

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 adhesive tape rod-like, directional electronic parts such as tabbed terminals for electrolytic capacitors or diodes for the purpose of providing a roll of electronic parts.

Description of the Prior Arts:

Lead legs of tabbed terminals for electrolytic capacitors or diodes are made of iron wire plated with copper and tin or solder material.

When making electrolytic condensers an automatic inserting or manufacturing apparatus is supplied with tapped terminals by unrolling a roll of tapped terminals and by removing one after another from a series of such directional

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parts arranged in the unrolled adhesive tape.

When arranging a plurality of such directional parts in the adhesive tape, they are subjected to vibration to form a train of parts, each being oriented in correct directions. In attaching such electronic parts to an adhesive tape, however, selected electronic parts are liable to be inclined and attached to the tape or to be deviated from correct positions to run over one longitudinal edge of the adhesive tape.

If the adhesive tape having tapped terminals put in wrong positions is wound into a roll, the roll will have some tapped terminals partly appearing laterally from one side of the roll, and if it is pushed into a box, the tapped terminals laterally appearing from the roll side will be caught by a selected side of the box, thereby causing them to be bent and deformed. Sometimes, wrong-oriented tapped terminals cause the roll to increase partly in diameter, and such a deformed roll cannot be pushed into the box without bending some tapped terminals.

If the automatic machine is loaded with such a deformed roll, wrong-oriented terminals are caught by some guides of the automatic machine to prevent it from continuing the working.

SUMMARY OF THE INVENTION

One object of the present invention is to provide an apparatus for putting rod-like, directional electronic parts in correct postures or orientations and arranging them at regular intervals on an elongated adhesive tape without missing any electronic parts in the series of electronic 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, said taping drum having a guide disk arranged concentric on one side, and pushed against the outer surface of said taping drum by an associated positioning member, said guide disk being somewhat larger than said taping drum, thereby permitting electronic parts carried by said taping drum to contact with the inner surface of said guide disk; a swingable lever placed between said pickup drum and said taping drum; and a pinch roll juxtaposed to said taping drum to push an elongated adhesive tape against said taping drum.

The positioning member may be a rotatable roll. A posture correcting disk may be arranged on the other side of said guide disk.

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 the outlet side of the feeder;

Fig.3 is a plane view of the taping apparatus, showing the pickup drum, the taping drum and the pinch roll;

Fig.4 is an enlarged view of a selected part of the pickup or taping drum to show slots for retaining electronic parts therein.

Fig.5 is an enlarged perspective view of a selected part of the taping drum.

DETAILED 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 made by plating a short length of iron wire plated with copper and tin or soldering material; by welding a very short of aluminum wire to the so plated iron wire; and by pressing and flattening the aluminum wire to an electrode tab 1b. The tabbed terminal is fixed to an elongated metal sheet by pressing or welding its electrode tab 1b to the electrode foil. A required number of tabbed terminals 1 are arranged on the elongated electrode foil, and then an elongated insulating sheet is laid on the elongated electrode foil to sandwich the tabbed terminals 1 therebetween. The resultant composite 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 in which their tabs are aligned in 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 2 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.

Still, referring to Fig.1, the container 2 is a hollow cylindrical body closing at its bottom, and a predetermined number of tabbed terminals 1 are put in the cylindrical container 2, standing on their legs 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 pivotally 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.

Fig.3 shows, in plane, how the pickup drum 8 and the taping drum 10 are constructed. As seen from Fig.4, 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.

As seen from Fig.4, each slot 15 has a diverging shape, the smallest bottom size of which is equal to the diameter of the tabbed terminal leg 1a. The magnet 16 lies parallel to the rotating axle 24, facing the diverging slot 15.

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 32 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 which is opposite to the rotating direction of the pickup drum 8.

The taping drum 10 has a guide disk 26 on one side thereof. Specifically, the guide disk 26 is somewhat larger than the second disk 18, and is fixed to the second axle 33 by a bushing 28. A coiled spring 27 is between the second disk 18 and the guide disk 26.

A pushing roll 29 is used to apply a pushing force to the guide disk 26 in the direction which is parallel to the second axle 33, thereby keeping the guide disk 26 inclined to the second disk 18.

The taping drum 10 has a posture correcting disk 30 on the other side thereof. Specifically, the posture correcting disk 30 is of the same size as the second circular cylinder 32, and is spaced a predetermined distance from the second disk 18, and fixed to the second axle 33. The diameter of the posture correcting disk 30 may be determined appropriately in consideration of the size and shape of the electronic part to be handled.

The angular speed of the pickup drum 8 and the angular speed of the taping drum 10 are so controlled that their slots 15 may come to meet at the transfer point at which the tabbed terminal 1 may be transferred from each slot of the pickup drum 8 to the counter slot of the taping drum.

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 downward, 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 downward, 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 1b put close to one of the opposite elongated 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 (see Fig.2).

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, thus permitting tabbed terminals 1 to advance downstream in formation.

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 partly out of a selected slot 15, such extra or wrong-oriented tabbed terminal 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 tabbed terminal.

As described above, tabbed terminals 1 are moved forward to reach the outlet of the feeding path 7 with their legs 1a directed to one of the opposite elongated walls, so that such tabbed terminals may be picked up by the pickup drum 8. In case that a lot of tabbed terminals stop and wait at the outlet of the feeding path 7, or in case that tabbed terminals are displaced somewhat by the rotatable brush 22, still remaining on the pickup drum 8, such tabbed terminals may be deviated by legs 1a from correct positions on the pickup drum 8, or may be inclined by electrode foils 1b on the pickup drum 8.

The pickup drum 8 carrying tabbed terminals 1 thereon rotates about its axle 24 in the direction indicated by arrow (clockwise) whereas the taping drum 10 rotates about its axle 33 in the opposite direction indicated by arrow (counterclockwise). The swingable lever 19 is placed between the pickup drum 8 and the taping drum 10, moving up and down in synchronism with the intermittent rotation of the pickup drum 8 to transfer tabbed terminals one by one from each slot 15 of the pickup drum 8 to the counter slot 15 of the taping drum 10.

When the sensor 20 detects a vacant slot having no tabbed 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. The control 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 10, 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.

When the tabbed terminals 1 are transferred from the pickup drum 8 to the taping drum 10, the leg ends of the tabbed terminals are put in contact with the inner surface of the rotating guide disk 26 so that the tapped terminals 1 are pushed in directions which are parallel to the second axle 33, thus being aligned by the rotating guide disk 26, which is inclined by the stationary roll 29. The stationary roll 29 pushes actually the tabbed terminals 1 via the guide disk 26, and the guide disk 26 rotates along with the taping drum 10, thereby pushing the tabbed terminals 1 smoothly without fear of bending the legs 1a of terminal or displacing tabbed terminals from their correct positions.

On the other side of the taping drum the tabs 1b of the tabbed terminals 1 are put on the circumference of the posture correcting disk 30, thereby putting the tabs 1b of the tabbed terminals 1 in correct posture under the attractive influence of small magnets 16.

Thus, the legs 1a of the tapped terminals 1 are aligned, and the tabs 1b of the tabbed terminals 1 are put in correct posture on the taping drum 10, and these tabbed terminals are brought to the space between the taping drum 10 and the pinch roll 23. An elongated adhesive tape 9a is unrolled from the roll 34 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 9a by the pinch roll 23.

A transparent tape 9b is unrolled from the roll 35 to be laid on the upper, adhesive side of the adhesive tape 9a, and finally a protection tape 9c is unrolled from the roll 36 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, the adhesive and transparent tapes stop simultaneously. A tension roll 21 is provided on the way to the point at which the protection tape 9c is laid on the adhesive-and-transparent composite tape, thereby pulling down the composite tape in the form of the letter "U". The tension roll 21 is allowed to move up and down in such a way to stretch the composite tape with appropriate force for removing the loosening of the composite tape, which may be caused by stopping and resuming of the rotation of the taping drum 10.

The circumferential speed of the cassette (not shown) will vary at the outset and termination of the winding. In order to remove the loosening or stretching of the tape in winding the cassette is rotated intermittently in response to the instantaneous stretching force applied to the tape so that it may be stretched by a given constant force. Thus, the composite tape can be wound about the cassette in the loose-free condition.

As may be understood from the above, in transferring electronic parts from the pickup drum to the taping drum, the stationary roll pushes the electronic parts in correct posture via the swingable guide disk, which is attached to one side of the taping drum, thus permitting the electronic parts to be aligned without fear of being inclined or displaced from correct positions, assuring that the so oriented electronic parts be put on the adhesive tape at correct positions. The posture correcting disk holds the selected portions of the electronic parts on its circumference to assist in arranging such electronic parts in correct positions on the adhesive tape. By supplying an

automatic machine with electronic parts one by one from such an adhesive tape having electronic parts arranged at correct positions the automatic machine will be guaranteed to be free of undesired stop caused by wrong-oriented electronic parts, 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, said taping drum having a guide disk arranged concentric on one side, and pushed against the outer surface of said taping drum by an associated positioning member, said guide disk being somewhat larger than said taping drum, thereby permitting electronic parts carried by said taping drum to contact with the inner surface of said guide disk; a swingable lever placed between said pickup drum and said taping drum; and a pinch roll juxtaposed to said taping drum to push an elongated adhesive tape against said taping drum.
2. An apparatus for taping electronic parts according to claim 1 wherein the positioning member is a rotatable roll.
3. An apparatus for taping electronic parts according to claim 1 or 2 wherein a posture correcting disk is arranged on the other side of said guide disk.