APPARATUS FOR THE PACKING OF FILLED TUBES
26 Claims, 8 Drawing Figs.

ABSTRACT: The invention provides apparatus for packing filled tubes, such as toothpaste tubes, in individual rectangular boxes with the end closure fins of the tubes extending diagonally of the boxes. A tube conveyor includes tongs movable in a horizontal endless path and adapted to suspend the tubes by their fins. The tubes are received from a rotary table and transported to a packing station at which the erected boxes are presented by a compartmented wheel. The tongs lower the tubes individually into the boxes at the packing station.
APPARATUS FOR THE PACKING OF FILLED TUBES

The present invention relates to an apparatus for packing filled tubes, such as toothpaste tubes, into individual boxes of rectangular cross section, which apparatus has an endless, stepwise driven conveyor for the tubes and an endless, stepwise drive conveyor for the boxes, the support devices of the two conveyors being in alignment with each other at a packaging station, the apparatus having a device for placing the tubes into the boxes with closure fins of the tubes located diagonally of the cross section of the boxes.

Such alignment of the tubes is required for the purpose of space-saving packaging, so that the smallest possible boxes can be used, the closure fin in the tube usually being longer than the diameter of the tube.

A known apparatus operates with a cell-type conveyor in which the tubes are located horizontally. Here, to ensure that the fins in the tubes are disposed diagonally of the cross section of the boxes, the tubes have to be aligned in a separate operation either manually by an operator or by means of a special aligning arrangement when the tubes are loaded into the conveyor and before they are placed into the boxes.

Thus, a feature of the present invention is to provide an apparatus for packing filled tubes, in which apparatus each tube is automatically aligned diagonally of the cross section of the box without a separate working operation and in which this aligned position is maintained until the tube is inserted into the box without the necessity for a manual working operation.

In accordance with the present invention, stepwise driven tube conveying means and likewise stepwise driven box conveying means move in horizontal planes diagonally of the cross section of the box, and the tube-conveying means being provided with tongs which are vertically movable on guides at transfer and packaging stations and which serve for individually gripping the fins of the tubes, and with actuating devices for these tongs, and the tube-conveying means is associated with the box-conveying means, moving in a different plane, in such a manner that each tube at the packaging station is held by one of the tongs with its closure fin located diagonally of the associated box and is inserted into the box by the tongs.

Thus the conveying means located in two different planes are constructed so that, at the packaging station, the fin of the tube to be packed is always located diagonally of the associated box, so that when the tube is released by the tube-conveying means, the tube is deposited into the box in the desired alignment.

In a preferred embodiment of the invention, the endless tube conveying means is formed by two endless traction cords or chains which are arranged in parallel planes located one above the other, each of which traction cords or chains being connected to each other by a plurality of guide bars which carry the tongs. Thus, a simple and reliably operating tube conveying means can be obtained whose tongs grip the tubes after the tubes have been filled and release the tubes in the desired diagonal position for the purpose of packing them into the boxes.

The box-conveying means can be formed by a compartmented wheel having separate pairs of retaining fingers for the individual boxes. To enable the compartmented wheel to be used for packing boxes of different sizes, it is advantageous if the distance between the retaining fingers of the separate compartments is simultaneously and commonly adjustable.

It is preferably possible in a simple manner infinitely to adjust the distance between the substantially radially projecting retaining fingers whilst maintaining the parallelism of associated fingers. In accordance with a feature of the present invention, at least one retaining finger of each pair of retaining fingers is hinged to a rotary disc which is rotatable relatively to the compartmented wheel, an extension of the said retaining finger being guided on a curve or cam on the compartmented wheel, and a drive arrangement is provided for turning the rotary disc.

The invention is further described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a schematic plan view of one embodiment of apparatus for packaging of tubes into boxes,

FIG. 2 is a schematic side view of the same apparatus,

FIG. 3 is a schematic side view of a part of the tube conveyor used in the apparatus illustrated in FIGS. 1 and 2,

FIG. 4 is a plan view corresponding to FIG. 3,

FIG. 5 is a schematic axial section through a compartmented wheel for conveying the packaging boxes,

FIG. 6 is a fragmentary plan view, partially sectionalized, of a part of the compartmented wheel illustrated in FIG. 5,

FIGS. 7 and 8 are schematic side elevation and a schematic plan view corresponding to FIGS. 2 and 1 respectively, but along a second embodiment of the apparatus constructed in accordance with the invention.

In the embodiment illustrated in FIGS. 1 to 4, tubes 6 made from metal foil are filled in a conventional manner (not illustrated), their rear, open ends are pressed flat, and the tubes are closed by crimping them to form a fin 6'. The tubes are then conveyed by a rotary table 1, in which the tubes are individually seated in receptacles 1', to a stepwise operating, endless conveyor which essentially comprises two traction cords 2 and 3 which are arranged in two planes one above the other. The rotary table 1 is located below the traction cords 2 and 3. Tongs 5 for gripping the tubes 6 in the region of their fins 6' are vertically displaceable on guide bars 4 which are mounted at uniform distances apart between the traction cords 2, 3. When the tongs 5 are in the bottom position illustrated in FIGS. 2 and 3 they can be opened to grip a tube 6 objected upwardly by the tube-conveying means being provided with tongs which are vertically movable on guides at transfer and packaging stations and which serve for individually gripping the fins of the tubes, and with actuating devices for these tongs, and the tube-conveying means is associated with the box-conveying means, moving in a different plane, in such a manner that each tube at the packaging station is held by one of the tongs with its closure fin located diagonally of the associated box and is inserted into the box by the tongs.

Thus the conveying means located in two different planes are constructed so that, at the packaging station, the fin of the tube to be packed is always located diagonally of the associated box, so that when the tube is released by the tube-conveying means, the tube is deposited into the box in the desired alignment.

In a preferred embodiment of the invention, the endless tube conveying means is formed by two endless traction cords or chains which are arranged in parallel planes located one above the other, each of which traction cords or chains being connected to each other by a plurality of guide bars which carry the tongs. Thus, a simple and reliably operating tube conveying means can be obtained whose tongs grip the tubes after the tubes have been filled and release the tubes in the desired diagonal position for the purpose of packing them into the boxes.

The box-conveying means can be formed by a compartmented wheel having separate pairs of retaining fingers for the individual boxes. To enable the compartmented wheel to be used for packing boxes of different sizes, it is advantageous if the distance between the retaining fingers of the separate compartments is simultaneously and commonly adjustable.

It is preferably possible in a simple manner infinitely to adjust the distance between the substantially radially projecting retaining fingers whilst maintaining the parallelism of associated fingers. In accordance with a feature of the present invention, at least one retaining finger of each pair of retaining fingers is hinged to a rotary disc which is rotatable relatively to the compartmented wheel, an extension of the said retaining finger being guided on a curve or cam on the compartmented wheel, and a drive arrangement is provided for turning the rotary disc.

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It is preferably possible in a simple manner infinitely to adjust the distance between the substantially radially projecting retaining fingers whilst maintaining the parallelism of associated fingers. In accordance with a feature of the present invention, at least one retaining finger of each pair of retaining fingers is hinged to a rotary disc which is rotatable relatively to the compartmented wheel, an extension of the said retaining finger being guided on a curve or cam on the compartmented wheel, and a drive arrangement is provided for turning the rotary disc.
are associated with the stepwise operating rotary table 16 located in a lower plane, so that the fin 6' of the tube is directed diagonally of the cross section of the box at the packaging station at which a tube 6 held by tongs 5 is in alignment with an open box 25 located therebelow (FIG. 1).  

In this position, the tongs 5 holding the tube 6 are guided downwardly by a further fork like the fork 13 which is guided on a further guide bar like the guide bar 4', this operation being effected by means of a device which corresponds to the device illustrated in FIG. 3 and which is illustrated only schematically in FIG. 2. For this purpose, the guide rail 10 is provided with a further opening in the region of the packaging station. On impact at the bottom end position, the gripping jaw 7 of the tongs 5 is opened by the fork 13, so that the tube 6 is released and slides into the box 25 located therebelow. After the tube 6 has been inserted into the box 25 clamped between the retaining fingers 15, the box is conveyed in a stepwise manner to an ejection device 17 from where the vertical boxes 25 are transferred on to a guideway 18. 

The empty packaging boxes 25 in the flat, folded state are stacked adjacent the rotary table 16 in a magazine 19 which is directed towards the periphery of the table 16. The table 16 forming the box conveyor has two substantially circular, spaced rotary bodies 31,32 which are arranged coaxially of each other, and each rotary body together with its retaining fingers 15 forms a compartmented wheel. A swinging arm 21 is mounted on a hinge 43 adjacent to the rotary table 16. The free end of the swinging arm 21 carries a suction finger 22 which removes the packaging boxes 25 one at a time from the magazine 19 and erects them when the arm 21 pivots by pulling the boxes open. The swinging arm 21 is then pivoted into the region between the two discs 31 and 32 and thereby moves the box 25 radially between the retaining fingers 15 of a pair of retaining fingers. 

Before a tube 6 is inserted into such a packaging box 25, the bottom end of the box can be closed in conventional manner by folding elements (not illustrated) and, after the tube 6 has been inserted, the top end of the box can be closed in conventional manner by further folding elements which are not further illustrated or described. The rotary table 16 forming the box conveyor, the tube conveyor formed by the traction cords 2,3, and the rotary table 17 advancing the tubes are driven in synchronism in a stepwise manner. The apparatus constructed in accordance with the present invention also enables an imprint on a tube to be associated in a specific manner with an imprint on a box. 

A construction of the compartmented wheels forming the rotary table 16 is illustrated in detail in FIGS. 5 and 6. The two substantially identical rotary bodies 31,32 are arranged on a common shaft 33 so as to be axially displaceable relatively to each other. The distance between the rotary bodies can be varied by means of a handwheel 34 by way of a screw thread 34' between one rotary body 31 and the shaft 33. The rotary bodies 31 and 32 are driven in common in a stepwise manner by way of the shaft 33. 

Each of the rotary bodies 31,32 comprises three parallel rotary discs 35,36,37, the two outer rotary discs 35 and 37 being rotatable relatively to the inner rotary disc 36 and in opposite directions to each other. The inner rotary disc 36 forms a fixed component of the compartmented wheel 16. A milled wheel 38 is arranged in an opening in each of the inner rotary discs 36 and, for the purpose of being gripped, projects beyond the planes defined by the two outer rotary discs 35 and 37. The milled wheel 38 is arranged on a pin 39 which has a right-hand thread on one end and a left-hand thread on the other end. The two ends of the pin 39 engage into respective nuts 40 and 41, one nut being secured to the rotary disc 35 for the purpose of moving the rotary disc 35, and the other nut being secured to the rotary disc 37 for the purpose of moving the rotary disc 37. The two outer rotary discs 35 and 37 are turned relatively to each other when the milled wheel 38 is turned. Whilst only the upper rotary body 32 is shown with the milled wheel, the lower rotary body 31 is likewise provided with a milled wheel. 

The two outer rotary discs 35 and 37 each carry similar retaining fingers 15, each retaining finger 15 on the other rotary disc 37 a pair of retaining fingers for receiving a packaging box 25. The retaining fingers 15 are each pivotable about pins 43 in the rotary discs 35 and 37. A curved piece 45 for each retaining finger 15 of each pair of retaining fingers is secured to the inner rotary disc 36. Each curved piece 45 forms part of a circle and is disposed inwardly relatively to the outer peripheries of the discs 35 and 37. Associated curved pieces 45 are slightly turned relatively to each other. The retaining fingers 15 commonly forming a pair of retaining fingers have angled inner ends 46 which are directed towards each other and which abut against respective curved pieces 45. The angled ends 46 are urged against the curved pieces 45 by leaf springs 44. 

The associated retaining fingers 15 on the two rotary discs are moved towards or away from each other when the two rotary discs 35 and 37 are turned relatively to each other by turning the milled wheel 38. If the retaining fingers 15 were rigidly connected to the rotary discs 35 and 37 they would remain directed in the radial direction i.e. they would no longer extend parallel to each other when the rotary discs are turned relatively to each other. Thus, packaging boxes could no longer be held between the retaining fingers. To ensure the parallelism of the retaining fingers, the retaining fingers 15 are hinged on the pins 43 and the angled inner ends 46 are guided on the curved pieces 45, thus acting as stops to ensure that each retaining finger 15 always maintains a position parallel to the other associated retaining finger 15 even when the distance between them varies. 

Two pairs of retaining fingers 15 are illustrated in FIG. 6 by way of example in different positions which in practice they cannot assume simultaneously. Only one finger 15 of a third pair of retaining fingers is illustrated. 

If the tubes 6 are made from thermoplastic material instead of metal, their open, rear ends do not have to be closed before the tubes are transferred from the rotary table 1 to the conveyor 2,3 but, in accordance with a modification of the invention which is illustrated in FIGS. 7 and 8, they can be sealed by the action of pressure and heat during conveyance on the conveyor 2,3. 

Except as hereinafter described, the conveyor in the embodiment illustrated in FIGS. 7 and 8 can be of exactly the same construction as in the embodiment illustrated in FIGS. 1 to 4. However, the tongs 50 guided on the guide bars 4 have clamping jaws which are inclined towards each other in a V-shape, and the filled tubes 6 which are still open at their top ends and which are advanced on the rotary table 1 are thrust between the clamping jaws at the transfer station by the upward movement of respective receptacles 1'. Thus, the originally cylindrical ends of the tubes are pressed flat into a V-shape. The distance between the clamping jaws of the tongs 50 at their apex is such that the flatly compressed end edges 6' of the tubes 6 pass upwardly between the clamping jaws and project upwardly beyond the latter. The tongs 50 are now moved upwardly along the guide bars 4 together with the tubes 6 in the manner previously described, and the receptacles 1' on the rotary table 1 move downwards again. The rotary table 1 and the conveyor 2,3 then effect their next operating step. The top, flatly compressed end edges 6' of the tubes 6 move between the V-forms of a heating rail 52 which can be heated electrically for example and which extends in the same direction as the top traction cord 2 of the conveyor. The top end edge 6' is heated between the two arms of the heating rail 52 to a temperature adequate for welding, the heat being transferable to the end edges 6' by radiation from the heating rail 52. The heating rail 52 extends along only a certain length of the top traction cord 2. The heated end edges 6' are compressed and tightly welded to each other to form fin seals by an additional, fixed, intermittently operated pressing tool 54 which is provided downstream of the heating rail 52. The pressing tool 54 operates intermittently in synchronism with
the conveying movement of the conveyor 2,3. It can be controlled bycams (not illustrated).

To cool the welded end edges 6" , they can be allowed to run free for a certain distance downstream of the pressing tool 54 before the tubes 6 are inserted diagonally into the packaging box 25 as in the previous embodiment, or a separate cooling device 56 which operates for example with air which directs an air jet towards the welded end edges 6" can be provided downstream of the pressing tool.

1. Apparatus for packing filled tubes in individual boxes of rectangular cross section with the end closure fins of the tubes located diagonally in the box, comprising tube conveying means including means for individually gripping the filled tubes to be packed, said tube-gripping means being movable in an endless horizontal path through a packaging station; box-conveying means including means for individually gripping the boxes, said box-gripping means being movable in an endless horizontal path also through said packaging station; and stepwise driving means for driving said tube-conveying means and said box-conveying means synchronously in a stepwise manner whereby each tube-gripping means is aligned with an appropriate box-gripping means at said packaging station, said tube-gripping means comprising tongs adapted to grip the tubes by their closure fins, guides on said tube-conveying means, said tongs being vertically movable on said guides, and actuating mechanisms for the tongs such that when each tube reaches the packaging station, the respective tongs are moved on their guide to insert the tube into a corresponding box supported at the packaging station by respective box gripping means with the end fin of the tube located diagonally of the box.

2. Apparatus according to claim 1, in which said tube conveying means comprises two endless traction cord means and two guide wheels guiding each of said cord means for movement in two parallel planes located one above the other, and in which said guides for said tongs comprise a plurality of guide bars interconnecting said traction cord means.

3. Apparatus according to claim 2, which further comprises rotary table means for advancing tubes to be packed, said two guide wheels for each cord means being disposed respectively adjacent said rotary table and said packaging station.

4. Apparatus according to claim 3, in which said tube conveying means is arranged above the level of said rotary table for advancing the tubes and above the level of said box-conveying means.

5. Apparatus according to claim 1 in which said tongs actuating mechanisms include a fixed guide rail associated with the tube-conveying elements and guide elements on said tongs and cooperating with said fixed guide rail.

6. Apparatus according to claim 5, in which said guide elements at the same time serve as actuating elements for opening and closing said tongs.

7. Apparatus according to claim 5 in which said tongs comprise stop jaws vertically displaceable on said guides and gripping jaws pivoted to said stop jaws for cooperation therewith.

8. Apparatus according to claim 7, further comprising spring means operative between said gripping jaws and said stop jaws to bias the tongs towards their closed position.

9. Apparatus according to claim 7 in which said gripping jaws are rigidly connected to said guide elements for said tongs.

10. Apparatus according to claim 5 in which said guide elements comprise support bars extending from said tongs and rollers which are arranged on the distal ends of said support bars and which are supported on said fixed guide rail when the tongs are in the tube-conveying state.

11. Apparatus according to claim 5 in which said fixed guide rail extends along said tube-conveying means and has a respective opening in the region of a tube transfer station at which tubes are to be placed on said tube-conveying means and in the region of said packaging station.

12. Apparatus according to claim 11 in which said tong-actuating mechanisms include at each of said openings in the fixed guide rail an associated shifting element cooperating with said tong guide elements for displacing the tongs along said guides.

13. Apparatus according to claim 12 in which said guide elements include rollers and means journaling said rollers on said tongs, said rollers being cooperating with said fixed guide rail and in which said actuating mechanisms include a fixed guide bar, said shifting element being displaceably mounted on said guide bar and having a fork for accommodating said rollers.

14. Apparatus according to claim 13 in which said fork is in the form of a horizontal U and has a top end position, in which its bottom arm is located in the associated guide rail opening at the level of the guide rail.

15. Apparatus according to claim 14 in which said tongs comprise stop jaws vertically displaceable on said guides, bottom stop means defining bottom positions of said stop jaws, and gripping jaws pivoted to said stop jaws, said guide rollers being journalied to said gripping jaws, said fork being downwardly moveable beyond a position in which said stop jaw engages said bottom stop means whereby to open the respective tongs.

16. Apparatus according to claim 1 in which said box conveying means comprises a rotary table and uniformly distributed pairs of box-retaining fingers projecting from the periphery of said table to define individual compartments for boxes.

17. Apparatus according to claim 16, further comprising common adjusting means for simultaneously and equally adjusting the distances between the retaining fingers of the individual compartments.

18. Apparatus according to claim 17 in which said rotary table comprises a rotary body comprising at least one first rotary disc and at least one second rotary disc turnable relatively to said first rotary disc by means of said adjusting means, one retaining finger of each of said pairs of fingers being pivoted to said second rotary disc, curves on said first rotary disc and an extension on each of said fingers which extension is guided on a respective one of said curves.

19. Apparatus according to claim 18 in which said rotary table comprises two of said second rotary discs disposed on opposite sides of and spaced apart by said first rotary disc, one finger of each pair being pivoted to one of said second discs and the other finger of each pair being pivoted to the other of said second discs.

20. Apparatus according to claim 19, in which said adjusting means comprises two nuts which are carried respectively on the two rotary discs and which are coaxial with each other, and a pin having thereon an adjusting wheel and a screw threaded which respectively engage said two nuts.

21. Apparatus according to claim 18 in which said rotary table comprises a plurality of coaxial, axially spaced rotary bodies which are arranged concentrically of each other and means for adjusting the axial spacing between said rotary bodies.

22. Apparatus according to claim 1 which further comprises, for the purpose of sealing the open rear ends of filled tubes of thermoplastic material, devices for compressing and welding the ends of the tubes when on said tube-conveying means.

23. Apparatus according to claim 22, in which said tongs comprise clamping jaws which are inclined towards each other in a V-shape for receiving and compressing the open ends of the tubes, the distance between the clamping jaws at their apex being such that the flatly compressed ends of the tubes pass between the clamping jaws when inserted and project beyond the clamping jaws.

24. Apparatus according to claim 23, which further comprises heating rail means for heating the projecting end edges of the tubes and extending in the direction of conveyance of
said tubes by said tube-conveying means, and a fixed, intermit-
tently operable pressing tool disposed at the end of the heating
rail means for compressing and welding the heated end edges.

25. Apparatus according to claim 24, which further com-
prises a cooling device disposed downstream of the pressing
tool for cooling the welded end edges.

26. Apparatus according to claim 1 which includes box-
erecting means for withdrawing boxes one at a time from a
magazine of boxes in a collapsed state and for erecting the
boxes so withdrawn and placing them on the box-conveying
means.