Feb. 25, 1964 W. H. VOGEL 3,122,071

APPARATUS FOR OPENING AND OVERSQUARING CARTONS

Filed Nov. 7, 1961 5 Sheets-Sheet 1

FIG. 1

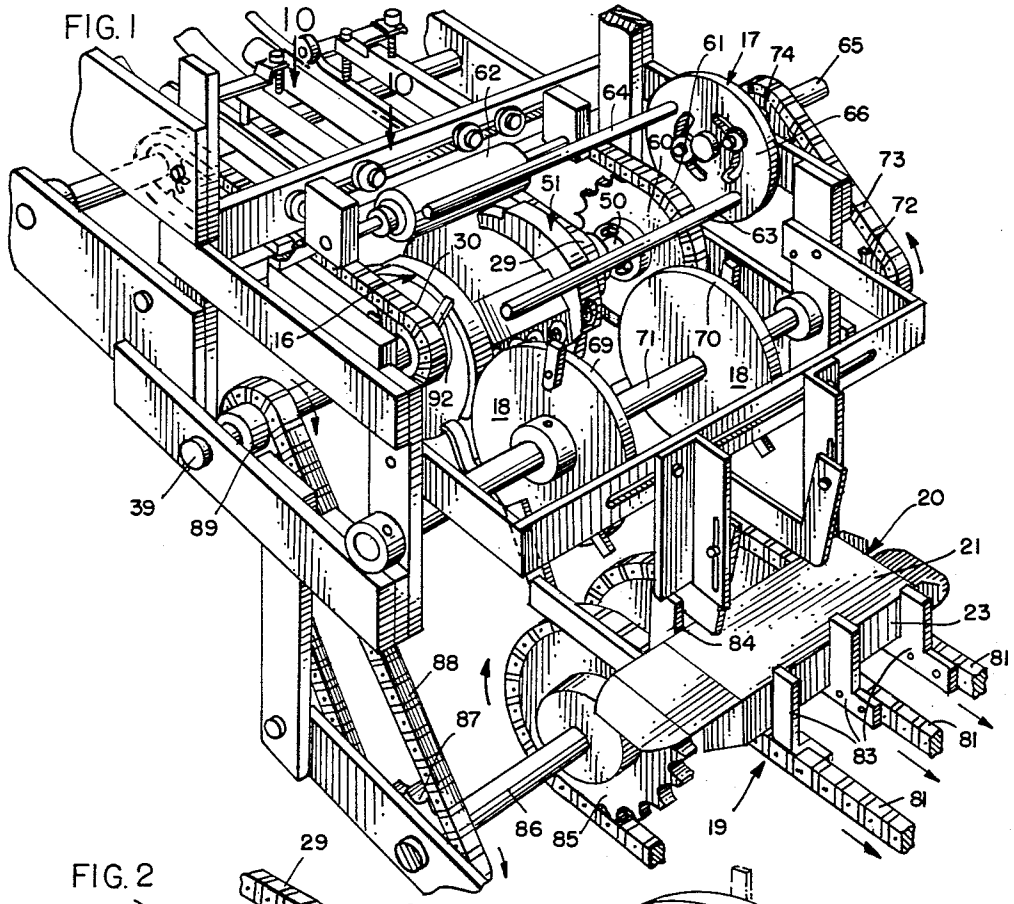
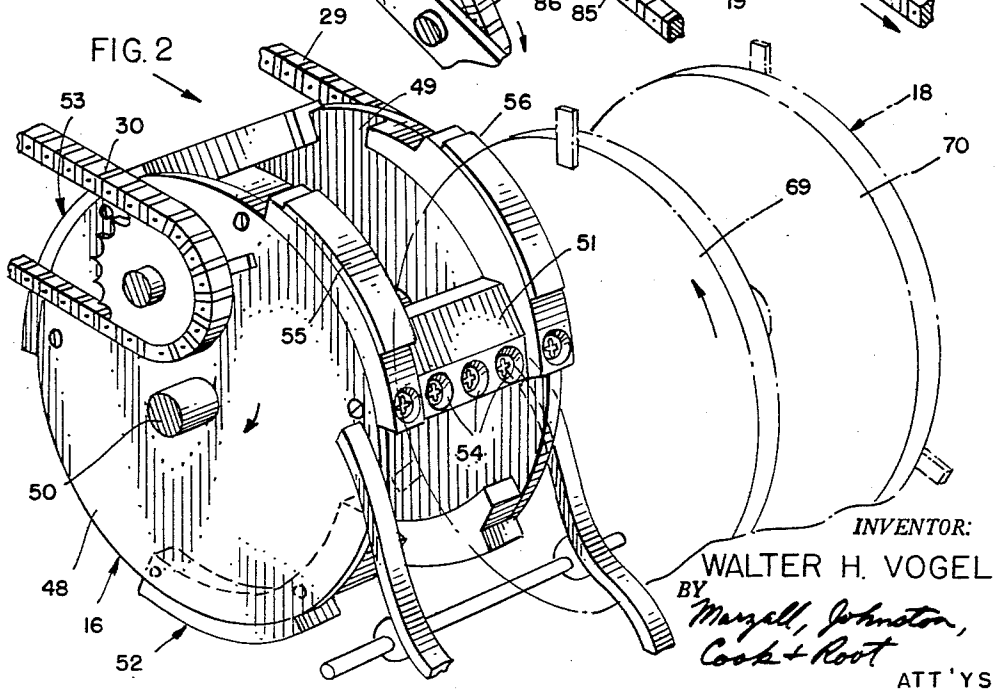


FIG. 2



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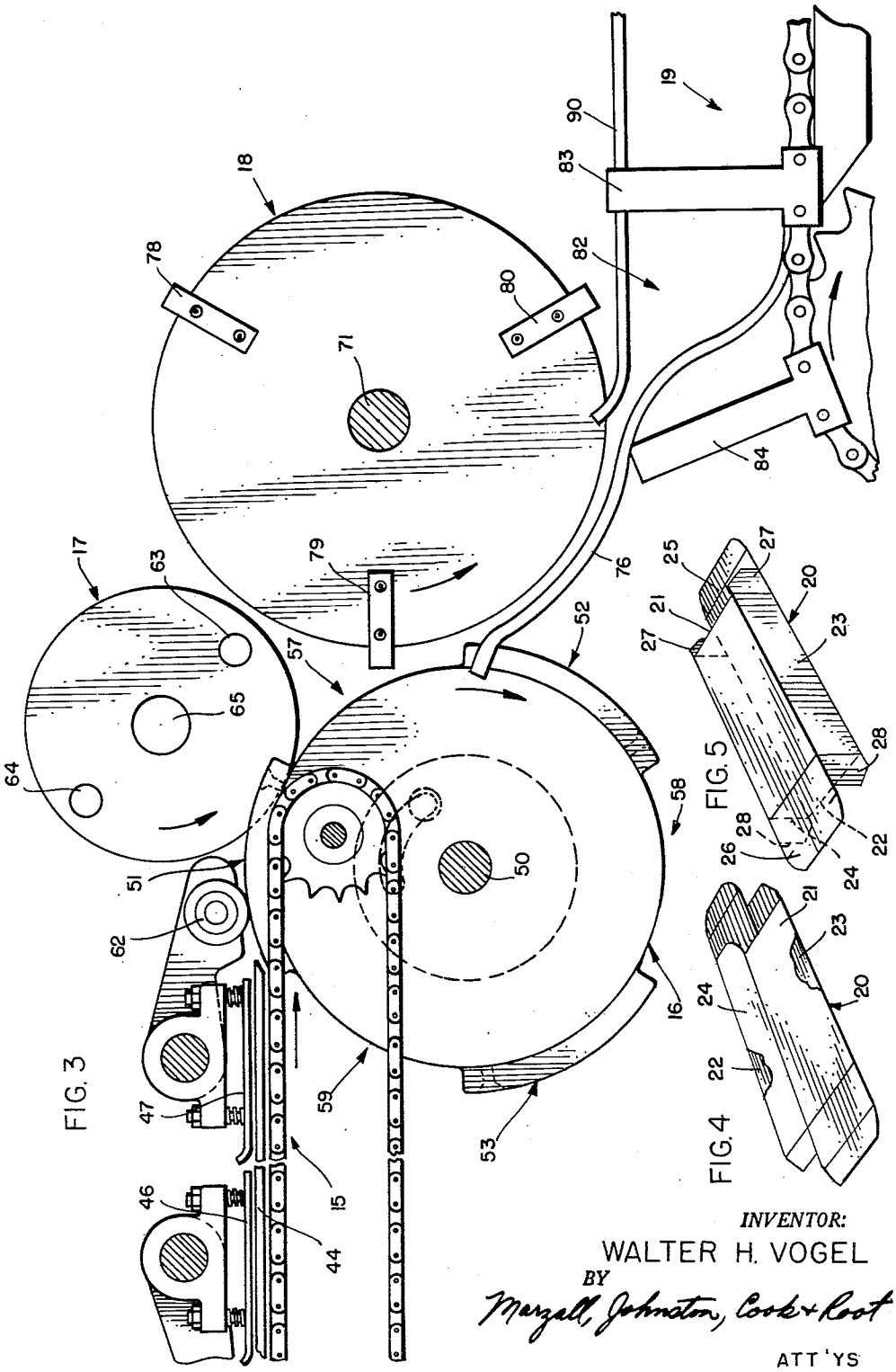


FIG. 3

FIG. 5

FIG. 4

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FIG. 6

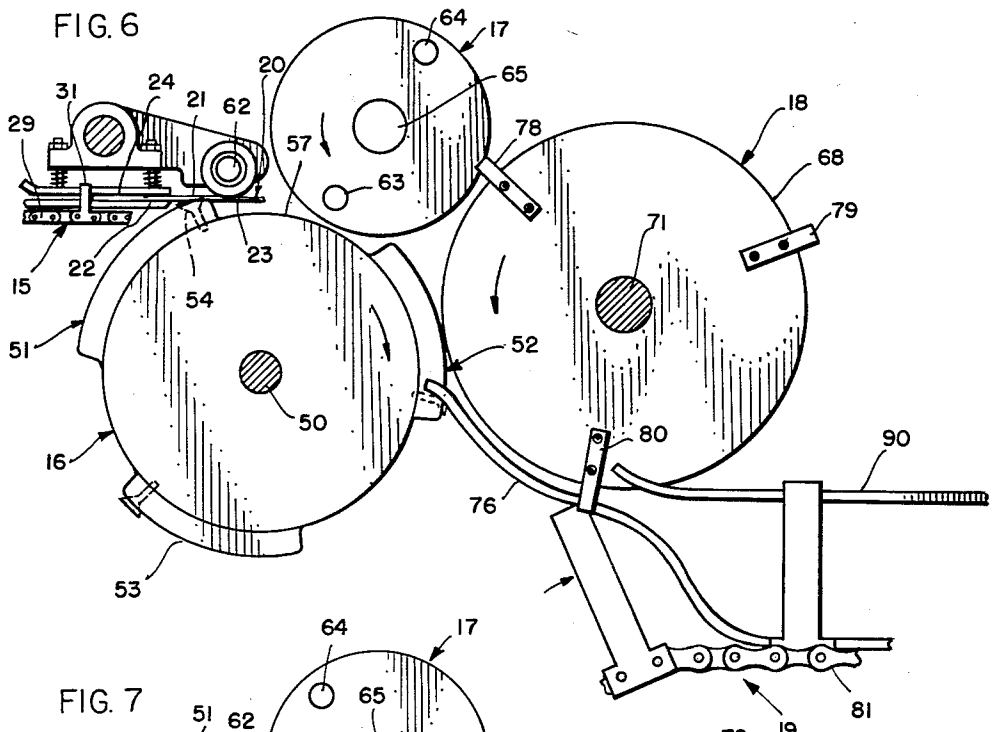
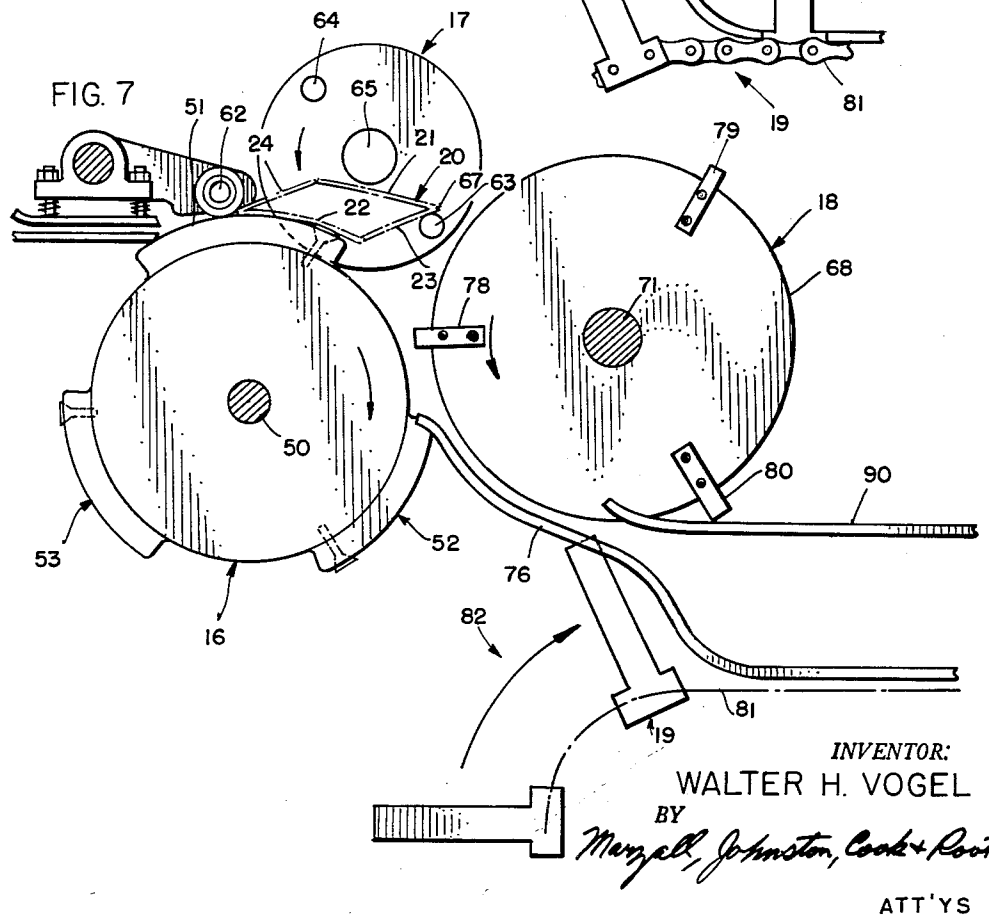


FIG. 7



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FIG. 8

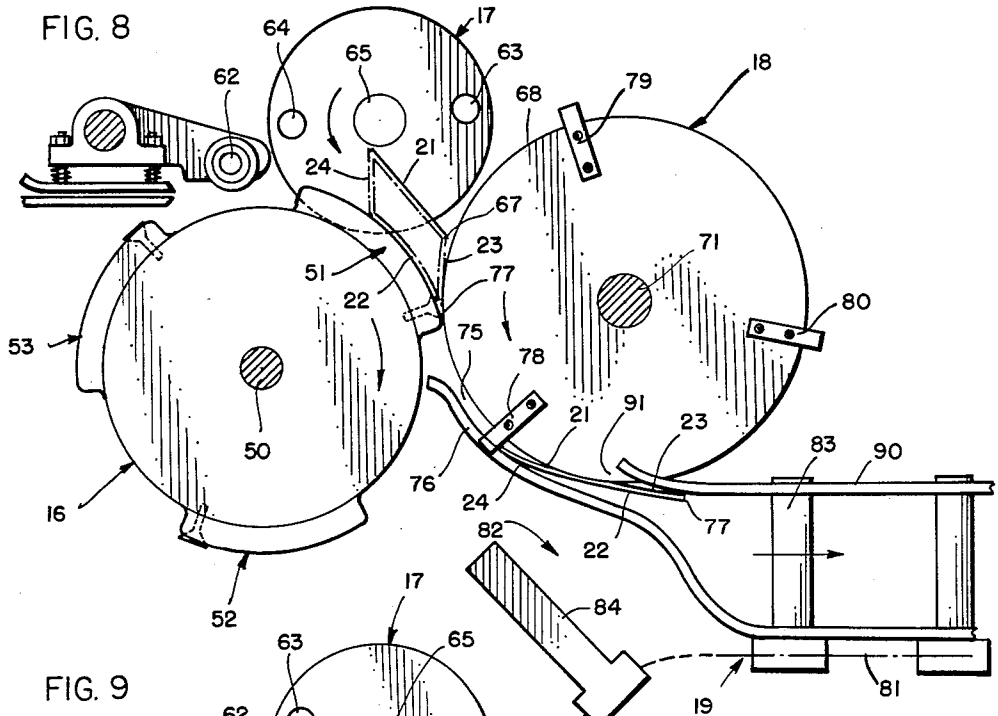
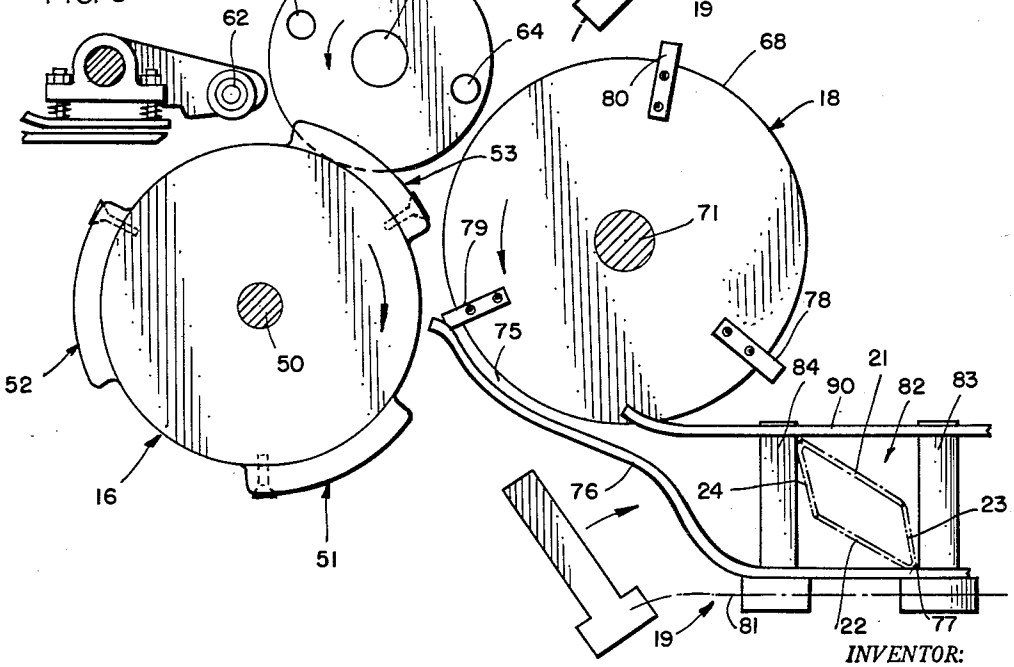


FIG. 9



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APPARATUS FOR OPENING AND OVERSQUARING CARTONS

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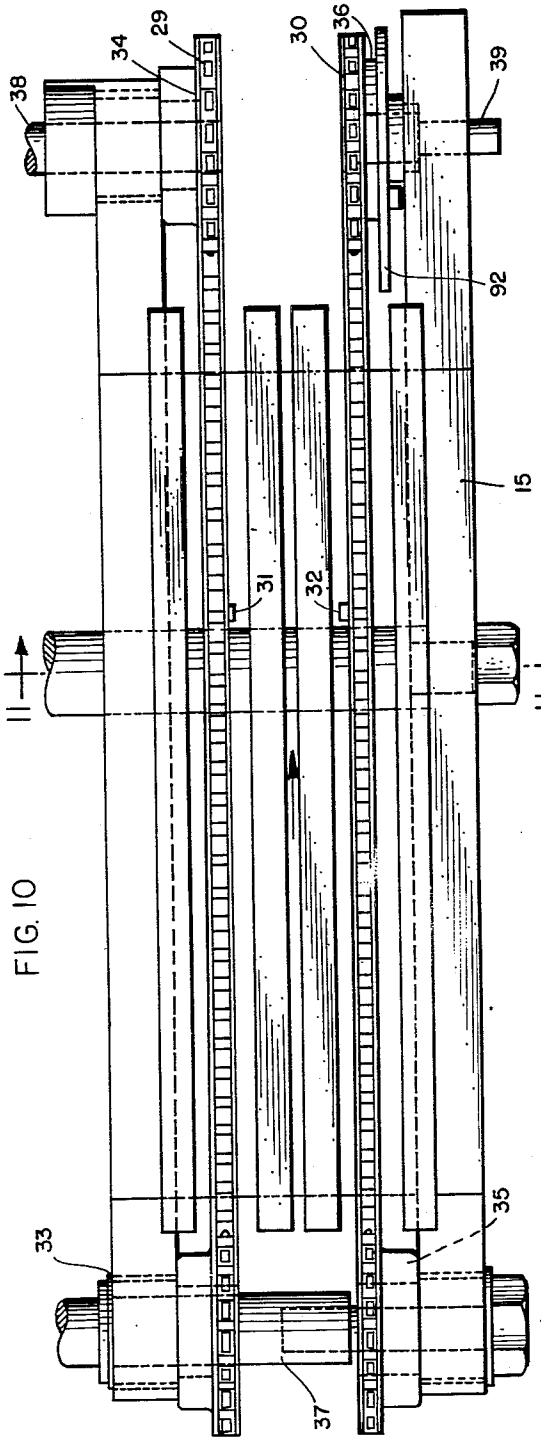


FIG. 10

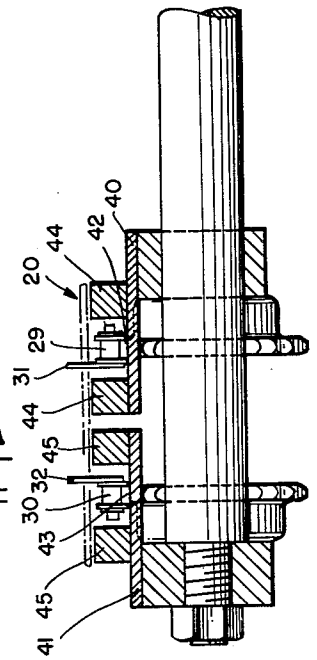


FIG. 11

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United States Patent Office 3,122,071 Patented Feb. 25, 1964

3,122,071

APPARATUS FOR OPENING AND OVERSQUARING CARTONS

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Filed Nov. 7, 1961, Ser. No. 150,679
4 Claims. (Cl. 93—53)

This invention relates in general to an apparatus for handling cartons, and more particularly to an apparatus for opening and oversquaring cartons that are to be delivered to a conveyor for filling purposes.

The carton opening and oversquaring apparatus of the present invention is primarily useful in opening and oversquaring straight or reverse tuck cartons in flattened condition, but it should be appreciated that the apparatus could equally be used in connection with opening and oversquaring of sleeves. A sleeve is merely a carton without flaps. While the invention will be described in relation to cartons, it is understood that sleeves could also be handled by the present invention and that the word "carton" includes "sleeve."

The carton opening and oversquaring apparatus of the present invention includes a conveyer for delivering flattened cartons one at a time along a rectilinear path to a rotary wheel. The rotary wheel is provided with a plurality of suction heads for gripping the lower trailing side wall or panel of each carton delivered thereto and for holding that side wall in gripping relationship until the carton has been opened and received by a transfer wheel. For opening the carton, an expander arm is provided which rotates in a circular path adjacent the periphery of the suction head wheel and freely engages the lower leading side wall of the carton to effectively hold it in position while the suction head wheel carries the carton around thereof and downwardly and to effectively open the carton. The leading corner of the opened carton is engaged by a transfer wheel which coacts with the suction head wheel to oversquare the carton and effectively flatten it again in the oversquared condition and to transfer the carton into a pocket of a conveyer. Because the carton is in oversquared condition when it is received in the pocket, it will pop open. The oversquaring operation is effective to aid in the further handling of the carton when it is received by the conveyer and also to more effectively square up the carton to receive its contents. Lugs are provided on the transfer wheel to advance a carton along a track after they have been released from the suction head wheel. The suction head wheel, expander arm and transfer wheel are driven in timed relation with each other and also are adjustable so that they may accommodate cartons of various sizes.

Accordingly, it is an object of this invention to provide a carton opening mechanism capable of opening cartons at a high rate of speed and for opening cartons of various sizes.

Another object of this invention is in the provision of an adjustable carton opening apparatus capable of handling cartons of various sizes within certain limitations.

Still another object of this invention is in the provision of a carton opening mechanism that is smooth acting and is not dependent upon any reciprocating motions.

A further object of this invention is to provide a carton opening and oversquaring apparatus capable of operating at high rates of speed to increase the number of cartons opened and oversquared in a given time.

A still further object of this invention resides in the provision of a carton opening and oversquaring apparatus that may be adjusted to handle cartons of various sizes within certain limitations.

A further object of this invention is in the provision of

an apparatus for opening and oversquaring cartons that is smooth acting and is not dependent upon any reciprocating motions.

Another object of this invention is in the provision of a carton opening and oversquaring apparatus capable of handling cartons with positiveness of action and wherein the apparatus is not effected by differences in thickness of the cartons, warpage or manufacturing tolerances.

A still further object of this invention is in the provision of an apparatus for opening and oversquaring cartons and for delivering the oversquared carton into a pocket on a conveyer.

Other objects, features and advantages of the invention will be apparent from the following detailed disclosure, taken in conjunction with the accompanying sheets of drawings, wherein like reference numerals refer to like parts, in which:

FIG. 1 is a perspective view of the carton opening and oversquaring apparatus of the present invention and the transfer mechanism for inserting the oversquared cartons into the buckets of a conveyer;

FIG. 2 is an enlarged perspective view of the suction head wheel of the present invention and illustrating the relative position of the transfer wheel in phantom as it would be positioned adjacent to the suction head wheel;

FIG. 3 is a side elevation view of the apparatus of the present invention which is illustrated in FIG. 1 and in somewhat diagrammatic form to illustrate its operation;

FIG. 4 is a perspective view of a flattened carton that is adapted to be opened and oversquared by the apparatus of the present invention;

FIG. 5 is a perspective view of the carton of FIG. 4, but in opened condition.

FIGS. 6, 7, 8 and 9 are somewhat diagrammatic side elevational views of the apparatus of the present invention and illustrating the sequential steps of operation and the advancing of a carton to the apparatus and into a conveyer pocket;

FIG. 10 is a plan view of the conveyer which delivers the cartons to the suction head wheel, and taken substantially along line 10—10 of FIG. 1; and

FIG. 11 is a transverse sectional view taken substantially along line 11—11 of FIG. 10.

Referring now to the drawings and more particularly to FIGS. 1 and 3, the carton opening and oversquaring apparatus of the present invention includes generally a means for feeding cartons along a rectilinear path and generally designated by the numeral 15, a first rotary wheel 16 receiving the cartons and suctionally gripping one side wall of each carton, a second rotary wheel 17 coacting with the first rotary wheel to open the cartons, a third rotary wheel 18 functioning to coact with the first and second rotary wheels to oversquare the carton, and a bucket conveyer 19 adapted to receive the opened cartons and to have them transferred thereto by the third rotary wheel 18. The feeding means 15 comprises a chain conveyer, while the first rotary wheel 16 may be defined as a suction head wheel. The second rotary wheel 17 is provided with arms and may be defined as an expander wheel, while the third rotary wheel 18 may be defined as an oversquaring and transfer wheel.

Illustrative of the type of carton that may be opened and oversquared by the present invention is the carton 20 in flattened condition in FIG. 4 and in opened condition in FIG. 5. The carton 20 includes a top or upper wall or side panel 21, a lower or bottom side wall or panel 22, and opposed side or end panel or walls 23 and 24. Closure flaps 25 and 26 are provided at the opposite ends of the carton and extend from the upper and lower side walls, while end flaps 27 and 28 extend from the side walls or panels opposing each other. Cartons are successively delivered one at a time in horizontal

position to the periphery of the suction rotary wheel 16 by the conveyer 15. And with the type of carton as illustrated and indicated by the numeral 20, this carton is delivered to the periphery of the suction wheel 16 with the side walls 23 and 22 facing the wheel and the side walls 21 and 24 extending away from the wheel. Further, cartons are delivered so that their longitudinal axis extends normal to the path of movement of the conveyer and the rotary suction wheel.

As may be seen particularly in FIGS. 1, 3, 10 and 11, the conveyer 15 includes a pair of endless chains 29 and 30 driven together at the same speed and having mounted thereon sets of lugs 31 and 32 for engaging the trailing edge of the flattened carton and advancing it along guide rails or tracks. The chain 29 is trained over longitudinally spaced sprockets 33 and 34, while the chain 30 is trained over longitudinally spaced sprockets 35 and 36. The sprockets 33 and 35 are aligned and mounted on a common drive shaft 37, while the sprocket 34 is mounted on an idler shaft 38 and the sprocket 36 is mounted on idler shaft 39. Thus the chains 29 and 30 are driven synchronously from the shaft 37.

Longitudinally extending plates 40 and 41 are arranged between the longitudinally spaced sprockets and have mounted thereon tracks 42 and 43 upon which are respectively guided chains 29 and 30. A pair of carton supporting guide rails 44, 44 are mounted on the plate 40 and extend longitudinally one on each side of the chain 29, while a pair of carton supporting guide rails 45, 45 are similarly mounted on the plate 41 and extend longitudinally one on each side of the chain 30. The lugs 31 and 32 engage the trailing edge of a flattened carton and adavnce it along the guide rails 44 and 45. It should be appreciated that any number of sets of lugs may be provided on the chains 29 and 30 depending upon the speed thereof and timed relation with respect to the rotary suction wheel 16. And cartons may be delivered onto the inlet end of the conveyer 15 by any suitable mechanism and most likely the cartons will have been delivered thereto from a magazine. In order to preclude the malpositioning of the cartons along the guide rails, holddown bars 46 and 47 are mounted above the guide rails and spaced so that a carton has a track within which to be advanced by the conveyer 15. The holddown bars may be resiliently mounted to a supporting structure if so desired, to accommodate irregularities in the cartons.

The delivering end of the conveyer 15 delivers the flattened cartons to the periphery of the rotary suction wheel 16 as can be seen in FIG. 3. The rotary suction wheel 16 includes a pair of disk-shaped members 48 and 49 secured to a shaft 50 and transversely spaced thereon. A plurality of suction head units 51, 52 and 53 are mounted between the disk-shaped members 48 and 49 as may be seen in the drawings. Each suction head unit includes a plurality of rubber suction cups 54 arranged in alignment transversely of the disk-shaped members and along a plane normal to the path of movement of the cartons so that the line of suction head can grippingly engage a single side wall of a carton. Further, the suction heads are arranged at the leading edge of each unit and are spaced outwardly of the peripheral edges of the disk-shaped members. Moreover, arcuately shaped carton supporting bars 55 and 56 are provided on each suction head unit and extend rearwardly of the line of suction cups 54. These carton supporting arcuate bars are also spaced outwardly of the periphery of the disk-shaped members 48 and 49. While only three suction head units are shown mounted on the disk-shaped members 48 and 49, it should be appreciated that a greater or lesser number may be mounted thereon depending upon the needs of the installation, as long as the suction head units are driven in timed relationship with the conveyer 15. Further, in view of the suction head units 51, 52 and 53 being arranged to protrude from the peripheral edges of the disk-shaped members 48 and 49, circumferentially spaced openings 57, 58 and 59 are defined between the circumferentially and equally spaced suction head units. The shaft 50 also has mounted thereon a drive sprocket 60 over which is trained a drive chain 61 which is driven from the same source of power that drives the conveyer drive shaft 37 so that the rotary suction head wheel 16 is driven in timed relation with the conveyer 15. As may be seen particularly in FIG. 3, the peripheral surfaces of the suction head units are arranged in overlapping relation with the end of the conveyer 15 and so that the path of the cartons defined by the guide rails and holddown bars is slightly below the highest point of travel of the peripheral surface of each suction head unit.

Referring to FIG. 6, the carton is delivered by the conveyer 15 at a time when the leading edge of a suction head unit is moving upwardly so that the carton lower trailing side wall 22 will mate with the line of suction cups 54. Actually, the leading portion of the carton is received in the opening 57 which extends between the suction head units 51 and 52. Preferably, the line of suction cups 54 will engage the lower trailing side panel 22 slightly behind the score line extending between the lower leading side panel 23 and the lower trailing side panel 22.

In order to accommodate any variations in the thickness of the cartons and to compensate for warpage and other manufacturing tolerances, a resiliently biased roller 62 is arranged above the rotary suction wheel 16 to urge the carton down onto the suction heads as the carton and suction heads pass beneath the roller. Actually, the roller 62 need not be resiliently biased but could be gravitationally biased, and may even be made of soft rubber or the like. The drive sprocket 60 is adjustably secured to the shaft 50 so that the rotary suction head 16 may be rotatively adjusted relative to the chain lugs on the conveyer in order to accommodate cartons of various sizes.

The carton 20 is advanced by the rotary suction wheel 16 in the flattened condition until the leading lower side wall or panel 23 engages an expander arm 63 on the second rotary or expander wheel 17. A second expander arm 64 is also mounted on the rotary wheel 17 which is carried on a shaft 65 suitably journaled in a part of the frame. The expander arms 63 and 64 are cantileverly supported on a circular plate 66, FIG. 1, which may be adjustably secured rotationally on the shaft 65. In the embodiment illustrated, the expander arms 63 and 64 are arranged diametrically to each other and eccentrically of the center of the circular plate 66 so that the arms move through a circular path about an axis parallel to the axis of the suction head wheel 16. While only two expander arms are shown on the expander wheel 17, it should be appreciated that any number of arms may be provided so long as they move in timed relation with the suction head units on the suction head wheel. The shaft 65 is thus driven from the same source of power that drives the conveyer 15 and the suction head wheel 16 so that the expander wheel moves in timed relation with the suction head wheel.

Actually, the expander wheel 17 moves at a slower speed than the carton so that the expander arm 63 may freely engage the leading forward side wall 23 of the carton and prevent this side wall from moving downwardly with the lower trailing wall 22 when the suction head wheel tends to move the carton around and downwardly thereof. The restraining force against the lower leading side wall 23 causes the carton to open as shown in FIG. 7, and the action of the expander arm against the lower leading side wall 23 continues until the leading corner 67 defined between the side wall 21 and side wall 23 passes out of the influence of the expander arm 63. During the engagement of the lower leading side wall 23, the expander arm 63 is moving in an arcuate path relative to the wall and the suction head wheel, which path somewhat intersects the path of movement of the suction cups

54 on the suction head wheel 16. Thus the expander wheel 17 coacts with the suction head wheel 16 to open the cartons. Further, it may be noted that the expander arm 63 is in timed relation with the suction head wheel 16 so that it passes in the openings created between the suction head units on the suction head wheel as can be seen somewhat in FIG. 6. The expander wheel 17 rotates in the opposite direction as the suction head wheel 16, so that the expander arms move in the same direction as the suction heads when they coact in opening a carton.

After the leading side wall 23 leaves the influence of the expander arm 63, it will snap over so that the leading corner 67 will initially engage the peripheral edge 68 of the oversquaring and transfer wheel 18. Then the leading side wall 23 will come into engagement with the peripheral edge 68 of the oversquaring and transfer wheel 18 as shown in FIG. 8. The oversquaring and transfer wheel 18, in this embodiment, comprises a pair of disks 69 and 70, FIG. 1, adjustably secured on a rotating shaft 71 journaled at opposite ends in the frame of the machine. A sprocket 72 is carried on the shaft 71 and has a drive chain 73 trained thereover and over a sprocket 74 mounted on the expander wheel shaft 65. Thus, the oversquaring and transfer wheel 18 is driven in timed relation with the expander wheel 17, and the expander wheel shaft 65 is suitably connected in driving relation to the main power source so that it is also driven in timed relationship with the conveyer 15 and the suction head wheel 16. The shaft 71 is also mounted parallel to the expander wheel shaft 65 and the suction head wheel shaft 50, and the peripheral edge 68 of the oversquaring and transfer wheel 18 is spaced closely adjacent the peripheral edges of the suction head units 51, 52 and 53 as can be particularly seen in FIGS. 6 and 8, there being just enough room to permit passage of the carton in flattened condition therethrough. When the carton passes between the oversquaring and transfer wheel 18 and the suction head wheel 16, it will be in reversely closed condition or in other words, be in oversquared condition. The suction heads 54 will continue in gripping engagement with the side wall 22 until the leading edge of the carton is received in a track 75 defined by the peripheral edge 68 of the oversquaring and transfer wheel 18 and an arcuate guide bar 76 which is mounted in spaced relationship with the periphery of the oversquaring and transfer wheel 18, FIGS. 3 and 6–9. The leading edge of the carton that enters the track 75 may be defined by the numeral 77, FIG. 8, which is the score line or corner fold between the walls 22 and 23 of the carton.

After the suction heads 54 release the carton, the frictional engagement between the peripheral edge 68 of the oversquaring and transfer wheel 18 and the peripheral edge of a suction head unit will continue to drive the carton in a direction downwardly and into the track 75. The oversquaring and transfer wheel 18 rotates in the opposite direction of the suction head wheel 16 and in the same direction as the expander wheel 17. Thus, the periphery of the oversquaring and transfer wheel moves in the same direction as the suction heads during the oversquaring of a carton.

The coaction between the suction head wheel 16 and the oversquaring and transfer wheel 18 serves to oversquare the carton and to convey the carton into the track 75 and between the periphery of the oversquaring and transfer wheel 18 and the guide rail or guide bar 76. In order to positively advance the carton to the bucket conveyer 19, sets of lugs 78, 79 and 80 are mounted on the oversquaring and transfer wheel 18 to advance the carton in oversquared condition along the track 75. The lugs are arranged in pairs and in alignment with each other on the disks 69 and 70.

The inlet end of the bucket conveyer 19 is arranged tangentially of the overquaring and transfer wheel 18 and slightly below thereof so that the cartons may be delivered directly thereto by the transfer wheel. The bucket or pocket conveyer 19 includes a plurality of chains 81, three in number in this embodiment. A plurality of spaced pockets or buckets 82 are arranged along the conveyer chains and defined by forward and rearward upstanding arms 83 and 84, respectively. The chains 81 are trained around sprockets 85 at the inlet end and below the oversquaring and transfer wheel 18, all of which are mounted on and rotatable with a drive shaft 86. The drive shaft 86 is also provided with a sprocket 87 thereon having trained thereover a drive chain 88 which is also trained on a sprocket 89 mounted on the feed conveyer shaft 39. Thus, the conveyer 19 which receives the cartons from the transfer wheel is driven in timed relation with the conveyer 15 which delivers the flattened cartons to the suction head wheel 16. The upstanding arms are arranged so that the buckets 82 may be adjusted as to size to accommodate various sizes of cartons.

As is well known with a chain type bucket conveyer as the conveyer 19, the buckets 82 open up when the upstanding arms 83 and 84 travel around the sprocket 85, as can be seen particularly in FIGS. 3 and 8. Actually, the bucket is in partially open position when the carton is delivered thereto.

The guide rail 76 is arcuately formed and diverges at the conveyer 19 to define the lowermost guide rail along which the cartons are moved. An upper guide rail 90 defines the upper limits of the cartons and extends from the discharge end of the oversquaring and transfer wheel 18, as seen particularly in FIG. 8 to define a mouth 91 into which the cartons are delivered. Inasmuch as the carton is in oversquared condition when it is delivered into the bucket 82, it will pop open as shown in FIG. 9, after which the upper guide rail 90 will move closer to the lower guide rail 75 and ultimately arrange the carton in squared condition for receiving its contents.

In order to aid in the initial opening of the cartons, a cam or bar 92 is mounted to rotate with one of the end sprockets on the conveyer 15 as seen in FIGS. 1 and 10. This cam engages a closure flap on one end of each carton as it passes over the sprocket. Actually, the cam is not needed for larger cartons, but is somewhat useful for cartons of small size.

The carton opening and oversquaring apparatus of the present invention is capable of handling cartons of various sizes as already stated. To change the apparatus for handling a carton of another size, various adjustments must be made. As heretofore stated, various elements are adjustably mounted, including the rotational adjustment of the suction head wheel 16, the expander wheel 17 and the oversquaring and transfer wheel 18. Further, the conveyer buckets 82 may be adjusted as to size. This versatility renders the apparatus more suitable for wide usage.

Therefore, it should be appreciated that the apparatus of the present invention not only opens and oversquares the cartons, but also delivers the carton in oversquared condition into a bucket on a bucket conveyer. The absence of any reciprocating motions provides smooth action for the opening and oversquaring functions and thereby enables much faster operation. Further, a more positiveness of action is provided by the present invention.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention, but it is understood that this application is to be limited only by the scope of the appended claims.

The invention is hereby claimed as follows:

1. Apparatus for opening and oversquaring flattened cartons having leading and trailing sidewalls, said apparatus comprising,

means for successively conveying horizontally arranged flattened cartons along a rectilinear path in a direction normal to the longitudinal axis of the cartons,

a first rotary wheel positioned below the rectilinear

path of said conveying means rotating about an axis normal to the path of the cartons and in the same direction and having its periphery intersecting said path and receiving the cartons thereon,

suction means on the periphery of said wheel and said wheel being synchronized with said conveying means so that the suction means grips the lower trailing side wall of a carton,

a second rotary wheel adjacent said first rotary wheel and rotatable about an axis parallel to the axis of rotation of the first wheel,

a plurality of expander arms extending above and parallel to the axis of said first rotary wheel and being circumferentially spaced on said second wheel,

each expander arm movable in synchronized relation to a suction gripping means and freely engaging the lower leading side wall of a carton gripped by said suction means to coact therewith and open each carton,

and an oversquaring wheel rotatable about an axis parallel to the wheel axes and adjacent to said first wheel to engage the leading corner of a carton gripped by said wheel and coact with said wheel to oversquare the carton.

2. The apparatus as defined by claim 1, wherein said suction means includes a plurality of suction gripping heads circumferentially spaced on said first rotary wheel.

3. The apparatus as defined by claim 1, and means for resiliently biasing each successive carton against said first rotary wheel to assure the necessary contact between the carton and said suction means.

4. The apparatus as defined by claim 1, and a bucket conveyer arranged below said oversquaring wheel and driven in synchronized relation therewith, a track between said oversquaring wheel and the bucket conveyer through which the oversquared carton is driven, and lugs on said oversquaring wheel to drive the carton through said track to said bucket conveyer.

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