARTS

BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention relates to an apparatus for arranging on an elongated tape rod-like, directional electronic parts such as tabbed terminals of electrolytic capacitors or diodes, and for applying another elongated tape on such rod-like, directional electronic parts in sandwiching fashion.

Description of the Prior Arts:

Automatic inserting or manufacturing machines are used in mounting diodes on printed boards or in making electrolytic capacitors. In such automatic machines vibrating type bowl feeders are used in feeding electronic parts such as tabbed terminals of electrolytic capacitors or diodes. These electronic parts are subjected to vibration and agitation, producing debris as a result of their rubbing

and wearing. Disadvantageously such debris may be the cause for adverse effects, such as shortcircuiting in precision printed circuits.

In case that electronic parts are supplied by removing from an adhesive tape one after another while unrolling the tape, no debris can be produced. In such unrolling-and-supplying system, however, electronic parts are failed to appear at regular intervals in rare cases, in which one or more electronic parts are missed or lost in position in the elongated tape. The loading of an automatic machine with such a part-deficient tape will lead to production of incomplete printed circuits having necessary diodes lost, incomplete electrolytic capacitors having necessary tabbed terminals lost or other deficient electronic devices.

SUMMARY OF THE INVENTION

One object of the present invention is to provide an apparatus for arranging rod-like, directional electronic parts at regular intervals on an elongated adhesive tape without missing any electronic parts in the series of parts.

To attain this object an apparatus for taping electronic parts according to the present invention comprises: a magnetic feeder for feeding electronic parts from its inlet to outlet side, said magnetic feeder comprising two parallel opposite elongated walls to define a feeding path therebetween and means for establishing a magnetic field across the feeding path with its magnetic strength increasing downstream toward the outlet of the feeding path; a vibrator connected to said magnetic feeder; a pickup drum placed at the outlet of said magnetic feeder; a taping drum juxtaposed to said pickup drum, each of said pickup drum and taping drum having a plurality of slots formed at regular intervals on its circumference for retaining electronic parts, each slot having a relatively small magnet buried under its bottom; a swingable lever placed between said pickup drum and said

taping drum; a pinch roll juxtaposed to said taping drum to push an elongated adhesive tape against said taping drum; a sensor responsive to absence of an electronic part in any selected slot on said pickup drum for generating a deficiency signal; and a drum control responsive to the deficiency signal for stopping the rotation of said taping drum for a moment.

The taping apparatus may further comprise a rotatable brush juxtaposed to said pickup drum, said rotatable brush rotating in the counter direction to said pickup drum.

In operation tabbed terminals are supplied to the inlet of the feeding path with their tabs down, thus permitting these electronic parts to be oriented under the influence of magnetic field with their tabs directed to one of the opposite walls, and with their legs directed to the other wall. Lateral vibration of the feeder along with the magnetic field increasing downstream cause the electronic parts to proceed toward the outlet of the feeder.

At the outlet of the feeder electronic parts are caught one after another by the rotating pickup drum. Specifically electronic parts are magnetically attracted and pulled one after another in the sequential slots of the drum so that they are magnetically retained therein.

When selected electronic parts on the rotating pickup drum approach the rotating taping drum, the swingable lever transfer electronic parts one after another from the pickup drum to the taping drum so that they may be retained in sequential slots of the taping drum.

The electronic parts on the taping drum approach an elongated adhesive tape, which runs between the taping drum and an associated pinch roll. Then, electronic parts are pushed against the underlying adhesive tape, so that they are transferred one after another to the adhesive tape.

A transparent tape running over the adhesive tape, is applied to the electronic parts, which are attached to the underlying adhesive tape, thus sandwiching these electronic

parts therebetween. The two-layer sandwich elongation is lined with a protection tape, and the resultant composite tape is wound about a cassette.

In rare cases few electronic parts are supplied to the feeder with their tabs up, so that such electronic parts are put on the adhesive tape in a wrong direction. Such wrong-oriented parts when transferred and caught by the pickup drum, cannot be fitted in the circumferential slots of the drum, partly floating on the circumference of the drum under the insufficient magnetic influence from the slot bottoms.

All of these wrong-oriented parts are removed from the rotating pickup drum by the counter-rotating brush.

As a result all electronic parts carried by the pickup drum are oriented in correct directions, and in rare cases there may be slots retaining no electronic parts.

The sensor detects vacant slots if any, to send deficient signals to the drum control. Every time such a deficient slot on the pickup drum approaches the taping drum, the taping drum is made to stop until the next slot containing an electronic part approaches the taping drum, and then the taping drum is permitted to rotate.

Thus, electronic parts can be put on the taping tape at regular intervals without missing any electronic part in position.

BRIEF DESCRIPTION OF THE DRAWING

Other objects and advantages of the present invention will be understood from the following description of a taping apparatus according to one preferred embodiment of the present invention, which is shown in accompanying drawings:

Fig.1 is a perspective view of a taping apparatus according to the present invention;

Fig.2 is a plane view of the taping apparatus, showing the feeder and the pickup drum on its outlet side; and

Fig.3 is an enlarged view of a selected part of one of

the opposite disks of the pickup or taping drum.

DESCRIPTION OF PREFERRED EMBODIMENTS

An apparatus for taping electronic parts according to one preferred embodiment of the present invention is described as taping tabbed terminals for electrolytic condensers. A tabbed terminal 1 is a copper or tin-plated iron wire having an aluminum electrode piece 1b welded thereto in the form of tab. The tabbed terminal is attached to an elongated electrode foil by welding or pressing its electrode piece thereto. An elongated insulating sheet is laid on the electrode foil to sandwich such tabbed terminals therebetween, and then the lamination is rolled to provide an electrolytic condenser.

An automatic machine is used in attaching tabbed terminals to elongated electrode foils, and then it is necessary that the tabbed terminals are oriented in correct directions, that is, with their tabs aligned in common series, and are supplied to the automatic machine to be put on the elongated electrode foil at correct positions.

Referring to Fig.1, the apparatus for taping electronic parts comprises an endless conveyor 3 for conveying containers 2 each containing tabbed terminals 1, reversing unit 5 for turning containers upside down, a turn table 4 for carrying tabbed terminals to a predetermined angular position, a chute 6 placed for receiving tabbed terminals thus carried to the predetermined angular position, a magnetic feeder 7 placed to receive tabbed terminals at its inlet, a pickup drum 8 placed at the outlet of the magnetic feeder 7 for picking up tabbed terminals one after another in its circumferential slots, a sensor 20 for detecting vacant slots if any, in the pickup drum, a rotatable brush 22 juxtaposed to the pickup drum at the outlet of the feeder 7, a taping drum 10 juxtaposed to the pickup drum 8, a swingable lever 19 located between the pickup drum 8 and the taping

drum 10 and a pinch roll 23 close to the taping drum 10 for pushing an elongated adhesive tape against the taping drum 10.

The container 2 is a hollow cylindrical body closing at its bottom, and a predetermined number of tabbed terminal 1 are put in the cylindrical container 2, standing on their foots 1a.

A train of containers 2 are moved forward step by step by the endless conveyor 3, and are transferred one by one to the reversing unit 5.

The reversing unit 5 comprises two opposite arms 5a to hold a container 2 therebetween, a bottom plate 5b to support the container 2, a turning axle 5c and an electromagnet 11 attached to the bottom plate 5b. The opposite arms 5a and the bottom plate 5b are integrally connected to the turning axle 5c, which traverses the end of the terminal feeding path provided by the endless conveyor 3, and can turn 180 degrees in either direction.

The turn table 4 is a revolving cylinder for holding tabbed terminals in lots that may be discharged in succession, comprising a horizontal stationary disk 4a, and a rotatable cylinder 4b having a plurality of cylindrical holes 4c made at equi-angular intervals, each cylindrical hole 4c having the same size as the cylindrical container 2. The rotatable cylinder 4b is pivotably fixed to the stationary disk 4a, and can be rotated by a motor (not shown) built in the turn table 4.

The outlet 12 of the stationary disk 4a is so positioned as to allow the coming cylindrical hole 4c to be in conformity with the outlet opening 12, which converges to a chute 6 opening to the terminal feeding end 7a of the magnetic feeder 7.

Fig.2 shows in plane, how the pickup drum 8 is placed relative to the magnetic feeder 7. The magnetic feeder 7 comprises two parallel opposite elongated walls 14 to define a feeding path having a width somewhat larger than the length

of the tabbed terminal, and two magnets 13 arranged with their N and S poles directed in opposing relation to establish a magnetic field across the feeding path. The inter-magnet space decreases downstream so that the magnetic strength of the magnetic field may increase downward toward the outlet of the feeding path.

The pickup drum 8 is placed close to the outlet of the magnetic feeder 7, and the taping drum 10 is juxtaposed to the pickup drum 8. The rotatable brush 22 and the sensor 20 are put close to the pickup drum 8, and the swingable lever 19 is placed between the pickup drum 8 and the taping drum 10. The pinch roll 23 pushes an elongated adhesive tape 9a against the taping drum 10.

In operation first, the reversing unit 5 transfers containers 2 first in first out from the endless belt 3 to the revolver 4 as follows: the reversing unit 5 holds a subsequent container 2 in its opposite arms 5a with the tabbed terminals 1 therein magnetically attracted to the disk 5b of the reversing unit 5 by energizing the associated electromagnet 11, and then, the axle 5c of the reversing unit 5 is made to rotate 180 degrees to turn the container 2 upside down. The turn table 4 rotates to bring a selected cylindrical hole 4c in alignment with the container 2 just turned upside down, and then, the electromagnet 11 is deenergized to permit the tabbed terminals 1 to fall in the selected cylindrical hole 4c with their tab electrodes 1b directed down, so that the tabbed terminals 1 stand on their tab electrodes 1b on the stationary disk 4a.

On the course to the original position close to the end of the endless conveyor 3 the opposite arms 5a are opened wide to discharge the empty container, thus permitting it to fall in a return duct (not shown) for collection.

When the turn table 4 rotates to the angular position in which the selected cylindrical hole containing a lot of tabbed terminals therein is put in conformity with the outlet 12 of the stationary disk 4a, the tabbed terminals 1 fall in

the outlet 12 of the stationary disk 4a with their tab electrodes 1b directed down, passing one by one through the inclined tapering trough 6 to be put one after another so that all tabbed terminals traverse the feeding path with their tab electrodes put close to one of the opposite walls 14.

Specifically all tabbed terminals are arranged to be perpendicular to the feeding path under the influence of the magnetic field so that their tab electrodes 1b may be put close to the right wall 7 as viewed in the feeding direction.

When the magnetic feeder 7 is vibrated transversely by a vibrator (not shown), all tabbed terminals 1 are subjected to vibration under the magnetic influence increasing gradually from the inlet to outlet side in strength, thus permitting tabbed terminals 1 to advance downstream in formation.

As seen from Fig.3, the pickup drum 8 comprises two opposite first disks 17 each having a plurality of slots 15 formed at regular intervals on its circumference, a first circular cylinder 25 sandwiched between these opposite disks 17, having small magnets 16 buried under slot bottoms, and a rotating axle 24 integrally connecting the first disks 17 and the first circular cylinder 25 in concentric relationship.

Each slot 15 has a diverging shape, the smallest bottom size of which is equal to tabbed terminal diameter. The magnet 16 lies parallel to the rotating axle 24, facing the diverging slot 15.

The pickup drum 8 is rotated intermittently at a given constant speed so that tabbed terminals may be magnetically attracted and put in sequential slots one after another. All tabbed terminals can be picked up by the pickup drum 8 without fail by placing the pickup drum 8 with its slotted disks 17 somewhat invading inward of the outlet of the feeding path.

If two tabbed terminals 1 should be put in a selected slot 15, or if a tabbed terminal 1 should be reversed and put in a selected slot 15 with its tab electrode caught by the

diverging end, such extra or wrong-oriented tabbed terminal will be put in unstable floating condition, and will be removed by the rotatable brush 22, which contacts with the pickup drum 8, rotating in the counter direction. Thus, the selected slot 15 has no tab terminal, and it is detected by the sensor 20, which is placed in the vicinity of the pickup drum 8.

The taping drum 10 is like the pickup drum 8, comprising two opposite second disks 18 each having a plurality of slots 15 formed at regular intervals on its circumference, and a second circular cylinder (not visible in Fig.1) sandwiched between these opposite disks 18, having small magnets 16 buried under their slot bottoms. The taping drum 10 rotates intermittently at a given constant speed in the direction opposite to the rotating direction of the pickup drum 8.

The swingable lever 19 is placed between the pickup drum 8 and the taping drum 10. The swingable lever 19 is pivoted at one end, extending the other end thereof far between the pickup drum 8 and the taping drum 10. It swings up and down in synchronism with the intermittent rotation of the pickup drum and taping drum, thereby transferring tabbed terminals one by one from each slot of the pickup drum 8 to the counter slot of the taping drum 10.

The pickup drum 8 and the taping drum 10 are driven at such controlled angular velocities that their slots meet at their contact area.

When the sensor detects a vacant slot having no tab terminal retained therein, a vacancy detection signal is directed to a drum rotating control (not shown), which stops the taping drum 10 when the vacant slot 15 comes to the transfer point at which a tabbed terminal would be transferred to the counter slot of the taping drum if the tabbed terminal were retained in the slot, and continues the stopping of the taping drum 10 until the subsequent slot having a tabbed terminal retained therein comes to the transfer point, and then, the tabbed terminal is transferred

to the taping drum, and the rotating of the taping drum 10 is resumed.

Thus, the taping drum 10 is loaded with tabbed terminals without permitting any slots to remain vacant.

An elongated adhesive tape 9a is unrolled from the roll 26 to run between the taping drum 10 and the pinch roll 23 with its adhesive side up, thus transferring tabbed terminals 1 from the taping drum 10 to the adhesive tape 9a by pushing and attaching tabbed terminals to the adhesive side of the adhesive tape by the pinch roll 23.

A transparent tape 9b is unrolled from the roll 27 to be laid on the upper, adhesive side of the adhesive tape 9a, and finally a protection tape 9c is unrolled from the roll 28 to be laid on the lower side of the adhesive tape 9a. The composite lamination tape having tabbed terminals sandwiched therebetween is rolled about a cassette (not shown).

When the taping drum 10 is made to stop in response to appearance of vacancy detection signals, all of the adhesive, transparent and protection tapes are made to stop, and the running of these tapes is resumed when the rotation of the taping drum 10 resumes.

A tension roll 21 is provided on the way to move up and down in response to the stretching or loosening of the adhesive-and-transparent composite tape, thereby removing the loosening of the composite tape, which may be caused by stopping the taping drum 10. Thus, the composite tape can be wound about the cassette in the loose-free condition.

The cassette is intermittently rotated so that the composite tape may be stretched by a given constant force, and wound without causing the excessive stretching and loosening of the composite tape by different circumferential speeds at the outset and termination of the winding.

As may be understood from the above, when wrong-oriented electronic parts are put in selected slots of the pickup drum, or when extra electronic parts are put in selected slots of the pickup drum, these parts can be removed from the

pickup drum by the rotatable brush, and then, the part-vacant slots will be detected by the sensor to stop the taping drum tentatively at the transport point at which electronic parts are transferred from the pickup drum to the taping drum until a subsequent slot containing an electronic part therein reaches the transport point, and then the rotating of the taping drum resumes to permit electronic parts to be transferred one by one to subsequent slots without fail, thus assuring that electronic parts are transferred and arranged on the adhesive tape at regular intervals without missing.

By supplying an automatic machine with electronic parts one by one from an adhesive tape having electronic parts arranged at regular intervals it is assured that the automatic machine be fed with electronic parts at regular intervals, thus preventing the undesired stopping of the machine caused by failing electronic parts at regular intervals, and accordingly the efficiency with which the machine can work will increase.



What is claimed is:

1. An apparatus for taping electronic parts comprising:

a magnetic feeder for feeding electronic parts from its inlet to outlet side, said magnetic feeder comprising two parallel opposite elongated walls to define a feeding path therebetween and means for establishing a magnetic field across the feeding path with its magnetic strength increasing downstream toward the outlet of the feeding path; a vibrator connected to said magnetic feeder;

a pickup drum placed at the outlet of said magnetic feeder;

a taping drum juxtaposed to said pickup drum, each of said pickup drum and taping drum having a plurality of slots formed at regular intervals on its circumference for retaining electronic parts, each slot having a relatively small magnet buried under its bottom; a swingable lever placed between said pickup drum and said taping drum; a pinch roll juxtaposed to said taping drum to push an elongated adhesive tape against said taping drum;

a sensor responsive to absence of an electronic part in any selected slot on said pickup drum for generating a deficiency signal; and

a drum control responsive to the deficiency signal for stopping the rotation of said taping drum for a moment.

2. An apparatus for taping electronic parts according to claim 1 wherein it further comprises a rotatable brush juxtaposed to said pickup drum, said rotatable brush rotating in the counter direction to said pickup drum.