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IMPROVEMENTS IN CARDBOARD BOX ASSEMBLY MACHINES

The present invention relates to improvements in cardboard box assembly machines.

Cardboard box assembly machines comprise an adjustable feed mechanism, to feed cardboard sheets from which boxes are formed, and a lifting device which lifts the laps of the cardboard sheets to form boxes.

In known cardboard box assembly machines there is a cardboard sheet feeding mechanism that comprises a series of vacuum suction elements (suction pads) which by means of up and down movement, supply the assembly machine with cardboard sheets.

The suction pads of these mechanisms are in a fixed position. To modify their position, in order to change the format or dimensions of the cardboard sheets, it is necessary to stop the machine, so that the operator can have access to the mechanism and make the necessary corrections and adjustment to the operation of the suction pads by hand.

Although this operation is known to be simple, it takes up a long time, especially in cases in which there are many suction pads.

Also, a series of mechanical tests, which involve stopping the machine, are necessary to effect the exact adjustment and positioning of the suction pads.

The known method of lifting the laps of the cardboard sheets uses tongues situated along the passage of the cardboard sheets in the feed path to the machine. These tongues are inclined, in accordance with the type of box to be assembled. In other words, the laps are lifted and subjected to the action of the assembly mold directly.

Certain difficulties regarding the operation of the gluing machines arise from this, due to the fact that the laps do not have a constant angular position.

It is an object of the present invention to provide improved cardboard box assembly machines which do not have the abovementioned problems.

According to the present invention there is provided a cardboard box assembly machine for assembling cardboard boxes from cardboard sheets having laps, the machine

comprising: means for feeding the cardboard sheets, said means including at least two groups of suction pads; means for adjusting the distance between the groups of suction pads; and means for lifting the laps of the sheets; the means for adjusting the distance between the groups of suction pads including: a pair of threaded, parallel spindles and means for rotating the said spindles simultaneously, the groups of suction pads each being mounted on the pair of spindles and each spindle having sections of opposite thread on which a respective group of pads is mounted, whereby the distance between the groups of suction pads is changed by rotating the spindles simultaneously; a striated shaft parallel with the two spindles and connected to a first one of said spindles by means of a first connecting means connected to said shaft and to the first spindle such that when said first spindle is rotated, the first connecting means is moved along the first spindle and along the striated shaft; at least one arm slidably connected to the shaft such that it can move along the shaft, and fixed to said first connecting means such that when the spindles are rotated, the first connecting means moves along the first spindle and along the shaft and as the striated shaft is rotated, said arm is caused to tilt simultaneously; said arm being connected to a mechanism which supports one of the groups of suction pads such that when said arm tilts,

the group of suction pads is moved in a generally vertical direction.

The cardboard box assembly machine allows the adjustment of its parts, operated by vacuum, which feed the cardboard sheets. Adjustment of the feed mechanism, to enable feeding of cardboard sheets of different dimensions, is possible even when the machine is fully operational.

More particularly, each suction pad is located on a support connected with a corresponding vertical guide, along which it moves. The vertical guide is operated by a connecting rod and lever, that gives it alternating up and down movement, to effect the unitary conveyance of a cardboard sheet which is removed from the base of a pile of sheets. The adjustment system comprises a pair of parallel spindles, connected together by chain transmission, each one of which comprises two identical sections of contrary thread. Each section of each spindle has mounted on it a sliding element that constitutes a support means for the raising and lowering mechanisms of the groups of vacuum suction pads. The two spindles are stably mounted by fixed supports on the body of the adjuster mechanism.

Parallel with one of the spindles there is a striated

shaft, whose ends rest on bearings fixed to the body. A nut which is moveable by turning the spindle is mounted on the spindle and has a radial extension by which it is connected with a hose mounted on the striated shaft and to which it transmits the displaceable movement. This hose receives, in one of its ends, the head of a lever that turns partially at pulses of a conventional alternating mechanism. This alternating mechanism acts on the striated shaft and transmits up and down movement to the suction pad groups.

Parallel with the other spindle, there are upper and lower bars, upon which there is a sliding piece which slides by means of rotation of the spindle, guided by the bars. Each one of the sliding parts is solidly connected to one of the vertical supports, with slipper and vertical linear guide of a vacuum suction pad group, for which purpose, each vertical support is connected with the sliding piece mounted in each contrary thread area of the spindle, permitting the vertical displacement of each support, in combination with the displacement of each one of the two levers, connected with the first spindle, which transmit the up and down movement to each vacuum suction pad group.

A wheel or handle is coupled to the end of one of the spindles by means of a hose, and rotation of the

spindles is produced by turning the wheel or handle by hand.

In accordance with what is described it can be seen that the approximation or separation of the vacuum suction pads group can be done even when the assembly machine is in motion, since the mechanisms which operate it move independent of the adjustment displacement. This adjustment allows coupling of the suction pad groups to different box formats.

In this embodiment the lap lifting device comprises a strip, tiltable by the action of two pneumatic cylinders. The cylinders act on a shaft, to which the arms of the strip are joined, and push the laps until they are perpendicular (90°) to the cardboard sheet from which they emerge.

The strip serves as a guide for the laps during the longitudinal movement of the cardboard sheet toward the gluing.

The lifting device has adjustment means to approach or

separate the device, depending on the format and dimensions of the laps.

Further features and advantages of the invention will become apparent from the following description and accompanying claims.

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

Fig. 1 is a raised longitudinal view of an adjustable mechanism for feeding cardboard sheets;

Fig. 2 is the mechanism of Fig. 1 in a plan view;

Fig. 3 shows a section of the cited mechanism along the line A-A' of Fig. 1;

Fig. 4 is a detail of the cited mechanism, on a larger scale, according to a section along the line B-B', of Fig. 2;

Fig. 5 shows schematically the longitudinally raised view of the cardboard box assembly machine. The sheet feed mechanism, according to the invention, is shown within a circle (seen from the side) in coincidence with Fig. 3;

Fig. 6 and 7 represent other assembly machines, with schematic side views, where the conventional vacuum suction pad system has incorporated the feed mechanism of the invention, seen in the same way as Fig. 5, in a side view within a circle for easy placement thereof;

Figure 8 is a side view of a lap lifting device, in use according to a section along line A-B of figure 9;

Figure 9 is a front raised view of a lap lifting device;

Figure 10 is a section along the line C-D of figure 9, showing the adjustment system which makes it possible to approximate or separate the lifting device according to the format or dimensions of the laps; and

Figure 11 is a front raised view of the box assembly machine of figure 6 showing, enclosed in a circle, the location of a lap lifting device, according to the invention.

The drawings show embodiments of the present invention.

The adjustable feed mechanism for feeding cardboard sheets comprises two groups of suction pads (1), with the mechanical operation elements of each group resting

on supports (2) and coupled upon the twin sections of contrary thread, of two parallel spindles (3) and (4). The spindles (3) and (4) are connected together by a chain transmission (5) and pinions (6) and (7), mounted on said spindles, which rest on the chassis (8) of the device. Both spindles rotate in the same direction driven by a wheel or handle placed in a coupling (9) provided in spindle (3). The rotation of the spindles, in one direction or the other determines the linear displacement of the elements that connect them with the support and drive means of the vacuum suction pad groups (1).

The operating means consist of an eccentric rod (10) that drives an eccentric articulated rod (11) and gives oscillating rotation movement to a striated rod (12) resting on supports (13) with bearings upon whose striated rod a striated bucket (14) is mounted and which rotates with the rod (12) and has coupled the end of an oscillation connected rod-lever (15) connected by a connecting rod (16) with the arm (17) support of the rods, to whose bar it is connected by means of a slipper (18), that moves along a linear vertical guide (19) resting on the support (20).

This vertical guide support is solidly connected to a piece (21) mounted on the bottom spindle and resting on

the parallel guide bars (22) and (23).

The striated buckets (14) turn with the bar (12) and are connected with the top spindle (3) by means of a binding nut (24).

The linear approach or separation displacement of the suction pad groups (1) and (2) is done by rotation of the top spindle (3) and simultaneously, due to the chain transmission (5) and pinions (6) and (7) by the bottom spindle (4), the first one guided by the striated bar (12) and the second one by the parallel bars (22) and (23).

It can be seen from the drawings that the adjustable cardboard sheet feed mechanism can adjust the approach or separation of the vacuum suction pad groups, irrespective of the oscillation movement produced, given that the transmission of this movement is done upon a fixed point of the striated shaft, and therefore, without interfering in the operation of the feeding of the cardboard sheets. The operation for adjustment of the separation or approach of the suction pad groups is therefore simplified since it is only necessary to adapt to the coupling (9) a handle or wheel which can be used to make the spindles (3) and (4) turn.

Now going on to the lap lifting device which is shown in figures 8, 9 and 10 of the drawings. The lap lifting device comprises pneumatic cylinders (25) articulated and resting on the support (26) having a ram connected by a connecting rod (27), and corresponding rotational axes (28) with arms (30) that have an angular shape and sustain the strip (31) destined to lift the laps (S) of the box.

The support (26) is mounted on a longitudinal bracket (29) to which some nuts (34) are joined. The nuts (34) are threaded to the spindles (35), and a wheel or handle can be adapted to one end of a spindle (35) for operation thereof. The rotation of these spindles is done simultaneously by a chain transmission, upon the pinions (33).

The support (26) has a vertical bottom extension (36) on which the rotation axis (28) of the arms (30) of the strip (31) rest.

CLAIMS

1. A cardboard box assembly machine for assembling cardboard boxes from cardboard sheets having laps, the machine comprising: means for feeding the cardboard sheets, said means including at least two groups of suction pads; means for adjusting the distance between the groups of suction pads; and means for lifting the laps of the sheets; the means for adjusting the distance between the groups of suction pads including: a pair of threaded, parallel spindles and means for rotating the said spindles simultaneously, the groups of suction pads each being mounted on the pair of spindles and each spindle having sections of opposite thread on which a respective group of pads is mounted, whereby the distance between the groups of suction pads is changed by rotating the spindles simultaneously; a striated shaft parallel with the two spindles and connected to a first one of said spindles by means of a first connecting means connected to said shaft and to the first spindle such that when said first spindle is rotated, the first connecting means is moved along the first spindle and along the striated shaft; at least one arm slidably connected to the shaft such that it can move along the shaft, and fixed to said first connecting means such that when the spindles are rotated, the first connecting means moves along the first spindle and along



the shaft and as the striated shaft is rotated, said arm is caused to tilt simultaneously; said arm being connected to a mechanism which supports one of the groups of suction pads such that when said arm tilts, the group of suction pads is moved in a generally vertical direction.

2. A machine as claimed in claim 1, further comprising a chassis, said striated shaft being supported by bearings mounted to said chassis, said first spindle being connected to said striated shaft by a nut mounted on the first spindle and a bucket mounted on the striated shaft, said bucket being connected to said arm.

3. A machine as claimed in claim 1 or 2, further comprising two bars and two support pieces, said two bars being mounted parallel to the second of said spindles, said two support pieces being slidably engaged to said bars and connected to a second of said spindles such that rotation of the second spindle causes said support pieces to travel on said bars, each of said support pieces being connected to a slipper and a vertical linear guide for supporting at least one of said suction pads for vertical movement.

4. A machine as claimed in claim 1, 2 or 3, further



comprising a lap lifting device, said lap lifting device comprising: a support; two vertical pneumatic cylinders with pistons mounted on said support; a shaft connected to said pistons such that actuation of said cylinders and pistons causes rotation of said shaft; two angled arms having proximal and distal ends, said arms each mounted on said shaft at its proximal end; a strip mounted on said angled arms at said distal ends, such that when said shaft is rotated, said angled arms will rotate and move said strip to a first position in which said strip contacts one of the flaps of one of the sheets and pushes said flap to a position substantially perpendicular to said sheet; and further comprising means for adjusting the positioning of said strip with respect to said sheet, said strip adjusting means having a bracket connected to said support and a nut mounted on a third threaded spindle such that when said third spindle is rotated, said bracket and said support will move in relation to said sheets.

5. A cardboard box assembly machine substantially as hereinbefore described with reference to, and as illustrated in, figures 1-5, 6 or 7 of the accompanying drawings .