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SPROCKET DRIVE FOR CARTON CONVEYOR

Filed March 4, 1963

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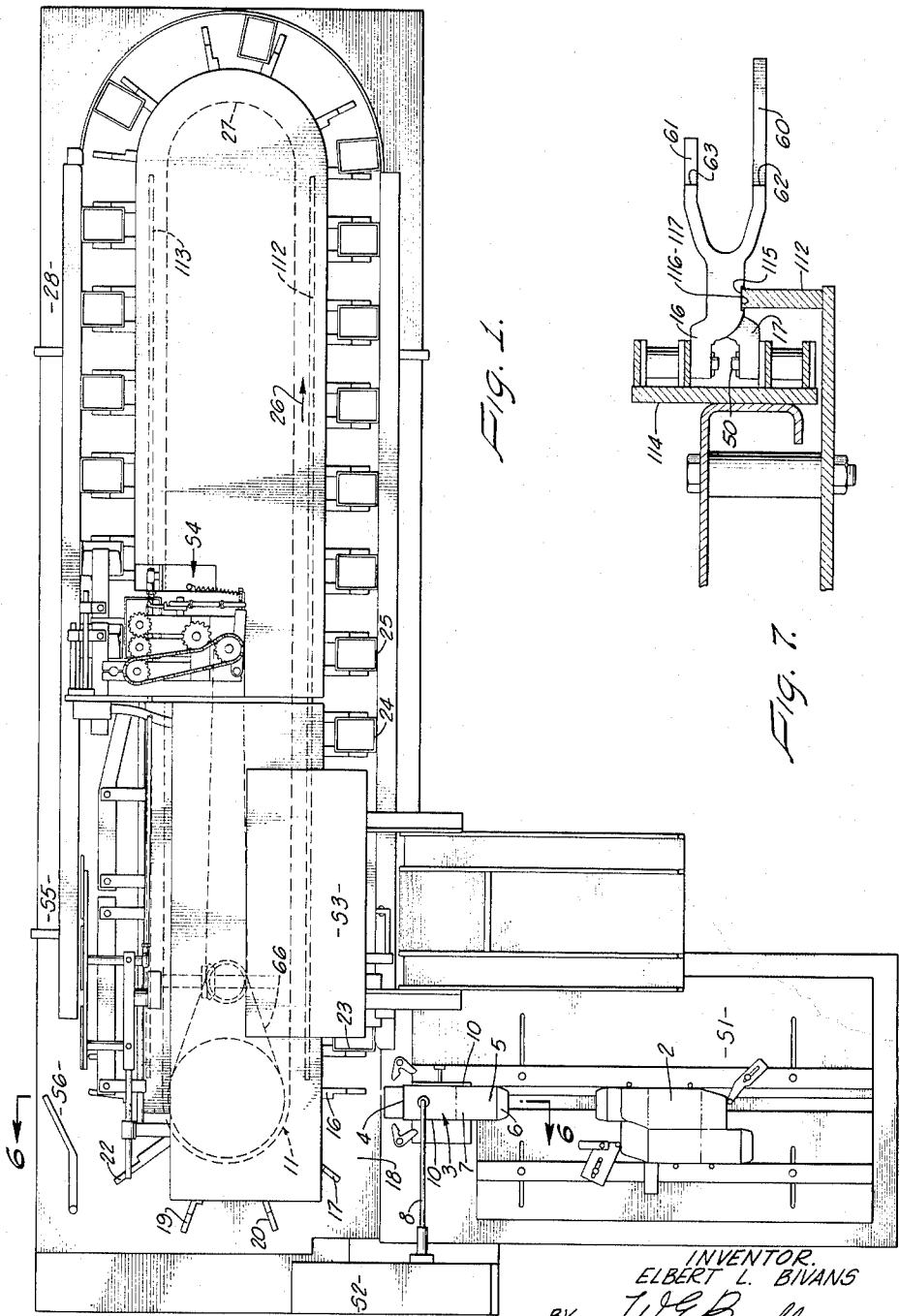


Fig. 1.

Fig. 7.

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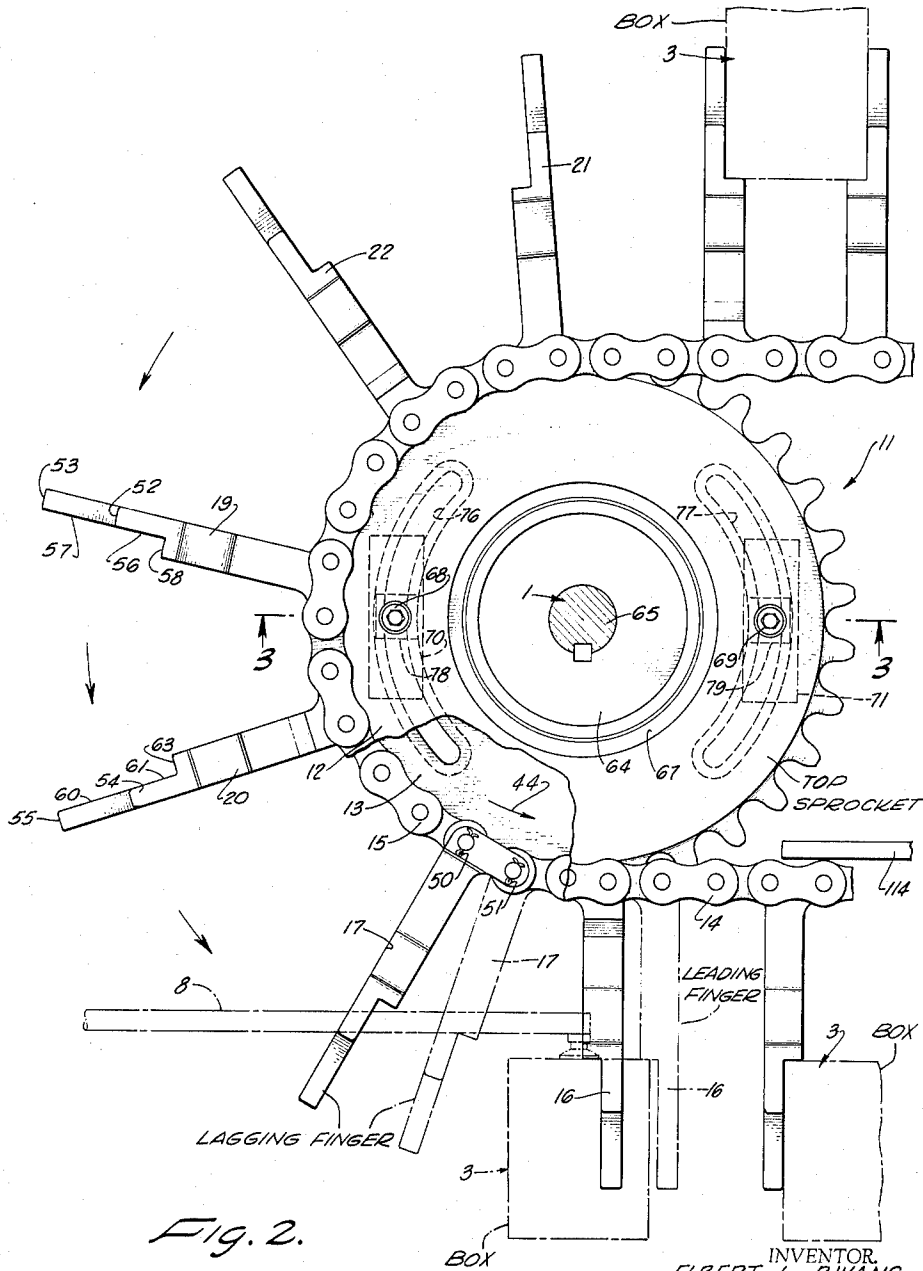
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5 Sheets-Sheet 2



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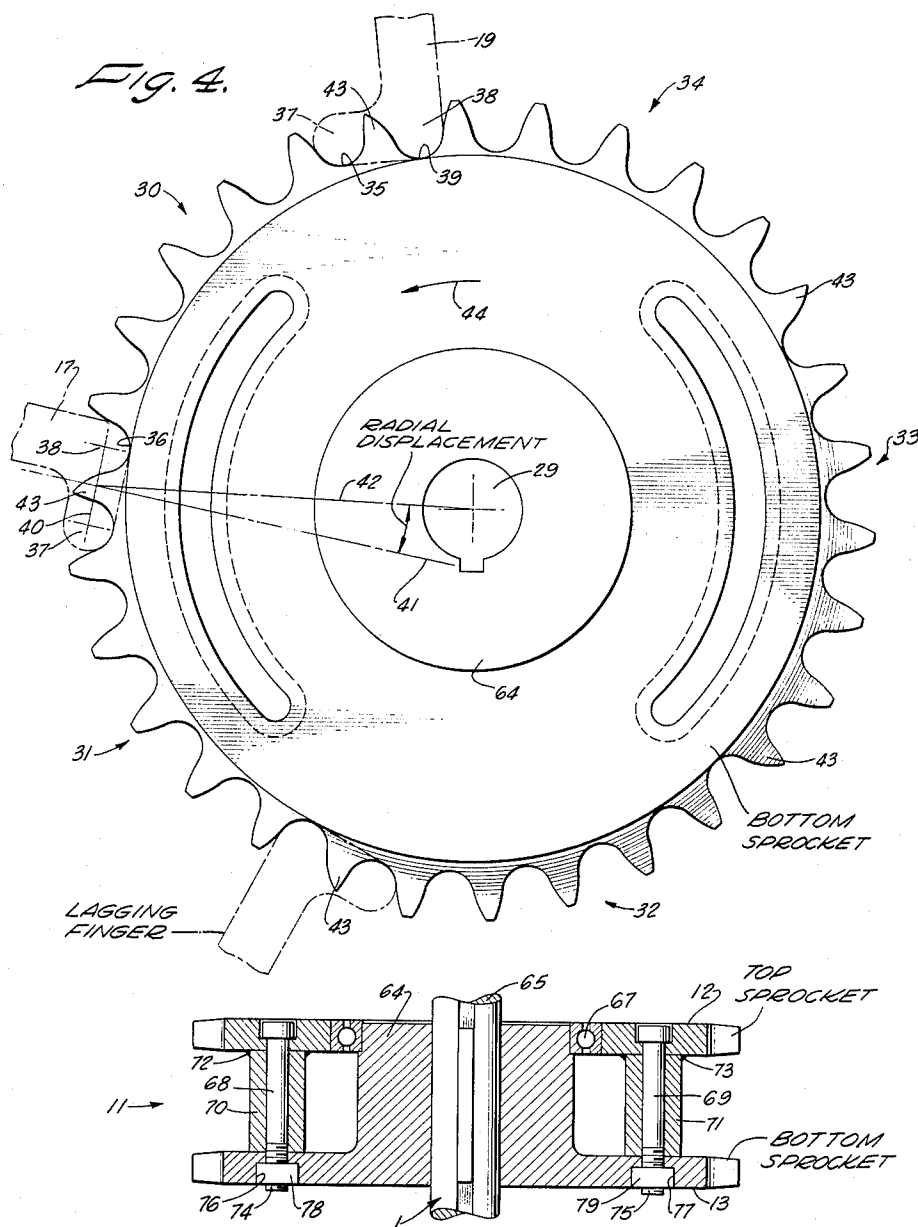
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5 Sheets-Sheet 4

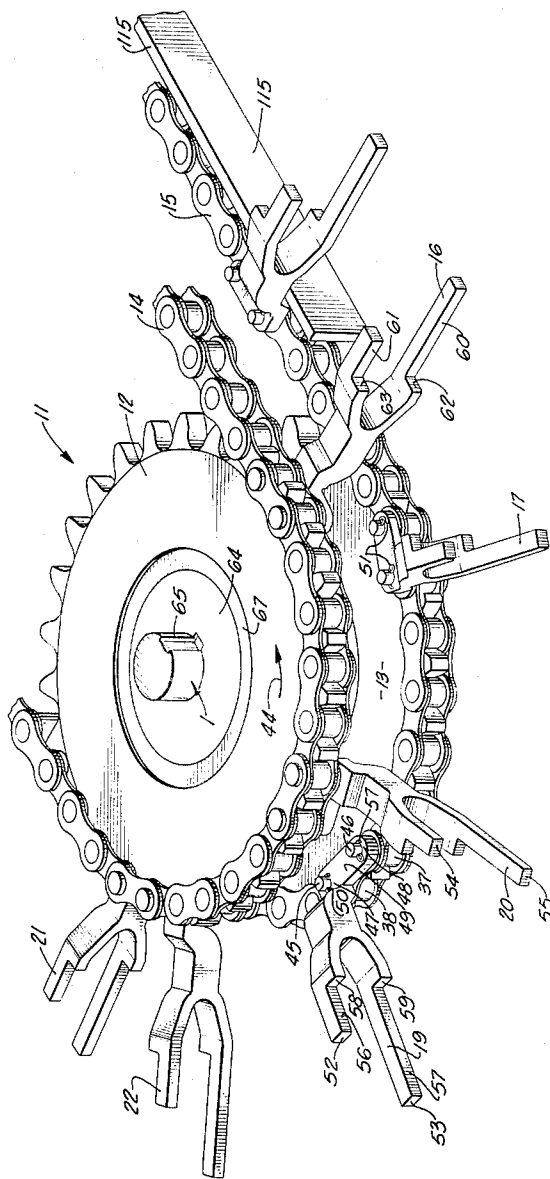


Fig. 5.

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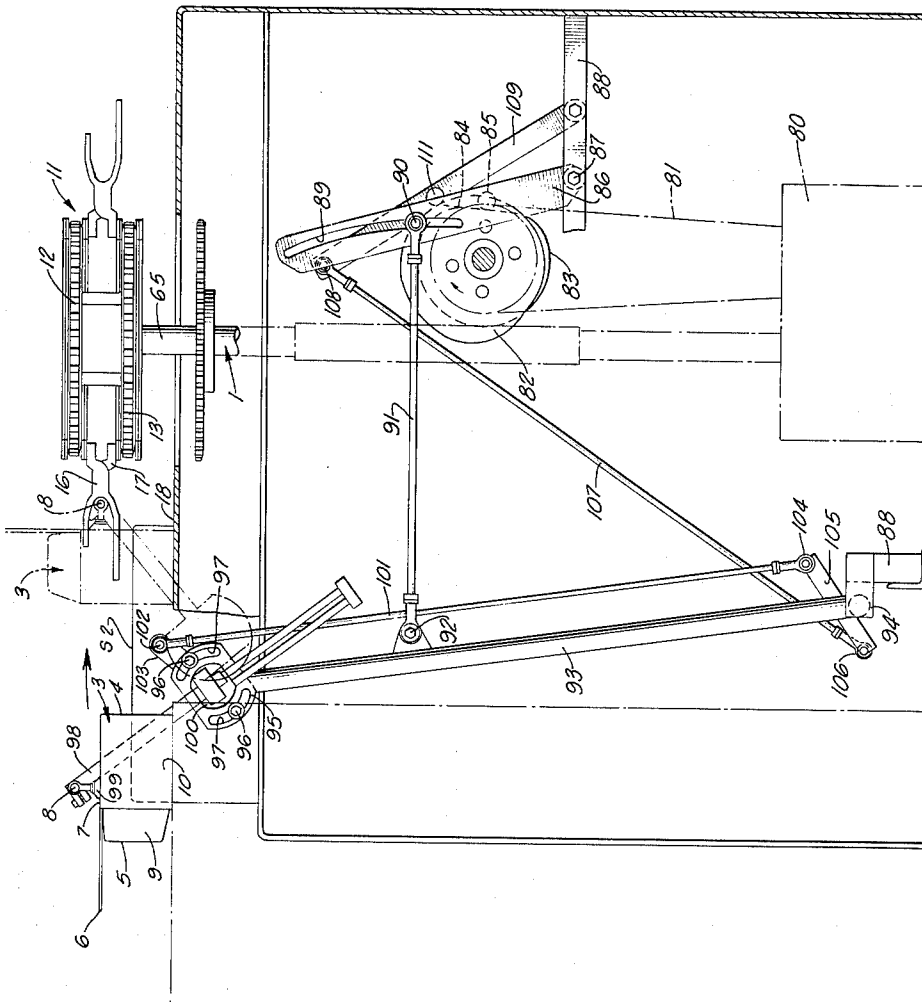


Fig. 6.

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SPROCKET DRIVE FOR CARTON CONVEYOR

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9 Claims. (Cl. 198-179)

This invention relates to Sprocket Drive for Carton Conveyor and, more particularly to an improved conveyor having an input of empty formed boxes which are to be conveyed through various stations where other operations are performed.

The formed empty box may be received from a box making machine described and claimed in applicant's Patents 2,682,209 and 2,682,210 dated June 29, 1954. The patented box making machine includes a stack of collapsed box blanks, the machine acting to open the box and tuck in the side flaps and the end flap at the outer end thereof, the empty box being ejected with the other or inner end open and with its side flaps and end flap projecting in the plane of their respective walls.

The present application discloses means for transferring the box from prone position at the outlet of a box forming machine to a vertical position in the conveyor, such means being described in further detail and claimed in copending application S.N. 316,950 filed Oct. 17, 1963, for Drive for Uprighting Boxes. The present invention deals particularly with an improved sprocket drive and conveyor which accept such upright empty boxes as an input. So far as the sprocket drive itself is concerned, the empty boxes may be fed to the conveyor by hand or the suction pickup disclosed herein may be operated by hand, although a fully automatic operation is preferred wherein the patented box making machine operates in timed relation with the conveyor and with the apparatus at other stations along the conveyor as described later.

When using a pair of endless chains, one of which has a set of spaced leading fingers and the other having a set of cooperating spaced lagging fingers, with fingers of each set embracing opposite sides of the box, on attempting to move the box into position between the companion leading and lagging fingers at a time when the leading finger is extended at right angles to its chain which has advanced beyond the sprocket, and the lagging finger which is still on the sprocket and extending on a radius to it, the difficulty arises of obtaining high speed operation while being restricted to a limited clearance for the box and for the suction head which moves the box into position and has to withdraw before the lagging finger moves off the sprocket to a position on the box parallel to the leading finger.

According to the present invention, sprocket means are provided for tilting the lagging finger on the sprocket in a lagging backward direction with respect to the sprocket which increases the size of the space for receiving the box between the leading and lagging fingers and increases the time interval for the lagging finger to move into position at the lagging side of the box parallel with the leading finger on the leading side of the box. This is conducive to a greater tolerance for a box feeding device and to a higher speed of operation.

The invention provides (a) means for adjusting the relative angular positions of the sprockets to suit articles of different widths, (b) a rail on which both the leading and lagging fingers ride to support the moving fingers, and (c) a slide bearing support for the chain carrying the lagging fingers to prevent sidesway created by the eccentricity of their sprocket.

For further details of the invention, reference may be made to the drawings wherein

FIG. 1 is a plan view of a fully automatic machine,

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except that no automatic loading of material into the boxes is shown, this machine including the improved sprocket drive and conveyor of the present invention.

FIG. 2 is an enlarged plan view of the top of the double sprocket, with parts broken away to also show the bottom sprocket, also the leading and lagging fingers shown at the bottom of the figure are also illustrated in an advanced position in broken lines, the figure also showing the box in position.

FIG. 3 is a sectional view on line 3-3 of FIG. 2.

FIG. 4 is an enlarged plan view of the bottom sprocket of FIG. 2 with the chain removed and illustrating the lagging displacement of the trailing fingers on the sprocket.

FIG. 5 is a perspective view of the double sprocket with portions of the chain broken away.

FIG. 6 is a view in elevation of the box transferring means covered by the application referred to above, the view looking to the left on line 6-6 of FIG. 1.

FIGURE 7 is an elevation view of a side run of the conveyor in the direction of travel illustrating supports for the chains and fingers.

Referring in detail to the drawings, the power drive for the apparatus at all stations shown is derived from a power shaft indicated at 1 and is driven by a suitable motor not shown. Station S1 includes a box forming machine, for example, as shown in the above patents. A collapsed box which is formed by this machine is indicated at 2. The open box after being operated on by machine S1 is indicated at 3 and is in prone position, with its outer end 4 closed and its inner end 5 open, the end flap 6 being uppermost and extending in the plane of its wall 7, the side flaps 9 extending in the plane of their respective walls like 10. This box 3 is moved to upright position by the suction arm 8 at the uprighting station S2 as described and claimed in the copending application referred to above, and as described later.

The improved sprocket device of the present invention is generally indicated at 11 in FIG. 1 and it includes upper and lower sprockets 12 and 13, each driving an endless chain shown at 14 and 15. The upper chain 14 at spaced intervals carries a leading finger like 16, and the lower chain at corresponding spaced intervals carries a lagging finger 17. The fingers 16 and 17 form one set, which engage the opposite sides of the box and propel it along the horizontal flat bed 18 of the machine. Similar sets of fingers are shown at 19 and 20 in FIG. 5 and at 21, 22. An open box being thus propelled is shown in FIG. 1 at 23, 24, 25, etc., along the conveyor.

On leaving the vicinity of the sprocket 11, the boxes are propelled along one side of the chains 14, 15 in a straight line on bed 18 in the direction indicated by arrow 26, and in the opposite direction by these chains at the other side of bed 18. A conventional double sprocket not shown is employed at the return bend 27.

In FIG. 1, station S3 indicates a leaflet inserter where a leaflet is inserted in the top open end of each box, as described and claimed in application S.N. 263,854 filed March 8, 1963, by applicant and John H. Bent for Leaflet Inserter for Box Conveyor. The boxes like 24 and 25 thus each have a leaflet therein. At the other side of the machine in FIG. 1, at the position indicated generally in 28, the desired goods are packed or stuffed by hand or by automatic means not shown, into the boxes. On arriving at station S4, the upright end flap is printed as described and claimed in application S.N. 316,959 filed Oct. 17, 1963, by applicant and August Kund for Printer for End Flap of Cartons.

Station S5 the printed end flap and associated side flaps are tucked in, after folding the end of the end flap, and the closed box is ejected at station S6.

Referring now to details of the improved sprocket device, in the usual case the working depth of the teeth is uniform. In other words, the grooves between adjoining teeth, such grooves receiving the bushings on the chain, at the bottom thereof are all tangent to a circle concentric with the axis of this sprocket. According to the invention, the grooves are subdivided into groups, which have a spacing the same as that of the trailing fingers, with the grooves at the end of each of such groups being eccentric, to tilt the trailing fingers in a backward direction around the sprocket. This is shown in FIG. 4 wherein the sprocket has for example five groups, 30, 31, 32, 33, 34, of teeth, wherein the radial distance from the sprocket axis 29 to the bottom of the grooves varies around the sprocket from a maximum at groove 35 to a minimum at groove 36. The groove 35 receives the leading bushing like 37, see FIG. 5, and at the time that bushing 37 rests in groove 35, the lagging bushing 38 on the lagging finger 19 rests in groove 39, which is at the minimum radius from the axis 29. The centers of bushings 37 and 38, see FIG. 4, thus lie on a line 40, as shown at trailing finger 17, line 40 being at right angles to line 41 which is abaxial, departing from a radial position as shown at 42.

As shown in FIG. 4, there may be a gradual decrease in the depth of the grooves, from the depth shown at 35 to that shown at 36, "depth" here meaning the distance from the axis 29 to the bottom of the groove. The difference in the depth of the grooves 35 and 39 accounts for the acute shape of the teeth like 43, which appear at spaced intervals around the sprocket corresponding to the spacing of the trailing fingers like 17, 19. From a groove like 39 to a groove like 35, the working depth or radial distance of the groove increases in a forward direction, the lower sprocket 13 rotating counter-clockwise as shown by the arrow 44.

In the ordinary case, the length of the chain need not bear any particular relation to the number of teeth or grooves on the sprocket, as each bushing on the chain will fit any groove. In the present case, however, the length of the chain is a multiple of the length of each group of teeth, like 30 to 34, so that the lagging fingers 17, 19, 21, etc., will always be received by an eccentric groove pair like 35, 39.

As shown in FIG. 5, the bushings 37, 38 are mounted on hinge pins having extensions 45, 46, which receive spaced apertures 47, 48 in the base 49 of the lagging finger, the base 49 being held in position by cotter pins like 50, 51, as shown for finger 17. Each of the leading and lagging fingers in fact includes vertically spaced upper and lower finger members like 52, 53, as shown for lagging finger 19. As shown at 54, 55 for leading finger 20, the upper fingers like 52, 54 are shorter than their companion lower fingers like 53, 55, to provide clearance for the pickup or suction arm 8. Also, each lagging finger has upright flats like 56, 57 which lie in a vertical plane and face forwardly, with conjoining flats 58, 59, which lie in a vertical plane and face outwardly to engage the trailing side and the trailing rear of the box. Each leading finger has corresponding flats 60, 61, in a vertical plane to engage the leading side of the box and flats 62, 63, to engage the rear of the box. The finger members like 52, 53, and the companion leading finger members of the finger device 20 all extend parallel to each other when the finger devices like 19 and 20 have departed from the sprocket, with the chains extending in a straight line.

As shown in FIGS. 2, 3 and 4, means are provided for adjusting the relative rotative position of the sprockets 12 and 13. As shown in FIG. 3, the bottom sprocket 13 has a hub 64 keyed to shaft 65 driven by a belt or chain 66, see FIG. 1, from the power shaft 1. Hub 64 has a ball bearing 67 for the top sprocket 12 which carries diametrically opposed bolts 68, 69 mounted in spacing sleeves 70, 71, welded or otherwise secured at their upper ends to the underside of sprocket 12, as shown at

72, 73. The threads 74, 75 of the bolts extend through opposed arcuate slots 76, 77 in the sprocket 13 and the nuts 78, 79, can be operated to secure the two sprockets in a desired rotative position.

Referring to FIG. 6, the sprocket device 11 has a vertical shaft 65 driven by gears not shown in a gear box 89, also having a drive for belt 81 which drives cams 82 and 83. Cam 82 has a flat portion 84 for a cam follower 85 on arm 86 pivoted at its lower end as shown at 87 to the frame 88 of the machine. Rotation of cam 82 clockwise oscillates arm 86 which has an arcuate slot 89 for adjusting the position of the end 90 of a link 91 pivoted as shown at 92 at its other end to an upright arm 93 pivoted as shown at 94 to the frame 88. Arm 93 at its upper end has a bracket 95 which is swiveled on the upper end of arm 93 and secured in adjusted position by nuts like 96 and slots like 97 on opposite sides of the arm as shown. The bracket 95 carries an arm 98 which extends at right angles to the pick-up arm 8 in FIG. 1. Fixed to arm 98 is the suction head 99 controlled by a valve not shown. The cams 82 and 83 operate the arm 98 in FIG. 6 between two positions, one of which is shown in full line at the left, box 3 being prone and with the suction head 99 on the top of the box, to the phantom line position in FIG. 6 where arm 98 is at right angles to its former position, the suction head now appearing at the back of the box which is now upright. This requires that the arm 98 be moved both back and forth in a somewhat horizontal direction as above described, but also with a vertical component which is derived from the pivotal movement of bracket 95 about its swivel mount 100 on arm 93, under control of link 101 which is hinged at its upper end as shown on 102 to an arm 103 on bracket 95. Link 101 is hinged at its lower end as shown on 104 to a lever 105 hinged also at 94, the other end of lever 105, having hinged connection 106 with a link 107, the upper end of which is hinged at 108 to an arm 109, having a hinge connection at its lower end with the frame 88. Arm 109 has a cam follower 111 operated by cam 83.

The suction head 99 delivers a box to the leading finger of a set and the stop portions 62, 63, as shown in FIG. 5 are long enough to remain behind the back wall of the box until the lagging finger catches up to the box and urges it against the leading finger, the suction head thereafter starting its return stroke to pick up the next box.

As shown in FIG. 2, a stationary support 114 is provided at the rear of the lower chain 15 which carries the lagging fingers 17 to reduce or prevent sidesway created by eccentricity of the sprocket 13. This eccentricity is due to the fact that the chain is periodically urged laterally different amounts due to variation in the distance from the axis of the sprocket to the bottom of the grooves between the teeth, the chain being at a greater radius when the lagging finger leaves the sprocket, and this is followed by a shorter working depth of the sprocket acting on the chain. The slide support 114 guides the chain to the path from the point of minimum working depth on sprocket 13 to the sprocket at return bend 27.

As shown in FIG. 7, a fixed slide support or rail 112 is provided with a horizontal bearing face 115 on which slides the leading fingers 16 as well as the lagging fingers 17, each of which has a downwardly facing bearing face like 116 for finger 16 and 117 for fingers 17, the bearing faces 116 and 117 for the leading and trailing fingers all lying in the same horizontal plane to fit and slide on the face 115 of the rail 112. The rail 112 thus supports the moving fingers 16 and 17. As shown in FIG. 1, the rail 112 is straight and extends from the sprocket device 11 to the return bend 27 at one side of the machine and parallel thereto a similar rail 113 is provided at the other side of the machine from the return bend 27 to the station S6 where the box or similar article is ejected.

While reference has been made to a box or carton, it is apparent that other types of articles, such as a bottle

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may be handled by the sprocket device and conveyor of the present invention.

I claim:

1. A sprocket device having a chain having link members having a hinge connection by means of pins carrying bushings spaced opposed sections of the chain, in combination with a finger bracket having a base having spaced bearing holes mounted on adjacent ones of said pins, means for retaining said base on said pins, and sprocket means having grooves of different radial distances from the center of said sprocket for tilting a finger on said bracket in a lagging direction.

2. A sprocket having a succession of similar eccentric working depth portions around its periphery, a chain having links connected by pins, a plurality of spaced fingers each having a base having hinge supports on adjacent pins, said chain fitting said sprocket with each of said bases on one of said eccentric portions in a position wherein said base is tilted with its finger extending in a lagging position with respect to a radial line from the center of the sprocket to the middle of the base.

3. A sprocket device according to claim 2, and a slide bearing support for said chain to reduce sidesway of the chain created by said eccentric portions.

4. A conveyor comprising a sprocket having teeth having a succession of pairs of grooves, the leading groove of each pair being at a greater radial distance from the center of the sprocket than the lagging groove, said pairs providing similar eccentric working depth portions around the periphery of the sprocket, a chain having links, spaced fingers each having a base connected to spaced points on said chain, said chain fitting said sprocket with each base supported by the grooves of one of said pairs, said fingers inclining in a lagging direction on the sprocket when said chain is on the sprocket and extending in a direction at right angles to the chain when the chain extends in a line from the sprocket.

5. A conveyor comprising upper and lower endless chains, spaced sets of upper and lower sprockets for said chains, one of said chains having spaced leading fingers and the other of said chains having spaced cooperating lagging fingers, each of said fingers extending at right angles to its chain when the chain is in extended position away from the sprocket, the sprocket for said lagging fingers having corresponding spaced pairs of grooves, one member of each pair being of greater radial distance from the center of the sprocket and the other member of the pair in a leading direction around the sprocket for supporting the lagging finger in a lagging position on the sprocket, each leading finger and its cooperating lagging finger having a stop shoulder for a corner of the box, and means for advancing a box into position against the

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stop shoulder of a leading finger when its chain is off the sprocket and at a time when its cooperating lagging finger is in said lagging position on the sprocket.

6. A conveyor comprising spaced sets of upper and lower sprockets for upper and lower chains, said upper chain having spaced leading fingers and said lower chain having cooperating spaced lagging fingers, each leading finger being spaced from a corresponding lagging finger by the width of a box, said leading and lagging fingers each having a base having spaced bearing supports on its chain, each finger extending substantially at right angles to its chain when the chain is straight, said chains having a straight reach between said sprockets providing a straight path for the box, means supporting the box for movement in said path, one of the sets of said sprockets being arranged at the entrance to said path, the sprocket for said upper chain having teeth having a working depth concentric with the axis of the sprocket, said lower sprocket of said one set having teeth having an eccentric working depth which increases in radial length in the direction of rotation of the sprocket, the lagging finger fitting on the sprocket at the rise of said eccentric portion and acting to increase the divergence of the lagging finger from its leading finger at the entrance to said path until the chain leaves the sprocket.

7. A conveyor according to claim 6, said lower sprocket having a series of said eccentric portions, the spacing of the rise from one eccentric portion to the next corresponding to the spacing of the lagging fingers on its chain.

8. A conveyor according to claim 6, and means for adjusting the relative angular positions of the sprockets of said one set to suit the box width.

9. A conveyor according to claim 6, in combination with means for advancing the box into position between a leading finger and its cooperating lagging finger when said upper chain has advanced beyond its sprocket and when the lagging finger is on its sprocket with said increased divergence.

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