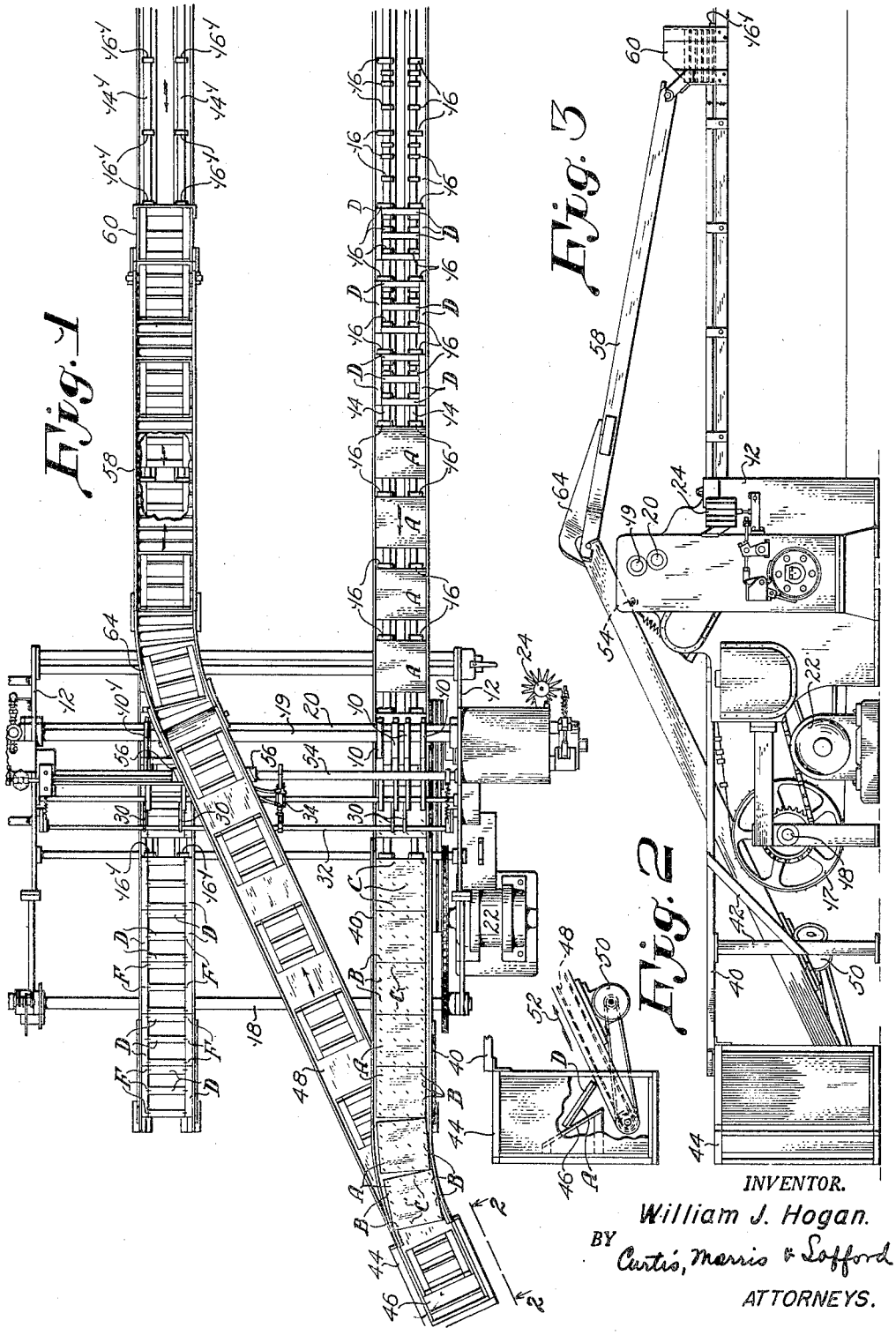
Dec. 7, 1954 W. J. HOGAN 2,695,998

APPARATUS FOR HANDLING BOX PARTS BETWEEN SEQUENTIAL STAPLING OPERATIONS

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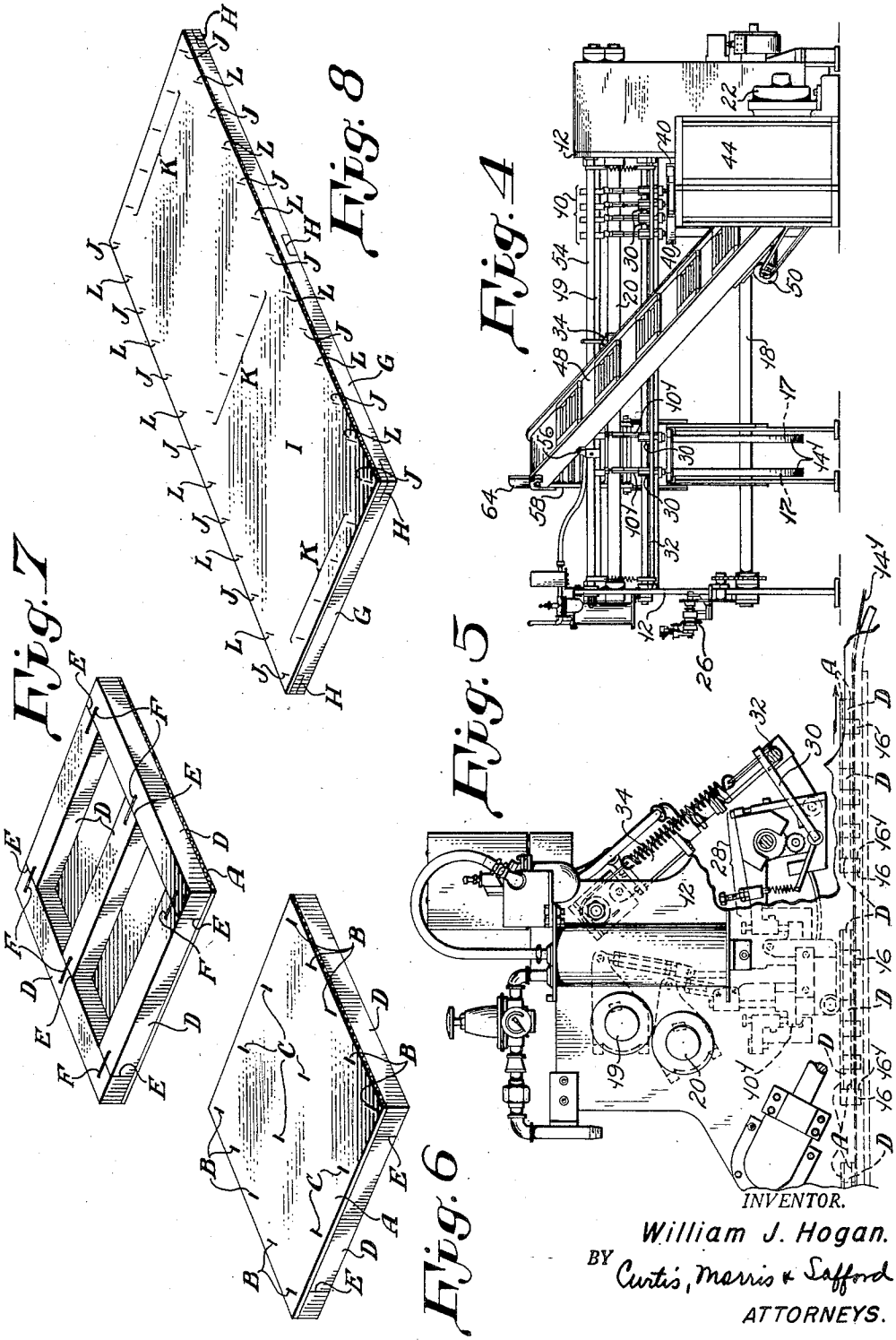


Fig. 4

Fig. 5

Fig. 6

Fig. 7

Fig. 8

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APPARATUS FOR HANDLING BOX PARTS BETWEEN SEQUENTIAL STAPLING OPERATIONS

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This invention relates to box or crate making machines and particularly to such machines having two or more banks of stapling units for making box panels or other box-part units requiring sequential stapling operations. The invention provides apparatus for mechanically handling the box-part units between the two stapling operations, i. e. for receiving the partially completed box-part units from the first bank of staplers and delivering them, properly oriented, to the second bank of staplers.

Many types of box or crate panels or other box-part units, because of their construction, cannot be completed in one pass through a conventional box-making machine. Heretofore, it has been common practice to employ two separate stapling machines in the manufacture of such box-part units. The partially completed box-part units issuing from the first machine have been manually stacked and subsequently transported into supply stacks adjacent the input end of the second machine, from which they were removed as needed and placed manually upon the moving conveyor bands of the second machine. These operations have required considerable manual labor, which has substantially added to the cost of manufacturing such box-part units. The present invention provides apparatus for mechanically receiving partially completed box-part units from the conveyor bands which transport them beneath the first bank of staplers and for carrying these box-part units upwardly and delivering them into the top of a hopper in which they are held in a generally vertical stack, from the bottom of which stack they are individually and successively removed by projecting push elements secured to the conveyor bands which transport them under the second bank of staplers. The two banks of staplers may be spaced laterally of each other within the same stapling machine and arranged to be driven in synchronous cyclical operation by the same drive mechanism, with control means for selectively controlling the operation of the two banks of staplers to position the staples in the desired pattern in the box-part units. If the design of the box-part units requires that the two banks of staplers drive staples into opposite sides of the box-part units, a baffle is provided for inverting the box-part units as they fall from the output end of the first set of conveyor bands onto the conveyor which carries them to the second set of conveyor bands.

In the drawings:

Figure 1 is a more or less diagrammatic view of a wirebound box-making machine, complete except for its input end, and embodying features of the present invention;

Figure 2 is a fragmentary side elevational view of the portion of the machine indicated by the arrows 2—2 at the left-hand side of Figure 1, a portion of the machine being broken away to show the baffle which inverts the box-part units;

Figure 3 is an elevational view of the left-hand side of the machine;

Figure 4 is an elevational view of the output end of the machine;

Figure 5 is a fragmentary elevational view of the right-hand side of the machine showing, at enlarged scale, the portion of the machine which appears at the upper left in Figure 4, with the machine sidewall being partially broken away to show the stapler wire feeding mechanism;

Figure 6 is an isometric view of a box panel requiring sequential stapling operations, which may be made by the machine illustrated in Figures 1–5;

Figure 7 is an isometric view of the reverse side of the panel shown in Figure 6; and,

Figure 8 is an isometric view of a different type of box panel which may be made by said machine.

Many box-part units, such as the box panels shown in Figures 6, 7 and 8, require sequential stapling operations, with selective control of the individual staplers or groups of staplers to produce the desired pattern of staples. Shown in Figures 6 and 7 are the two sides of a box panel formed of face material A of corrugated fiberboard secured by staples B and C to one side of a framework of cleats D having butt-type joints E secured together by staples F driven into the opposite side of the cleat framework.

Since this box panel has staples driven into it from opposite sides, it is obvious that it could not be made in one pass under the transverse bank of staplers of a conventional box-making machine.

The panel shown in Figure 8 comprises a framework of cleats G with shiplap-type joints H having a sheet of corrugated fiberboard face material I fastened thereto by staples J, K and L driven into one surface. While this panel can be made in one pass, the speed of the conveyor bands can be increased if staples J and K are driven in one pass and staples L are driven in a second pass.

The compound stapling machine shown generally in Figures 1, 3 and 4 is capable of producing box panels of the type shown in Figures 6–8 without manual handling of the partially completed panels between the successive stapling operations. This machine includes a pair of banks of stapling units **10** and **10'** (Figures 1 and 4) which are spaced laterally of each other within the side frames **12** of the machine. Beneath these two banks of stapling units the work is continuously conveyed on two sets of conveyor bands **14** and **14'** supported on sprockets **17** keyed on common transverse shafts **18** at opposite ends of the machine. The work is engaged and maintained in properly assembled relation during its movement through the machine by means of projecting push elements **16** ad **16'** adjustably secured on the conveyor bands **14** and **14'** respectively.

The staple forming and driving elements of the stapling units **10** and **10'** are each actuated by a pair of rock shafts **19** and **20** (see especially Figure 5) which extend transversely of the machine. These rock shafts are driven in regular cyclical operation by a motor **22** through a clutch (not shown) which is controlled by a solenoid **24**, to synchronize the stapling operations of all of the stapling units. The energization of the solenoid **24** is controlled by means of a remote pattern chain **26**, an arrangement which is fully described in U. S. Patent No. 2,482,370 issued to A. L. Rosenmund on September 20, 1949. The cyclical operations of the stapling units **10** and **10'** are thus started and stopped at such times as properly to position the transverse rows of staples driven into the box-part units—for example, so that the transverse rows of staples fall upon the transverse cleats of the box-part units.

Staple wire is fed to each of the stapling units **10** and **10'** by means of a wire feed mechanism, such as that generally indicated at **28** (Figure 5). This wire-feed mechanism is described in detail in U. S. Patent No. 2,578,936 issued on December 18, 1951, to David G. Kingsley. It includes a pair of knurled wire feed wheels (not shown) which embrace the wire and which are driven to feed the wire to the stapling units. One of these wire-feed wheels is eccentrically mounted on a cylindrical shaft from which extends an arm **30** (Figure 5), which rests upon a transverse rod **32**, which is actuated by means of pneumatic cylinder **34**. The supply of air to the pneumatic cylinder **34** is controlled by the remote pattern chain **26**, as is described in said Patent No. 2,578,936. The eccentrically mounted wire feed wheels are thus moved toward or from the coacting wheels to cause wire to be fed to the stapling units as desired. Of course, the cessation of wire feed to any of the stapling units during any stapling cycle means that it will not drive

staples during that cycle, even though its staple forming and driving mechanisms are actuated together with those of the other stapling units. This permits one or more staples to be selectively omitted from any of the transverse rows of staples being driven in the box-part units.

In Figures 1–4, the operation of the machine in the production of box panels of the general type shown in Figures 6 and 7 is illustrated. In making such box panels, first the cleats D are laid on the moving conveyor bands 14 in properly assembled relation, as shown at the lower right-hand portion of Figure 1. The push-elements 16 secured to the conveyor band facilitate proper positioning of the cleats on the conveyor bands and maintain them in properly assembled relation as they are moved through the machine by the conveyor bands. Next, the face material A is laid on top of the cleats, as shown at the lower center of Figure 1. The face material A and cleats D, thus properly assembled, are conveyed beneath the first bank of stapling units 10 where the staples B and C are driven through the face material and into the cleat framework to form partially completed box panels, as shown at the lower left in Figure 1. Since there are four longitudinal rows of staples in this side of the box panels, four stapling units 10 are required in the first bank of stapling units. The two outside stapling units 10 drive staples during each stapling cycle and thus position staples at equal intervals along the full length of the longitudinally extending outside cleats of the panel. The two intermediate stapling units in the first bank do not drive staples every stapling cycle, but only where they would fall upon one of the transversely extending cleats of the box panel. This is accomplished by setting up the remote pattern chain 26 so that no staple wire is fed to the intermediate stapling units during the second and fourth stapling cycles for each box panel.

A pair of guide rails or "strippers" 40 are provided to receive the partially completed box panels issuing from the first set of conveyor bands 14. These guide rails 40 are L-shaped in cross-section and are adapted to slidably support the opposite edges of the box panels and to guide them laterally as they push forward in a contiguous succession from the conveyor bands 14. The guide rails 40 are supported upon a suitable fabricated framework indicated generally at 42 (Figure 3). The output or left-hand ends of the guide rails 40, as viewed in Figure 1, are curved so as to direct the box panels into the upper end of panel-inverting hopper 44. The hopper 44 is generally in the form of a three-sided box, being open on the side facing the box-making machine.

On the rear wall of the hopper 44 is secured a baffle 46 which is obliquely positioned, being arranged to face generally upwardly and in a direction opposite to the direction of movement of the box panels on the guide rails 40. Near the lower end of the hopper 44 is positioned the input end of a power conveyor belt 48 which is driven by means of a motor 50 in the direction indicated by the arrow 52 (Figure 2).

When the panels reach the ends of the guide rails 40, they fall into the upper end of the hopper 44. As they fall they turn through a partial revolution in a counterclockwise direction, as viewed in Figure 2, and strike the baffle 46 end-wise. The orientation of the baffle 46 is such that it deflects the panels through an additional fractional revolution in a counterclockwise direction. As the panels slide downwardly off the baffle 46 their leading ends strike the power conveyor belt 48 and, due to frictional engagement between the leading ends of the panels and the moving belt 48, the ends of the panels are moved upwardly by the belt, as shown in Figure 2. This results in a further counterclockwise rotation of the panel. The upward movement of the leading ends of the panels is continued until their trailing ends fall off the baffle 46 onto the conveyor belt 48, at which time the panels will have completed rotation through an angle slightly in excess of 180°, to arrive at a cleat-side-up position.

The power conveyor belt 48 extends from the lower end of the hopper 44 upwardly and diagonally of the machine to a point above the second set of conveyor bands 14' where it is supported upon a transverse member 54 of the machine and is suitably braced by brackets 56. The output end of the power conveyor belt 48 communicates with a curved, roller-type gravity conveyor 58 which extends forwardly of the machine above the line of the conveyor bands 14' to the upper end of a hopper 60 which is supported above the conveyor bands 14'. A curved guide rail 64 (see especially Figures 3 and 4) is mounted on the outboard side of the receiving end of the gravity conveyor 58 to direct the panels from the power conveyor belt 48 onto the gravity conveyor 58.

The hopper 60 is adapted to support a generally vertical stack of the partially completed box panels above the conveyor bands 14' in position for removal of the box panels individually and successively from the bottom of the stack by the push elements 16' on the conveyor bands 14'. The conveyor bands 14' thus pick up and convey the panels, cleat-side-up, under the second bank of stapling units 10' where the reinforcing staples F are driven into the butt joints E of the cleat framework to complete the box panels.

The push elements 16' on the second set of conveyor bands 14' are aligned with the push elements 16 on the first set of conveyor bands 14, and the sprockets 17 on which the two sets of conveyor bands are trained are keyed on the same transverse drive shaft 18, and are thus driven in synchronism, so that the panels on the two sets of conveyor bands are always in alignment with each other. Accordingly, the staples F driven by the two stapling units 10' of the second bank of stapling units fall into proper position astride the butt joints E of the panels. The wire feed mechanisms of both the stapling units 10' in the second bank are under the control of the same remote pattern chain 26 which also controls the intermediate stapling units 10 of the first bank; thus no staples are driven in the second and fourth stapling cycles for each panel, but only in the first, third and fifth cycles, where they will fall upon the butt joints E.

As the completed box panels issue from the second set of conveyor bands 14' they are stripped from the bands, stacked, bundled if desired, and stored for use as needed.

Box panels of the type shown in Figure 8 are made in a manner just described as being used in making those of the type shown in Figures 6 and 7, except that it is necessary to offset the push elements 16' on the second set of conveyor bands 14' from the position of the push elements 16 on the first set of conveyor bands 14 by a distance equal to one-half of the interval between adjacent staples J (Figure 8) so that the simultaneous operation of the two banks of stapling units will result in driving the staples J and L at staggered, equally spaced positions along the box panel.

This arrangement, wherein the two banks of stapling units drive alternate staples in the same longitudinal rows, allows the speed of the conveyor bands to be doubled without increasing either the maximum rate of effective operation of the stapling units or the spacing of the staples in the box-part units. This makes possible a substantial increase in the work output of the machine, with a resultant reduction in unit manufacturing costs.

Where the panels being made do not have to be turned over between the stapling operations performed upon them by the two banks of stapling units, the baffle 46 may be dispensed with or may be so oriented and arranged as to cause the partially completed box-part units to fall from the first set of conveyor bands 14 onto the power conveyor belt 48 without rotation of the box-part units.

It will thus be appreciated that the present invention provides apparatus by which the partially completed box-part units issuing from one bank of stapling units may be inverted if desired and mechanically fed into proper position onto moving conveyor bands which will carry them under a second bank of stapling units where the remaining staples will be driven to complete the box-part units. All these functions are performed by automatically operating mechanism, thereby considerably reducing the manual labor in the handling of box-part units requiring sequential stapling operations and greatly reducing the cost of manufacture of such box-part units. However, it should be emphasized that the particular embodiment of the invention shown and described herein is intended as merely illustrative and not as restrictive of the invention.

I claim:

1. A box-part-making machine for performing multiple stapling operations on box-part units, said machine comprising two banks of stapling mechanisms arranged generally laterally of each other, two sets of conveyor bands,

each adapted to convey properly assembled box-parts past one of said banks of stapling mechanisms for the driving of staples therein to form said box-part units, a movable box-part conveyor having an end portion positioned below the output end of the first of said sets of conveyor bands for receiving partially stapled box-part units therefrom and extending diagonally of said machine from the output end of said first set of conveyor bands to a level above said second set of conveyor bands, and a hopper positioned below the output end of said box-part conveyor and above an input end portion of the second of said sets of conveyor bands and adapted to receive box-part units from said box-part conveyor and to hold them in a generally vertical stack in position for removal individually and successively from the bottom of said stack by projecting push elements secured on said second set of conveyor bands.

2. A box-part-making machine for performing multiple stapling operations on box-part units, said machine comprising two banks of stapling mechanisms arranged generally laterally of each other, a single drive mechanism adapted to drive both of said banks of stapling mechanisms in synchronous cyclical operation, two sets of conveyor bands, each adapted to convey properly assembled box-parts past one of said banks of stapling mechanisms for the driving of staples therein to form said box-part units, a single drive mechanism for driving said two sets of conveyor bands in synchronism, means to feed wire to said stapling mechanisms for the forming of staples to be driven into said box-part units, control means selectively

operative upon such wire feeding means to interrupt the supply of wire to selected stapling mechanisms in each of said banks to cause said stapling mechanisms not to drive staples into said box-part units in certain of their stapling cycles, whereby to produce desired patterns of staples in said box-part units, a movable box-part conveyor having an end portion positioned at the output end of the first of said sets of conveyor bands for receiving partially stapled box-part units therefrom and extending diagonally of said machine from the output end of said first set of conveyor bands to a point above the input end portion of said second set of conveyor bands and a hopper positioned below the output end of said box-part conveyor and above an input end portion of the second of said sets of conveyor bands and adapted to receive said box-part units from said box-part conveyor and to hold them in a generally vertical stack in position for removal individually and successively from the bottom of said stack by projecting push elements secured on said second set of conveyor bands.

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