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"A carrier strip for tab terminals and an apparatus for conveying the tab terminals to a next step"

The present invention concerns a carrier strip for receiving a number of tab terminals for small-sized aluminum electrolyte capacitors.

5 The present invention also concerns an apparatus for conveying the tab terminals on conveying means to a next step with their predetermined attitude maintained during the conveying operation by automatically opening a number of hollow spaces on the carrier strip one by one.

10 A tab terminal for a small-sized aluminum electrolyte capacitor is composed of an aluminum portion including a flat part coated with a chemically deposited film and a lead wire made of a steel material, and the aluminum portion is connected to the lead wire by welding. Generally, several hundred or several thousand tab terminals are received in a container such
15 as a can of aluminum, a bag of polyethylene or the like as a single delivery lot size so that they are delivered from a manufacturer to a purchaser on the commercial basis.

As shown in Fig. 5, the purchaser takes out the tab terminals from the container 50 by a manual operation and the
20 tab terminals are then supplied to a part bowl 52. The part bowl 52 is constructed such that the tab terminals are vibrated during a turning movement in the interior thereof and approach an outlet while they are increasingly assuming an upright attitude. Then, they enter a straight feeder 54 while

maintaining the upright attitude in the side-by-side relationship. Thereafter, they are delivered to a next working step (not shown) from the straight feeder 54 one by one

When the tab terminals are supplied to the part bowl 52, an operator is required to stand in the vicinity of the part bowl 52 so as to visually observe that a proper quantity of tab terminals are supplied to the part bowl without any excess or shortage in quantity at all times, resulting in a productive efficiency being reduced undesirably. In addition, if an operator's hand erroneously comes in direct contact with one of the tab terminals while they are supplied to the tab bowl 52, there arises a problem that the tab terminal is contaminated with an impurity such as a chlorine or the like, resulting in a leakage current being increased undesirably.

Another problem is that a chemically deposited film on the aluminum portion of each tab terminal is peeled off therefrom due to the vibration during a turning movement of the tab terminals in the part bowl 52.

The present invention has been made with the foregoing background in mind.

An object of the present invention is to provide a carrier strip for receiving a number of tab terminals for small-sized aluminum electrolyte capacitors with a predetermined attitude relative to the direction of extension of the carrier strip maintained therefor.

According to the present invention a carrier strip comprises a plurality of closed compartments equally spaced along the strip, each compartment containing a plurality of tab terminals, each tab terminal extending transversely of the strip and the strip having a tear-off portion along one edge removable to give access to the compartments.

Also according to the present invention an apparatus includes a carrier strip for conveying a plurality of tab terminals, from one stage to the next, whilst maintaining the terminals in a predetermined arrangement during the conveying operation, the carrier strip comprising a plurality of closed compartments equally spaced along the strip, each compartment containing a plurality of tab terminals, each extending transversely of the strip and the strip having a tear-off portion along one edge removable to give access to the compartments, the apparatus comprising a first winding means for winding the tear-off portion torn from the main part of the carrier strip, a second winding means for winding the main part of the carrier strip, a conveying means arranged below the carrier strip, at least one sensor disposed on the conveying means to detect the presence or absence of the tab terminals at predetermined positions on the conveying means and a controller for controlling the first winding means and the second winding means in response to a signal transmitted from the sensor, the controller performing an operation such that when a single compartment on the carrier strip is displaced to the region above the conveying means by driving the second winding means, the first winding means is

activated to tear the tear-off portion from the main body of the carrier strip by a length corresponding to a width of each compartment so as to open the compartment and then allow a plurality of tab terminals in the compartment to fall down on the conveying means which in turn conveys the tab terminals to a next stage.

The carrier strip is constituted by a single band-shaped sheet material which is folded in the U-shaped configuration in the longitudinal direction while opposite ends of the sheet material are thermally fused together at an elevated temperature to form one edge of the carrier strip.

The tear-off portion may include a perforated line which extends along the one edge of the carrier strip so as to allow a tearing operation to be performed along the perforated line to open each compartment.

Alternatively, the tear-off portion may comprise a band-shaped piece which is torn from the main body of the carrier strip thereby to open each compartment.

To assure that a plurality of tab terminals in each compartment are smoothly displaced to the conveying means, it is recommendable that an inclined plate having a certain inclination angle is arranged below the carrier strip on the upstream side of the conveying means.

It is preferable that the sensor is attached to a guide plate on one side or opposite sides of the inclined plate.

When the apparatus is used in practice, the carrier strip is arranged above the conveying means such that the tear-off

portion of each compartment on the carrier strip is located on the lower side of the carrier strip. Since a plurality of tab terminals are received in each compartment with a predetermined attitude at a substantially right angle relative to the direction of extension of the carrier strip the tab terminals fall down on the conveying means via the inclined plate with the tear-off portion torn from the main body of the carrier strip while maintaining the predetermined attitude. After the tab terminals are correctly placed on the conveying means, they are conveyed to a next step by driving the conveying means while the predetermined attitude is maintained substantially unchangeably during a conveying operation.

The invention will now be described further, by way of example, with reference to the accompanying drawings, in which:-

Fig. 1 is a partially exploded front view which illustrates the structure of a carrier strip for receiving a number of tab terminals for small-sized aluminum electrolyte capacitors in accordance with an embodiment of the present invention:

Fig. 2 is fragmentary sectional view of the carrier strip in Fig. 1, particularly illustrating an essential part thereof;

Fig. 3 is a perspective view of a carrier strip in accordance with other embodiment of the present invention;

Fig. 4 is a perspective view of an apparatus for conveying a plurality of tab terminals for small-sized aluminum electrolyte

capacitors in each compartment on a carrier strip to a next step in accordance with another embodiment of the present invention; and

Fig. 5 is a perspective view which schematically illustrates a conventional method of conveying a plurality of tab terminals for small-sized aluminum electrolyte capacitors to a next step.

Fig. 1 is a partially exploded front view which shows a carrier strip for receiving a number of tab terminals for small-sized aluminum electrolyte capacitors in accordance with an embodiment of the present invention and Fig. 2 is a fragmentary sectional view which shows an essential part of the carrier strip in Fig. 1 on an enlarged scale. The carrier strip designated by reference numeral 10 is molded of a sheet material of polyvinyl chloride or the like material in the band-shaped configuration and includes a number of compartments 12 which are arranged in the longitudinal direction of the sheet material in the equally spaced relationship. Each compartment 12 is usually formed by thermally fusing two sheets material together at an elevated temperature. The compartment 12 is sealed along an adhering portion 14.

As represented by a dotted line in Fig. 1, a cutting line 16, e.g., in the form of a perforated line is formed in the longitudinal direction of the carrier strip 10 to extend across each compartment 12. Formation of the cutting line 16 makes it possible to open the compartment 12 by performing a tearing

operation along the cutting line 16. According to the embodiment shown in Fig. 1, the cutting line 16 is formed by a perforated line. Alternatively, a cutting band as often seen in the case of a transparent package bag for a cigarette box may be substituted
5 for the cutting line 16.

The case where the cutting band is used in place of the cutting line 16 will be described with reference to Fig. 3. As shown in Fig. 3, the cutting band is designated by reference numeral 20. In this case, the cutting band 20 is interposed
10 between a pair of foremost ends of an inverted U-shaped sheet material 18 for the carrier strip 10 in the clamped state and the foremost ends of the sheet material 18 are then thermally fused together at an elevated temperature by heating means (not shown). To assure that each compartment 12 is opened without
15 fail in the same manner as the preceding case where the cutting line 16 is formed, the cutting band 20 is properly dimensioned in respect to a width and a thickness.

As shown in Fig. 1 and Fig. 2, a plurality of tab terminals 22 are received in each compartment 12. It is
20 preferable that aluminum portions 26 each having a weight heavier than a lead wire 24 are located on the lower side of the carrier strip 10 where the cutting line 16 or the cutting band 20 is formed, as shown in Fig. 2. Alternatively, the lead wires 24 may be located on the lower side of the carrier strip 10 in the
25 opposite manner to the shown case, if necessary. It should be noted that all the tab terminals 22 are arranged to extend in the direction at a substantially right angle relative to the

longitudinal direction of the carrier strip 10.

Next, an apparatus for automatically conveying a number of tab terminals for small-sized aluminum electrolyte capacitors to a part feeder at a next step will be described below with
5 reference to Fig. 4.

The apparatus includes conveying means 28 such as a belt conveyor or the like means so as to convey the tab terminals 22 to a next step. An inclined plate 30 having a certain inclination angle is disposed on the upstream side of the conveying means 28
10 and the carrier strip 10 is arranged slightly above the upper end of the inclined plate 30. In addition, the apparatus includes first winding means 34 at the position above the carrier strip 10 for winding a band-shaped piece 32 derived from a tearing operation for the carrier strip 10 and second winding
15 means 38 for winding the main part 36 of the carrier strip 10 with the band-shaped piece 32 torn therefrom.

A pair of guide plates 40 are arranged on the opposite sides of the conveying means 28 and sensors 42 are mounted on the guide plates 40 so as to determine whether or not the tab
20 terminals 22 are existent at predetermined positions on the conveying means 28. The result derived from the determination made by the sensors 42 is transmitted to a controller 44 as a signal. If the result is NO, i.e., the result reveals that no tab terminal is existent on the conveying means 28 at the
25 predetermined positions, the controller 44 activates the first winding means 34 and the second winding means 38 so as to supplement the conveying means 28 with another set of tab terminals 22.

Next, a method of automatically conveying tab terminals 22 on to the conveying means 28 by using the carrier strip 10 in which a number of tab terminals 28 are received will be described below.

5 In a case where no tab terminal is existent on the conveying means 28 at the predetermined position, the controller 44 is informed about this fact by receiving a signal from the sensors 42. In response to the signal, the first winding means 34 is rotated for a predetermined period of time. As the first
10 winding means 34 is rotated in this way, the band-shaped piece 32 having a length corresponding to a single compartment 12 above the inclined plate 30 is torn from the carrier strip 10. In other words, a quantity of winding of the band-shaped piece 32 is set to a pitch of the compartment 12 which has been
15 brought in the region above the inclined plate 30. At this time, the second winding means 38 is not activated so that the main part 36 of the carrier strip 10 with the band-shaped piece 32 torn therefrom is held in the immovable state. In this manner, the compartment 12 is opened by winding the band-shaped piece
20 32 with the aid of the first winding means 34, whereby a plurality of tab terminals 22 received in the compartment 12 fall down on the inclined plate 30 by their own dead weight and they are then placed on the conveying means 28 from the inclined plate 30.

25 When it is confirmed that all the tab terminals 22 received in the compartment 12 above the inclined plate 30 fall down on the inclined plate 30, the second winding means 38 is activated

by the controller 44 such that the main part 36 of the carrier strip 10 is wound by a length corresponding to a single pitch of the compartments 12.

After the tab terminals 22 are placed on the conveying means 28, they are conveyed toward a straight feeder or the like means (not shown) at the next step by driving the conveying means 28. When the sensors 42 detect that the tab terminals 22 have been displaced away from the predetermined positions on the conveying means 28 toward the next step, the controller 44 activates the first winding means 34 and the second winding means 38 again so that the conveying means 28 is supplemented with another tab terminals 22.

According to the embodiment shown, a belt conveyor is employed for the conveying means 28 to receive and convey the tab terminals 22 in the carrier strip 10. Alternatively, a part bowl which has been heretofore used as conveying means may be employed for the conveying means 28 so that tab terminals are conveyed to the position in the vicinity of an outlet port of the part bowl. In this case, vibrations induced by the part bowl are transmitted to the tab terminals to some extent. However, since the tab terminals are conveyed immediately from the part bowl to the straight feeder (not shown) at the next step, there is no possibility that a chemically deposited film on each of the tab terminals is damaged or injured by the undesirable influence of vibrations. In this case, it is preferable that the sensors are arranged at suitable positions in the vicinity of the outlet of the part bowl.

According to the embodiment shown, the apparatus is provided with the inclined plate 30. Alternatively, the tab terminals 22 may fall down on the conveying means 28 directly from the carrier strip 10 with the inclined plate 30 removed
5 from the apparatus.

As is apparent from the above description, the carrier strip for receiving a number of tab terminals for small-sized aluminum electrolyte capacitors is constructed such that a plurality of tab terminals are received in each compartment on a
10 band-shaped sheet material while assuming a predetermined attitude and a tear-off portion in the form of a cutting line or a band-shaped piece is formed along one edge of the band-shaped sheet material so as to allow it to be torn from the band-shaped
sheet material. With this construction, while the tab terminals
15 are arranged in each compartment with the predetermined attitude maintained relative to the direction of extension of the band-shaped sheet material, they can be conveyed to the next step with the predetermined attitude maintained unchangeably.

In addition, since the apparatus is provided with the
20 sensors for detecting presence or absence of the tab terminals on the conveying means as well as means for successively opening each compartment on the carrier strip one by one, the apparatus assures that a predetermined number of tab terminals can automatically be supplied to the conveying means without fail.

Consequently, the apparatus can eliminate a necessity for an operator who has been hitherto required for placing tab terminals in a container on a part bowl or the like means, resulting in improvement of productivity and reduction of a
5 production cost being accomplished reliably.

CLAIMS

1. A carrier strip comprising a plurality of closed compartments equally spaced along the strip, each compartment containing a plurality of tab terminals, each tab terminal extending transversely of the strip and the strip having a tear-off portion along one edge removable to give access to the compartments.
2. A carrier strip as claimed in claim 1, in which the strip is constituted by a single piece of sheet material longitudinally folded in a U-shaped configuration, opposite edges of the sheet material being thermally fused together at an elevated temperature to form one edge of the strip.
3. A carrier strip as claimed in claim 1, in which the tear-off portion includes a perforated line extending parallel to one edge of the strip so as to allow a tearing operation to be performed to allow access to the compartments.
4. A carrier strip as claimed in claim 1 or 2, in which the tear-off portion comprises a ribbon forming a pull tab inserted between the longitudinal edges of the strip.
5. An apparatus including a carrier strip for conveying a plurality of tab terminals, from one stage to the next, whilst maintaining the terminals in a predetermined arrangement during the conveying operation, the carrier strip comprising a plurality of closed compartments equally spaced along the strip, each compartment containing a plurality of tab terminals, each tab terminal extending transversely of the strip and the strip having a tear-off portion along one edge removable to give access to the compartments, the apparatus



comprising a first winding means for winding the tear-off portion torn from the main part of the carrier strip, a second winding means for winding the main part of the carrier strip, a conveying means arranged below the carrier strip, at least one sensor disposed on the conveying means to detect the presence or absence of the tab terminals at predetermined positions on the conveying means and a controller for controlling the first winding means and the second winding means in response to a signal transmitted from the sensor, the controller performing an operation such that when a single compartment on the carrier strip is displaced to the region above the conveying means by driving the second winding means, the first winding means is activated to tear the tear-off portion from the main body of the carrier strip by a length corresponding to a width of each compartment so as to open the compartment and then allow a plurality of tab terminals in the compartment to fall down on the conveying means which in turn conveys the tab terminals to a next stage.

6. An apparatus as claimed in claim 5, in which the carrier strip is arranged above the conveying means such that the tear-off portion of each compartment on the carrier strip is located on the lower side of the carrier strip.

7. An apparatus as claimed in claim 5, in which an inclined plate, is arranged below the carrier strip on the upstream side of the conveying means so as to allow the tab terminals in their compartments to be smoothly displaced towards the conveying means.



8. An apparatus as claimed in claim 7, in which the sensor is attached to a guide plate on one or each side of the inclined plate.

9. An apparatus as claimed in claim 5, in which the carrier strip is constituted by a single piece band-shaped sheet material which is folded longitudinally in a U-shaped configuration while opposite edges of the sheet material are thermally fused together at an elevated temperature to form one edge of the carrier strip.

10. An apparatus as claimed in claim 5, in which the tear-off portion includes a perforated line which extends parallel to one edge of the carrier strip so as to allow a tearing operation to be performed along the perforated line to open each compartment.

11. An apparatus as claimed in claim 5, in which the tear-off portion comprises a ribbon forming a pull tab which is adapted to be torn from the main part of the carrier strip to open each compartment.

12. A carrier strip containing tab terminals for capacitors constructed and arranged substantially as herein described with reference to and as illustrated in Figs. 1 to 3 of the accompanying drawings.

13. An apparatus for conveying tab terminals to the next stage constructed and arranged to operate substantially as herein described with reference to and as illustrated in Fig. 4 of the accompanying drawings.

