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(54) MACHINES FOR APPLYING CARRIER STOCK TO CONTAINERS

(71) We, ILLINOIS TOOL WORKS INC., a corporation organized under the laws of the State of Delaware, United States of America, of 8501 West Higgins Road, Chicago, Illinois 60631, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an improvement in known container and carrier assembling machines of the type shown in our British Patents Nos. 974,619 and 998,736. These machines are for applying, to a succession of pairs of containers, a carrier stock made of a resilient plastics material and comprising a longitudinally extending series of pairs of stretchable bands, each pair being transverse to the stock, and each band being a closed loop defining an aperture for receiving a respective container, e.g. a can. Drum assemblies of the prior art machines are of limited versatility because they include jaw stations which receive, stretch and apply the carrier stock to a continuous series of cans, and these stations have a limited movement and limited adjustability in their opening and closing operations. That limited movement requires that certain types of carrier stock be used with the machine for efficient application. The present invention introduces a basic improvement over the prior art machines in the substantially increased range and character of jaw operation.

The primary object of the present invention is to provide a drum construction and arrangement for a rotary carrier applying machine which will permit carriers of closer container aperture spacing to be applied serially to containers such as cans to produce more compact container-carrier packages than heretofore deemed practically possible.

According to the present invention a

machine for applying, to a succession of pairs of containers, a carrier stock made of a resilient plastics material and comprising a longitudinally extending series of transverse pairs of stretchable closed-loop bands, includes: a conveyor system for directing the pairs of containers; a rotating drum assembly for receiving the carrier stock and stretching and applying the carrier stock to the containers, the drum assembly comprising a pair of wheels mounted in a parallel spaced apart relationship for rotation about a horizontal axis above the succession of pairs of containers, and a plurality of jaw stations mounted in a series around the peripheries of the wheels, with the longitudinal axes of the jaw stations arranged parallel to the axis of rotation of the wheels, each of these jaw stations comprising two pairs of jaws arranged along the longitudinal axis of that station and with one pair on each side of a central plane midway between the wheels, each jaw being capable of independent rectilinear movement along the longitudinal axis of the station; and cam means arranged to move each jaw longitudinally in response to rotation of the wheels, the two jaws further from the central plane undergoing greater movement than the two jaws nearer to the central plane, as the wheels turn from the rotary position at which the jaws receive a pair of bands to the rotary position immediately before that pair of bands is applied to a respective pair of the containers.

An unexpected advantage of this invention is that, because of the individual jaw movements, a differential action is produced in the jaw operations to produce differential stretching of different portions of the carrier bands to produce different packaging effects. That advantage may be the result of initial closed jaw positions and the relative timing and speed of opening of the jaws from the initial closed positions.

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The accompanying drawings show one example of a machine embodying this invention. In these drawings:—

Figure 1 is a fragmentary side elevation of the machine;

Figure 2 is a plan view of the machine;

Figure 3 is a fragmentary end elevation of the drum assembly of the machine;

Figure 4 is a side elevation of one of the jaw stations of the drum assembly;

Figure 5 is an inverted plan view of the jaw station; and

Figure 6 is a cross section on the line 6—6 in Figure 4.

A complete machine of the general type in question is shown and described in the aforementioned British Patent No. 998,736. The complete machine need not be described herein, and reference is made to that Patent for general details of the machine which are not described herein.

Figures 1 and 2 show the general organization of the machine. Containers 10 are supplied to the machine from a container filling station upstream of the machine. The containers enter the machine at 11 in two side-by-side rows. After being properly aligned and positioned, the containers 10 are directed by an appropriate conveyor system to pass in a succession of pairs beneath the drum assembly 12. The drum assembly applies carrier stock to the upper ends of the containers 10. At the output side of the machine appropriate means (not shown) are provided for severing the applied carrier stock between selected cans to produce the container-carrier packages at 13.

The carrier stock 16 is supplied to the machine from a reel 14, which is supported in a reel stand 15. Suitable carrier stock 16, which has been found to be easily applied by the machine, is shown in our co-pending British Patent Applications Nos. 9440/74 and 9517/75 (Serial Nos. 1,458,276 and 1,458,277).

From the stock reel 14, the carrier stock 16 is directed over and about a series of rollers to the drum assembly 12. Such rollers are generally shown in Figures 1 and 2 at 17, 18 and 19.

Upon reaching the drum assembly 12, the carrier stock 16 is directed through an appropriate guide system, a portion of which is shown at 20 in Figure 3. The carrier stock 16 is then received onto jaw stations of the drum assembly 12 and carried round with the assembly as it is rotated. As viewed in Figure 1, the drum assembly 12 is rotated in a counter-clockwise direction. As viewed in Figure 3, the upper end of the drum assembly 12 is being moved out of the drawing while the lower end is being moved into the drawing. In other words, the view in Figure 3 of the drum assembly 12 is from the input side of the machine and is a view

such as taken along the line 3—3 of Figure 1.

In passing through the guide system 20, those portions of each band of the carrier stock 16 which lie nearest the centre line and nearest the edges of the stock are folded to lie in planes generally perpendicular to the axis of rotation of the drum assembly 12. Contemporaneously with the folding operation, the guide system 20 directs each successive pair of the bands of the carrier stock 16 onto the jaws of a respective jaw station of the drum assembly 12. At the position of application of the carrier stock 16 to the jaws, the jaws are in what may be called their "closed" positions. As the drum assembly 12 is further rotated, the jaws are differentially moved and thereby spread, stretch and position the bands for application to respective pairs of the containers 10 in the area beneath the drum assembly 12.

In Figure 3, most of the jaw stations, which are indicated at 22, have been removed to clearly show the detailed construction of the drum assembly 12. The drum assembly 12 is rotatively carried between frame members 23 fixed in the machine. The drum shaft 24 is rotatively carried between the frame members 23 and appropriate means (not shown) are provided for rotating the shaft 24 in timed relation to the movement of the containers 10 beneath the drum assembly 12. At spaced apart positions on the shaft 24, a pair of wheels 25 are provided. The wheels 25 are fixed to rotate with the shaft 24. The wheels 25 have a series of tapped holes 26 about the peripheries thereof. The jaw stations 22 are mounted in a series around the peripheries of the wheels 25, with the longitudinal axes of the jaw stations 22 aligned substantially parallel to the axis of rotation of the shaft 24, by means of screws 27 (Figure 4) which enter the tapped holes 26.

As shown in Figures 4, 5 and 6, each jaw station 22 comprises a mounting plate 28 through which the screws 27 are carried in a longitudinally spaced apart relationship. On each end of the mounting plate 28, a support member 30 is mounted by screws 31. The support members 30 are positioned perpendicular to the mounting plate 28 and each one has six holes therethrough. The six holes in each support member 30 carry six rods. Two of the rods 32 are secured between the support members 30 in a spaced apart relationship parallel to the mounting plate 28. The rods 32, in cooperation with the mounting plate 28 and the support members 30, provide a secure supporting arrangement for the jaws 33, 34, 35 and 36. In the following description, the jaw station will be described as in the attitude shown in Figures 4 and 6.

Each of the jaws 33 to 36 has six holes

therethrough at the same spacing as the holes through the support members 30. The upper side of each of the jaws 33 to 36 is formed with a channel for sliding cooperation with the mounting plate 28, as may be seen in Figure 6. The lower sides of the jaws 33 to 36 carry curved teeth 33a to 36a. The teeth 33a to 36a receive and hold the folded carrier stock 16 thereabout as may be seen in Figure 3. The space between teeth 33a and 34a and the space between teeth 35a and 36a are each sufficient to encircle a container 10 when the jaws 33 to 36 are in their "open" positions. The rods 32 extend through the jaws 33 to 36 so that the jaws 33 to 36 can slide on the rods 32.

Two operating rods are provided for each of the jaws 33 to 36. A pair of rods 38 slide through one of the support members 30. The rods 38 extend through two of the holes in the jaw 33 and are secured to the jaw 33. The other ends of the rods 38 slide through a cam follower assembly 41 and are secured to a cam follower assembly 39. A second pair of rods 40 slide through the same support member 30 as the rods 38. One end of each of the rods 40 extends into and is secured to the jaw 34. The other end of each of the rods 40 is secured to the cam follower assembly 41. The rod arrangement for the other two jaws 35 and 36 is similar to that described for jaws 33 and 34. A pair of rods 42 slide through the other support member 30, with one end of each of the rods 42 secured to the jaw 35 and with the other end of each rod 42 secured to a cam follower assembly 43. A pair of rods 44 also slide through the same support member 30 as the rods 42, and one end of each rod 44 is secured to the jaw 36. The other ends of the rods 44 slide through the cam follower assembly 43, and are secured to a cam follower assembly 45.

From the foregoing it may be seen that when the cam follower assemblies 41 and 43 are moved towards the longitudinal centre of the jaw station 22 (which lies in a central plane midway between the two wheels 25), the jaws 34 and 35 will be moved towards each other. When the cam followers 41 and 43 are moved apart, the jaws 34 and 35 will be moved apart. It may be seen that in a similar manner the jaws 33 and 36 will respectively follow the longitudinal reciprocating movements of the cam followers 39 and 45. Each of the cam follower assemblies 39, 41, 43 and 45 is similarly constructed and includes a roller, and a grease fitting for the roller bearings. The rollers for the cam follower assemblies 39, 41, 43 and 45 are respectively shown at 49, 50, 51 and 52.

Each jaw station 22 further includes what may be called a tucker assembly 54. The tucker assembly 54 comprises an angled member 55 having one leg thereof secured to

the radially inner side of the mounting plate 28 by screws 56 as may be seen in Figures 4 and 6. The other leg of the angled member 55 is bifurcated and extends radially outwards along one side of the jaws 33 to 36 as may be seen in Figure 5. The ends of the leg of the angled member 55 positioned at the side of the jaws 33 to 36 serve to aid in the removal of the carrier stock 16 from the jaws 33 to 36 after application of the carrier stock 16 to the containers 10. The tucker assembly 54 further includes a plate 57 which is positioned perpendicular to the longitudinal axis of the jaw station 22 and midway between the jaws 34 and 35. The plate 57 serves to cooperate with the guide assembly 20 partially shown in Figure 3, to aid in the proper folding of the longitudinal centre portion of the carrier stock 16 upon the application of the carrier stock to the jaws 33 to 36.

The positions and movement of the jaws 33 to 36 are controlled by four cam members 60, 61, 62 and 63 as shown in Figure 3. The cam members 60 to 63 are substantially annular in shape, concentric with the axis of rotation of the wheels 25, and may each be conveniently formed as semi-circular sections which are bolted together and fixed in the machine. Each cam member 60 to 63 has a radially inwardly extending flange, such as the flanges 62a and 63a respectively shown for cam members 62 and 63. A cam supporting member 65 is mounted on each of the frame members 23, as may be seen in Figure 3, and the cam members 62 and 63 are mounted in a side-by-side relationship with the flanges 62a and 63a thereof on each side of the member 65. A plurality of bolts 66 are secured through the flanges 62a and 63a and member 65 at a suitable number of positions to securely fixedly mount the cam members 62 and 63. Alternatively, the flanges 62a and 63a may be separately secured to the member 65, with shims to provide axial adjustment of the cam members 62 and 63. The cam members 60 and 61 are mounted to the frame member 23 in a similar manner. Each of the cam members 60 to 63 is formed with a cam groove respectively indicated at 60b to 63b. The cam follower assembly 39 of each jaw station is positioned to have the cam roller 49 thereof within the cam groove 60b. The cam roller 50 of each cam follower assembly 41 is positioned within the cam groove 61b. The cam roller 51 of each cam follower assembly 43 is positioned within the cam groove 62b, and the cam roller 52 of each cam follower assembly 45 is positioned within the cam groove 63b.

The cam grooves 60b to 63b are so arranged that each pair of jaws 33, 34 and 35, 36 is closed when the respective jaw station 22 is at the position wherein the jaws enter

the guide assembly 20. In other words, the jaws 34 and 35 are at their maximum spaced positions from the longitudinal centre of the jaw station 22, and the jaws 33 and 36 are positioned at their closest position to the longitudinal centre of the jaw station 22 when the jaws enter the guide system. From that position, which is on the backside of the drum assembly as shown in Figure 3, the cam grooves 60b to 63b cause a period of dwell in which no jaw movement occurs relative to the drum assembly while the guide system folds and applies the carrier stock 16 to the jaws 33 to 36. Before the rotating drum carries the carrier stock out of the guide system, the cam grooves 60b and 63b begin to move the jaws 33 and 36 outwardly against the folded carrier stock 16. At about the top of the drum, the cam grooves 61b and 62b are directed to begin to move the jaws 34 and 35 towards the centre of the jaw station, against the carrier stock 16. Starting from the top of drum, the cam grooves 60b to 63b are shaped substantially as shown in Figure 3, with the cam grooves 60b and 63b having a substantially "higher rise" than the cam grooves 61b and 62b. The resulting action on the carrier stock 16 is a compound action. Due to the band interconnections in the carrier stock 16, the initial positions of those bands and the jaws 33 to 36, and the different movement between the jaws 34, 35 nearer the centre and the jaws 33, 36 further from the centre, the band portions engaged by the outside jaws 33 and 36 are stretched more than the band portions engaged by the inside jaws 34 and 35. Further, the final jaw positions, with the bands of the carrier stock 16 fully stretched, position the bands of each pair close together for application to each pair of containers 10 close together beneath the drum.

The cam grooves 60b to 63b include a dwell period immediately before the jaws reach the bottom of the drum for application of the carrier stock 16 to the containers 10.

After application of the carrier stock 16 to the containers 10, the cam grooves are directed, on the backside of the drum assembly as shown in Figure 3, to again close the jaws to again receive the carrier stock 16.

WHAT WE CLAIM IS:—

1. A machine for applying, to a succession of pairs of containers, a carrier stock made of a resilient plastics material and comprising a longitudinally extending series of transverse pairs of stretchable closed-loop bands, the machine including: a conveyor system for directing the pairs of containers; a rotating drum assembly for receiving the carrier stock and stretching and applying the carrier

stock to the containers, the drum assembly comprising a pair of wheels mounted in a parallel spaced apart relationship for rotation about a horizontal axis above the succession of pairs of containers, and a plurality of jaw stations mounted in a series around the peripheries of the wheels, with the longitudinal axes of the jaw stations arranged parallel to the axis of rotation of the wheels, each of these jaw stations comprising two pairs of jaws arranged along the longitudinal axis of that station and with one pair on each side of a central plane midway between the wheels, each jaw being capable of independent rectilinear movement along the longitudinal axis of the station; and cam means arranged to move each jaw longitudinally in response to rotation of the wheels, the two jaws further from the central plane undergoing greater movement than the two jaws nearer to the central plane, as the wheels turn from the rotary position at which the jaws receive a pair of bands to the rotary position immediately before that pair of bands is applied to a respective pair of the containers.

2. A machine as defined in Claim 1, wherein each of the jaw stations comprises a base plate mounted on the peripheries of the wheels, a respective support member secured to each end of the base plate to upstand therefrom in a direction radially outwards from the axis of rotation of the wheels, and a pair of rods secured between the support members, each of the jaws having a pair of holes making a sliding fit on the pair of rods.

3. A machine as defined in Claim 2, wherein each of the jaw stations further comprises an independent pair of operating rods connected to each jaw, these operating rods for the jaws on one side of the central plane sliding through the support member on that side and these operating rods for the jaws on the other side of the central plane sliding through the other support member, and the cam means acts upon the outer ends of the operating rods.

4. A machine as defined in Claim 3, wherein the cam means comprises a respective cam follower assembly for each pair of operating rods of each jaw station, and four annular cam members fixedly mounted in the machine concentrically about the axis of rotation of the wheels, and each of these cam follower assemblies at each jaw station cooperates with a respective one of the cam members.

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the guide assembly 20. In other words, the jaws 34 and 35 are at their maximum spaced positions from the longitudinal centre of the jaw station 22, and the jaws 33 and 36 are positioned at their closest position to the longitudinal centre of the jaw station 22 when the jaws enter the guide system. From that position, which is on the backside of the drum assembly as shown in Figure 3, the cam grooves 60b to 63b cause a period of dwell in which no jaw movement occurs relative to the drum assembly while the guide system folds and applies the carrier stock 16 to the jaws 33 to 36. Before the rotating drum carries the carrier stock out of the guide system, the cam grooves 60b and 63b begin to move the jaws 33 and 36 outwardly against the folded carrier stock 16. At about the top of the drum, the cam grooves 61b and 62b are directed to begin to move the jaws 34 and 35 towards the centre of the jaw station, against the carrier stock 16. Starting from the top of drum, the cam grooves 60b to 63b are shaped substantially as shown in Figure 3, with the cam grooves 60b and 63b having a substantially "higher rise" than the cam grooves 61b and 62b. The resulting action on the carrier stock 16 is a compound action. Due to the band interconnections in the carrier stock 16, the initial positions of those bands and the jaws 33 to 36, and the different movement between the jaws 34, 35 nearer the centre and the jaws 33, 36 further from the centre, the band portions engaged by the outside jaws 33 and 36 are stretched more than the band portions engaged by the inside jaws 34 and 35. Further, the final jaw positions, with the bands of the carrier stock 16 fully stretched, position the bands of each pair close together for application to each pair of containers 10 close together beneath the drum.

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