

SPECIFICATION

Tape dryer

5 *Description:—*

The present invention relates to an apparatus for drying a continuous narrow web such as a sliding clasp fastener tape having a beaded edge.

- 10 According to the invention, there is provided an apparatus for drying a continuous narrow web having a bulged edge, comprising a frame and a pair of spaced heating drums rotatably mounted on said frame for jointly
- 15 carrying the continuous narrow web therearound and rotatable for transporting the continuous narrow web, each of said heating drums including a cylindrical body and a plurality of annular serrations extending circumferentially
- 20 around and arranged axially of said cylindrical body, each of said annular serrations including an inclined annular surface for supporting a turn of the continuous narrow web thereon, said inclined annular surface having an annu-
- 25 lar slot at its radially most inward edge for receiving a corresponding portion of the bulged edge, a pair of guides being mounted on said frame and extending parallel to said heating drum, each of said guides having a
- 30 plurality of flanged rolls each including an annular slot, each flanged roll being radially aligned with corresponding one of said annular serrations on one of said heating drums whereby, in use, the bulged edge of the web
- 35 is received in the annular slot of each flanged roll of each guide and is guided thereby into the annular slot of a corresponding one of the annular serrations of the heating drums.

The invention will now be described by way of example, with reference to the accompanying drawings, wherein:—

Figure 1 is a side elevational view of a tape drying apparatus constructed in accordance with the present invention;

45 *Figure 2* is a front elevational view of a pair of cylindrical heating drums around which a tape is wound;

Figure 3 is an enlarged fragmentary cross-sectional view of a portion of one of the

50 heating drums;

Figure 4 is an enlarged fragmentary plan view of a tape dried by the apparatus;

Figure 5 is an enlarged front elevational view of a tape end detector;

55 *Figure 6* is a fragmentary perspective view of tape end portions interconnected by staples for being fed into the apparatus; and

Figure 7 is a fragmentary perspective view of dried tape end portions interconnected by an adhesive tape for delivery to a next processing apparatus.

60 As shown in Fig. 1, a tape drying apparatus 10 according to the present invention comprises a frame 11 including two pairs of

65 vertical posts 12, 13 (only one pair shown)

and two pairs of upper and lower horizontal beams 14, 15 (only one pair shown) extending between the posts 12, 13. A pair of upper and lower heating drums 16, 17, each in the form of a hollow cylindrical body with closed ends, are rotatably supported respectively on the upper and lower beams 14, 15, and extend substantially parallel to each other in their axial direction. The heating drums 16, 17 have a pair of hollow shafts 18, 19, respectively, the shaft 18 being journaled in a pair of upper bearings 20 (only one illustrated) supported on the upper beams 14 and the shaft 19 journaled in a pair of lower bearings 21 (only one illustrated) supported on the lower beams 15. A pair of steam pipes 22, 23 are connected to the bearings 20, 21, respectively, and communicate with the shafts 18, 19 to supply steam into the drums 16, 17 for heating them.

The posts 12 support thereon a pair of brackets 24 (only one shown) between which there extend a pair of upper and lower guides 25, 26 located just below and above the upper and lower heating drums 16, 17, respectively. The guides 25, 26 extend parallel to the heating drums 16, 17 (Fig. 2). An L-shaped support arm 27 is fixed to the frame 11 at a position adjacent to the upper beams 14 and supports thereon a no-tape detector 28 comprising a sensing switch 29 having a feeler 30. A set of inlet rolls 31 and a guide roll 32 are rotatably mounted on the support arm 27, the no-tape detector 28 being disposed between the set of inlet rolls 31 and the guide roll 32. The frame 11 also supports thereon a pair of idler guide rolls 33, 34 located adjacent to the lower beams 15. A tape end detector 35, which will be described later on, is mounted on one of the upper beams 14. A bracket 36 mounted on the frame 11 adjacent to the upper beams 14 supports a discharge roll unit 37 and a tape passage 38 that is positioned between the tape end detector 35 and the discharge roll unit 37. Located downwardly of the discharge roll unit 37 is a receptacle 39 for receiving a dried tape as it is issued out of the apparatus 10.

115 The upper and lower heating drums 16, 17 are rotatable respectively by a pair of drive belts 40, 41, and the discharge roll unit 37 is rotatable by a drive belt 42 trained around an idler roll 43 rotatable by a drive belt 44.

120 The apparatus 10 is particularly useful for drying a continuous narrow web such as a sliding clasp fastener tape 45 having a bulged or beaded edge 46 (Figs. 3 and 4) around which the legs of a series of coupling element scoops (not shown) are to be clamped. After such tape 45 has been dyed, the wet tape 45 is fed into the apparatus 10 for being dried. The tape 45 is trained around the inlet rolls 31, the guide rolls 32, 33, and 34, and is fed 130 via the upper guide 25 toward the upper

heating drum 16, around which the tape 45 is wound by a turn. The tape 45 is then supplied via the lower guide 26 toward the lower heating drum 17 where another turn of the tape 45 is wound therearound. The tape 45 is transported again to the upper heating drum 16, where another turn of the tape 45 is coiled therearound. The tape 45 is thus trained alternately around the upper and lower heating drums 16, 17 until a suitable number of turns of the tape 45 are wound around each heating drum, the tape 45 crossing itself between the drums 16, 17. The tape 45 as it finally leaves the upper drum 16 is transported through the tape end detector 35 and the guide passage 38 by the discharge roll unit 37, and is discharged downwardly into the receptacle 39.

As shown in Figs. 2 and 3, the upper heating drum 16 has a first group of annular serrations 51 and a second group of annular serrations 52, the annular serrations 51, 52 extending circumferentially around and being arranged axially of the cylindrical body of the heating drum 16. The first and second groups of serrations 51, 52 are divided by a central flange 53 of the drum 16 and disposed between a pair of end flanges 54, 55 thereof. Each of the annular serrations 51, 52 is composed of an annular surface 56 for supporting a turn of the tape 45 thereon and an annular wall 57 adjacent to the annular surface 56 of each annular serration 51 is inclined radially inwardly of the heating drum 16 toward the central flange 53, and the annular surface 56 of each annular serration 52 is inclined radially inwardly toward the central flange 53. Each annular surface 56 has an annular slot 58 (Fig. 3) at its radially most inward edge adjacent to the annular wall 57 of adjacent one of the serrations 51(52). When a turn of the tape 45 is placed on the annular surface 56, a portion of the beaded edge 46 which corresponds to such turn is received snugly in the annular slot 58 for protection against any damages which would otherwise be caused to such portion of the beaded edge 46. Turns of the tape 45 can be supported stably on and around the heating drums 16 against any lateral displacement. Similarly, the lower heating drum 17 has a central flange 59 and a pair of end flanges 60, 61. A first group of annular serration 62 is disposed around the cylindrical body of the drum 17 and located between the central flange 59 and one of the end flanges 60, and a second group of annular serrations 63 is disposed around the cylindrical body of the drum 17 and located between the central flange 59 and the other end flange 61. The annular serrations 62, 63 are identical in structure and orientation to the annular serrations 51, 52 on the upper heating drum 16. The first group of annular serrations 51 on the upper heating drum 16 are vertically opposed

to the first group of annular serrations 62 on the lower drum 17, and likewise the second group of annular serrations 52 on the upper heating drum 16 are vertically opposed to the second group of annular serrations 63 on the lower heating drum 17. The number of the upper annular serrations 51(52) in each group on the heating drum 16 is greater by one than the lower annular serrations 62(63) in each group on the heating drum 17. In addition, the upper annular serrations 51, 52 in each group are out of radial alignment with the corresponding lower annular serrations 62, 63 in each group. With such an arrangement the tape 45 can be wound alternately around the upper heating drum 16 and around the lower heating drum 17 neatly and smoothly without being subjected to excessive frictional engagement between spans of the tape 45 that extend between the upper and lower heating drums 16, 17.

In Fig. 2, each of the guides 25, 26 comprises a plurality of guide rolls 64 each having a flange 65 and an annular slot 66. The guide rolls 64 of the guides 25, 26 correspond in position respectively to the annular serrations 51, 52 on the heating drum 16 and the annular serrations 62, 63 on the heating drum 17. The tape 45 rides on each of the guide rolls 64 with the beaded edge 46 received in each of the annular slots 66 so as to be smoothly guided onto the corresponding one of the annular serrations 51, 52, 62 or 63, each annular slot 66 guiding the beaded edge 46 into the annular slot 58 of a corresponding one of the annular serrations 51, 52, 62 or 63 of the heating drums 16 and 17.

During operation of the apparatus 10, the tape 45 as it is discharged is curved with the beaded edge 46 on the concave side (Fig. 4) since the tape 45 is wound on and set by the inclined annular surfaces 56 with the beaded edge 46 disposed in the annular slots 58. Such curved tape 45 is advantageous in that it will become substantially straight after the legs of coupling elements are clamped around the beaded edge 46.

The tape end detector 35 in Fig. 5 basically comprises a bracket 70 fixed to one of the beams 14 and a lever 71 pivotally mounted by a pin 72 on the bracket 70, the lever 71 being normally urged to pivot counter-clockwise by a tension spring 73. The lever 71 is angularly movable between a pair of stops 74, 75 and is normally pressed against the stop 74 under the bias of the spring 73. The bracket 70 supports thereon a sensing switch 76 having a contact pin 77 and a leaf-roller actuator 78. When the lever 71 is turned clockwise against the force from the spring 73, the leaf-roller actuator 78 is pushed by the lever 71 and depresses the contact pin 77, thereby actuating the sensing switch 76.

An upper plate 79 is pivotally mounted by a pin 80 to the lever 71 and is suspended by a tension spring 81. A lower plate 82 is pivotally mounted by a pin 83 on the lever 71 and has an abutment 84 normally held against a stop 85 on the lever 71 under the force of a compression spring 86 acting between the lower plate 82 and the stop 85. The upper and lower plates 79, 82 have a pair of opposed lands 87, 88 jointly providing a throat therebetween for the passage therethrough of the tape 45. An indicator needle 89 pivoted by a pin 90 to the lever 71 has an eccentric cam 91 against which the upper plate 79 is pressed under the bias of the spring 81. The upper plate 79 is angularly movable up and down by pivotal movement of the indicator needle 89 so that the throat can be varied to allow tapes of different thicknesses to pass therethrough. A pair of spaced pins 92, 93 are rotatably mounted on the bracket 70 for guiding the tape 45 to move through the throat between the upper and lower lands 87, 88.

Two lengths of the tape 45 are interconnected at their overlapped end portions 95, 96 by a plurality of staples 97, as shown in Fig. 6. Such overlapped tape end portions 95, 96, combined with the staples 97, have a thickness greater than that of the remainder of the tape 45. Upon arrival of the overlapped end portions 95, 96 at the detector 35 while the apparatus 19 is in motion, they are forcibly pulled into the throat, depressing the lower plate 82, as the lever 71 is caused to pivot clockwise (Fig. 5) about the pin against the force of the spring 73 due to frictional engagement of the overlapped end portions 95, 96 with the upper and lower lands 87, 88. The lever 71 as it angularly moves causes the leaf-roller actuator 78 to push the contact pin 77, whereupon the switch 76 is energized to stop operation of the apparatus 10. The lever 71 then is held against the stop 75 and, as the overlapped tape end portions 95, 96 move past the detector 35 due to inertia, the lever 71 is returned until it abuts against the pin 74.

When the apparatus 10 becomes inoperative, the overlapped end portions 95, 96 of the tape 45 are manually separated by removing the staples 97, and the tape end portions 95, 96 are butt-spliced by an adhesive tape 98 bonded around and over the end portions 95, 96 for facilitating successive tape processing steps.

During operation of the apparatus 10, the tape 45 as it travels from the rolls 31 to the roll 32 is kept under tension, thereby maintaining the feeler 30 in its upper position to hold the switch 29 to remain de-energized. As the end of the tape 45 leaves its bobbin (not shown), a portion of the tape 45 which spans between the rolls 31 and the roll 32 becomes slackened, allowing the feeler 30 to move

down, whereby the switch 29 is actuated to stop the operation of the apparatus 10. Then, another length of the tape 45 is stapled to the tape end before the apparatus 10 is operated again.

CLAIMS

1. An apparatus for drying a continuous narrow web having a bulged edge, comprising a frame and a pair of spaced heating drums rotatably mounted on said frame for jointly carrying the continuous narrow web therearound and rotatable for transporting the continuous narrow web, each of said heating drums including a cylindrical body and a plurality of annular serrations extending circumferentially around and arranged axially of said cylindrical body, each of said annular serrations including an inclined annular surface for supporting a turn of the continuous narrow web thereon, said inclined annular surface having an annular slot at its radially most inward edge for receiving a corresponding portion of the bulged edge, a pair of guides being mounted on said frame and extending parallel to said heating drums, each of said guides having a plurality of flanged rolls each including an annular slot, each flanged roll being radially aligned with corresponding one of said annular serrations on one of said heating drums whereby, in use, the bulged edge of the web is received in the annular slot of each flanged roll of each guide and is guided thereby into the annular slot of a corresponding one of the annular serrations of the heating drums.

2. An apparatus according to claim 1, said heating drums extending substantially parallel to each other in their axial direction, the annular serrations on one of said heating drums being out of radial alignment with the corresponding annular serrations on the other heating drum.

3. An apparatus according to claim 1 or 2, including means on said frame for sensing a thickened portion of the continuous narrow web to stop the rotation of said heating drums.

4. An apparatus according to claim 3, said sensing means including a lever pivotally mounted on said frame, a pair of plates pivotally mounted on said lever and spaced from each other to provide therebetween a throat through which the continuous narrow web is transportable, and switch means actuatable to stop the rotation of said heating drums in response to engagement of the thickened portion of the continuous narrow web with said plates.

5. An apparatus according to claim 4, said sensing means including means for positionally adjusting one of said plates so as to vary said throat.

6. An apparatus substantially as herein described with reference to and as illustrated in Figs. 1, 2, 3 and 5 of the accompanying

An upper plate 79 is pivotally mounted by a pin 80 to the lever 71 and is suspended by a tension spring 81. A lower plate 82 is pivotally mounted by a pin 83 on the lever 71 and has an abutment 84 normally held against a stop 85 on the lever 71 under the force of a compression spring 86 acting between the lower plate 82 and the stop 85. The upper and lower plates 79, 82 have a pair of opposed lands 87, 88 jointly providing a throat therebetween for the passage therethrough of the tape 45. An indicator needle 89 pivoted by a pin 90 to the lever 71 has an eccentric cam 91 against which the upper plate 79 is pressed under the bias of the spring 81. The upper plate 79 is angularly movable up and down by pivotal movement of the indicator needle 89 so that the throat can be varied to allow tapes of different thicknesses to pass therethrough. A pair of spaced pins 92, 93 are rotatably mounted on the bracket 70 for guiding the tape 45 to move through the throat between the upper and lower lands 87, 88.

Two lengths of the tape 45 are interconnected at their overlapped end portions 95, 96 by a plurality of staples 97, as shown in Fig. 6. Such overlapped tape end portions 95, 96, combined with the staples 97, have a thickness greater than that of the remainder of the tape 45. Upon arrival of the overlapped end portions 95, 96 at the detector 35 while the apparatus 19 is in motion, they are forcibly pulled into the throat, depressing the lower plate 82, as the lever 71 is caused to pivot clockwise (Fig. 5) about the pin against the force of the spring 73 due to frictional engagement of the overlapped end portions 95, 96 with the upper and lower lands 87, 88. The lever 71 as it angularly moves causes the leaf-roller actuator 78 to push the contact pin 77, whereupon the switch 76 is energized to stop operation of the apparatus 10. The lever 71 then is held against the stop 75 and, as the overlapped tape end portions 95, 96 move past the detector 35 due to inertia, the lever 71 is returned until it abuts against the pin 74.

When the apparatus 10 becomes inoperative, the overlapped end portions 95, 96 of the tape 45 are manually separated by removing the staples 97, and the tape end portions 95, 96 are butt-spliced by an adhesive tape 98 bonded around and over the end portions 95, 96 for facilitating successive tape processing steps.

During operation of the apparatus 10, the tape 45 as it travels from the rolls 31 to the roll 32 is kept under tension, thereby maintaining the feeler 30 in its upper position to hold the switch 29 to remain de-energized. As the end of the tape 45 leaves its bobbin (not shown), a portion of the tape 45 which spans between the rolls 31 and the roll 32 becomes slackened, allowing the feeler 30 to move

down, whereby the switch 29 is actuated to stop the operation of the apparatus 10. Then, another length of the tape 45 is stapled to the tape end before the apparatus 10 is operated again.

CLAIMS

1. An apparatus for drying a continuous narrow web having a bulged edge, comprising a frame and a pair of spaced heating drums rotatably mounted on said frame for jointly carrying the continuous narrow web therearound and rotatable for transporting the continuous narrow web, each of said heating drums including a cylindrical body and a plurality of annular serrations extending circumferentially around and arranged axially of said cylindrical body, each of said annular serrations including an inclined annular surface for supporting a turn of the continuous narrow web thereon, said inclined annular surface having an annular slot at its radially most inward edge for receiving a corresponding portion of the bulged edge, a pair of guides being mounted on said frame and extending parallel to said heating drums, each of said guides having a plurality of flanged rolls each including an annular slot, each flanged roll being radially aligned with corresponding one of said annular serrations on one of said heating drums whereby, in use, the bulged edge of the web is received in the annular slot of each flanged roll of each guide and is guided thereby into the annular slot of a corresponding one of the annular serrations of the heating drums.

2. An apparatus according to claim 1, said heating drums extending substantially parallel to each other in their axial direction, the annular serrations on one of said heating drums being out of radial alignment with the corresponding annular serrations on the other heating drum.

3. An apparatus according to claim 1 or 2, including means on said frame for sensing a thickened portion of the continuous narrow web to stop the rotation of said heating drums.

4. An apparatus according to claim 3, said sensing means including a lever pivotally mounted on said frame, a pair of plates pivotally mounted on said lever and spaced from each other to provide therebetween a throat through which the continuous narrow web is transportable, and switch means actuatable to stop the rotation of said heating drums in response to engagement of the thickened portion of the continuous narrow web with said plates.

5. An apparatus according to claim 4, said sensing means including means for positionally adjusting one of said plates so as to vary said throat.

6. An apparatus substantially as herein described with reference to and as illustrated in Figs. 1, 2, 3 and 5 of the accompanying



drawings.

7. A heating drum substantially as herein described with reference to and as illustrated in Figs. 2 and 3 of the accompanying drawings.

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Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1982.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.