

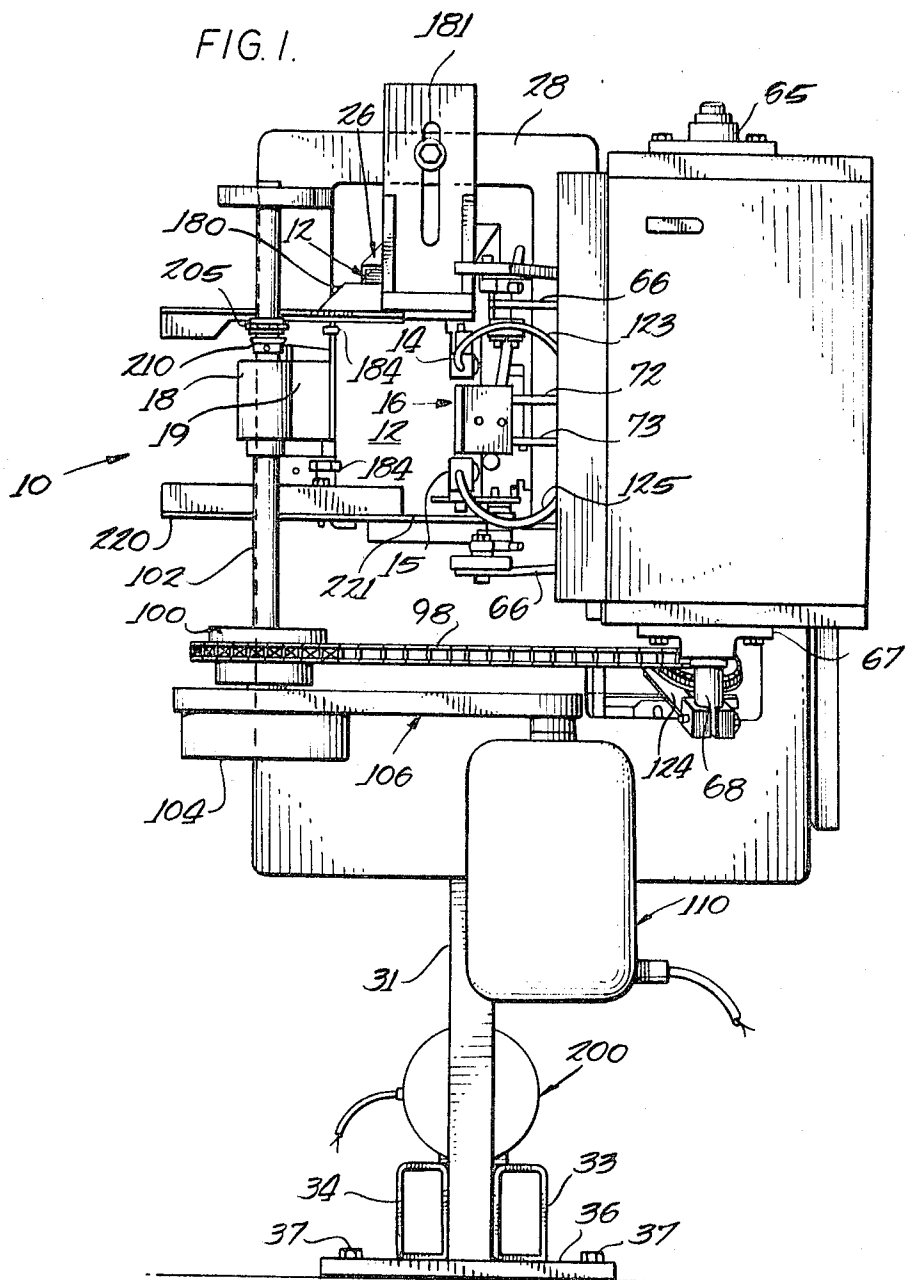
July 22, 1969

R. K. GALLOWAY
APPARATUS FOR TRANSFERRING ARTICLES FROM
ONE STATION TO ANOTHER

3,456,816

Filed Dec. 1, 1965

8 Sheets-Sheet 1



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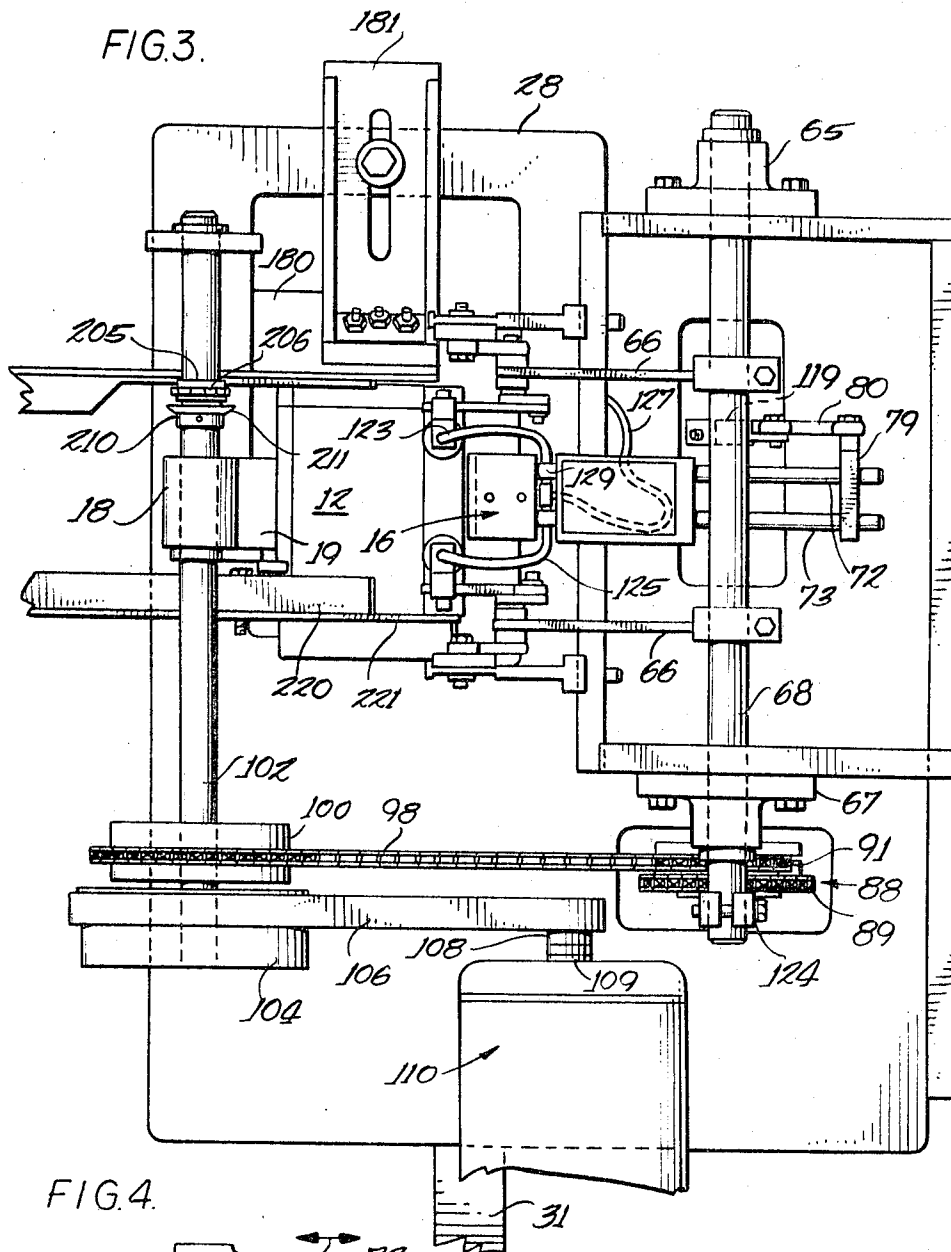
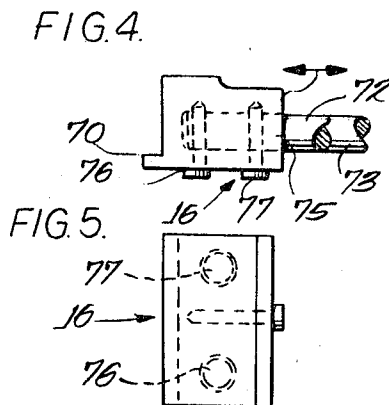
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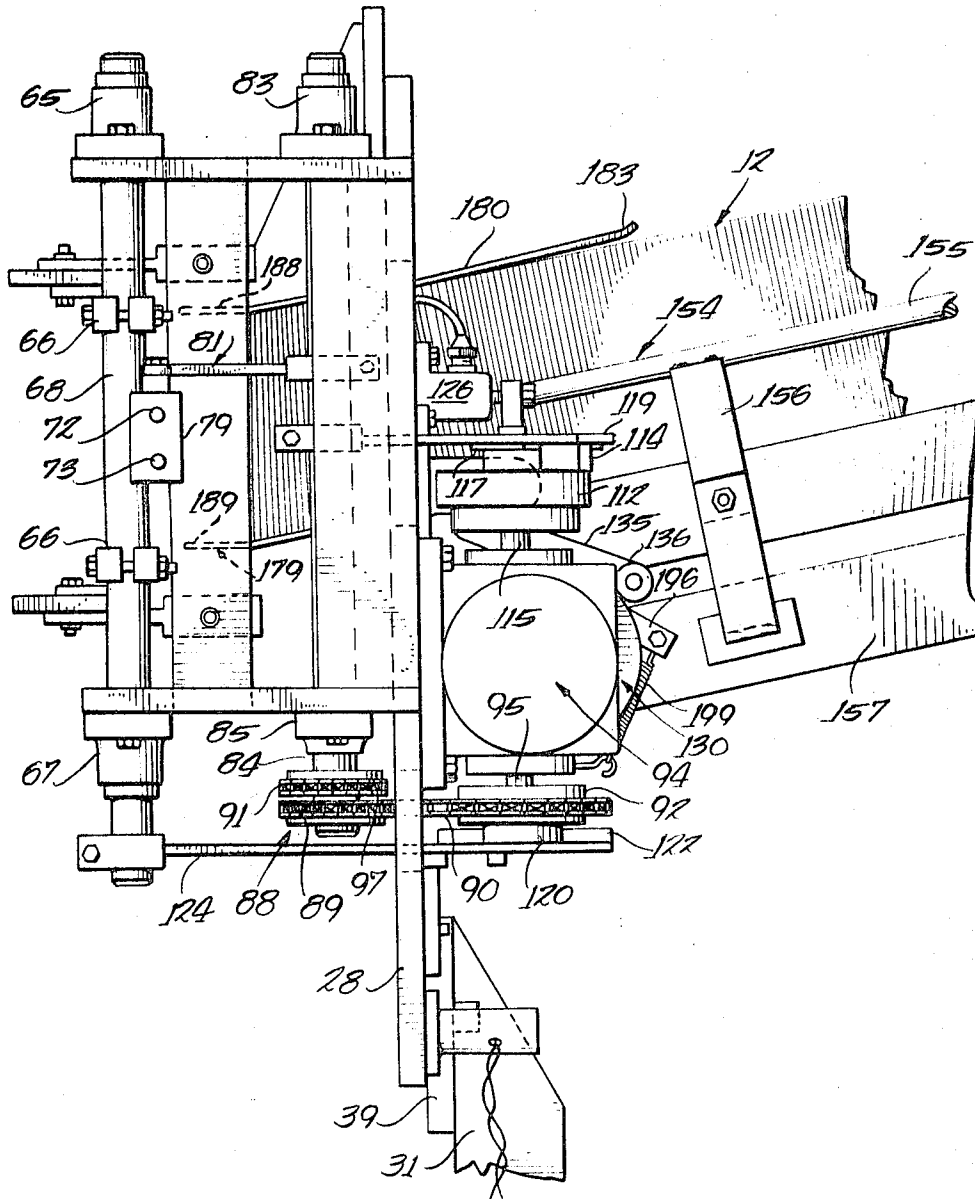
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FIG. 8.



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FIG. 9.

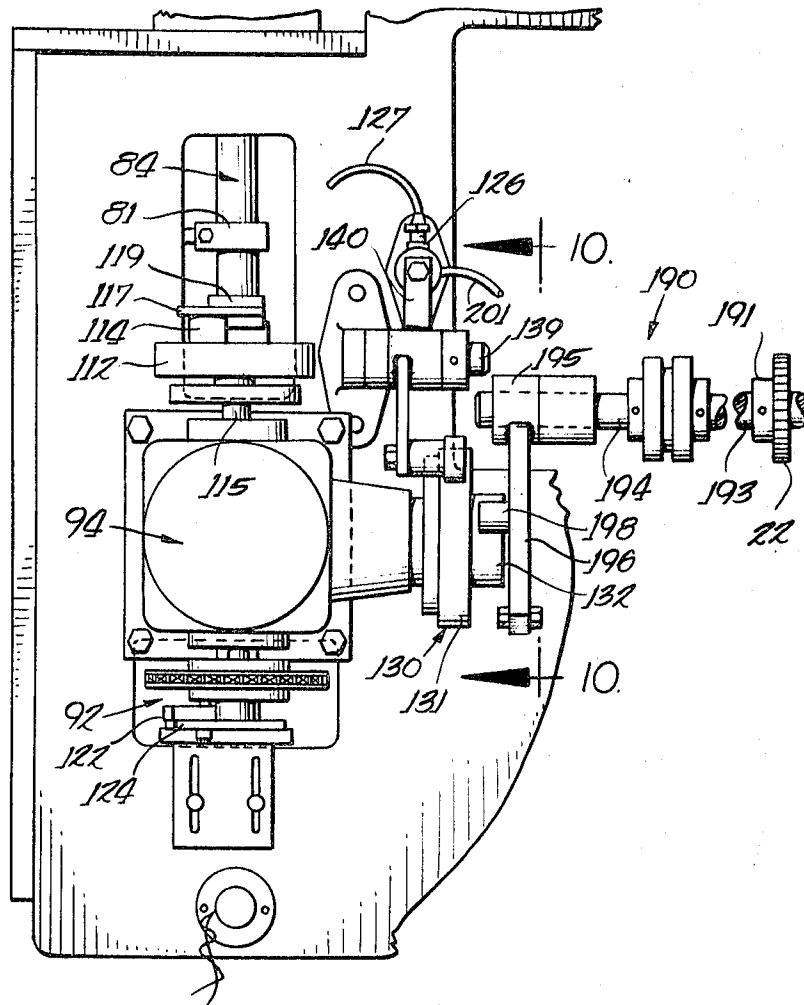
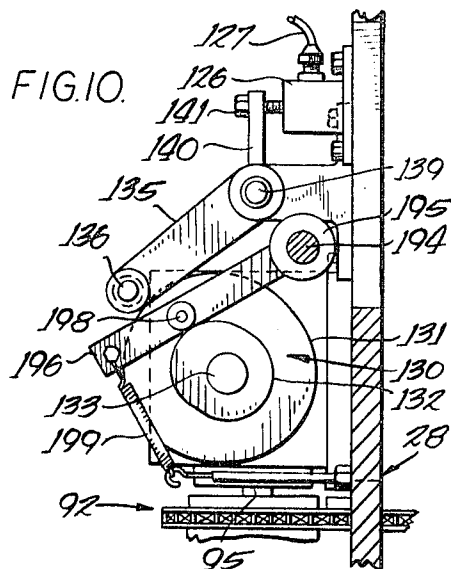


FIG. 10.



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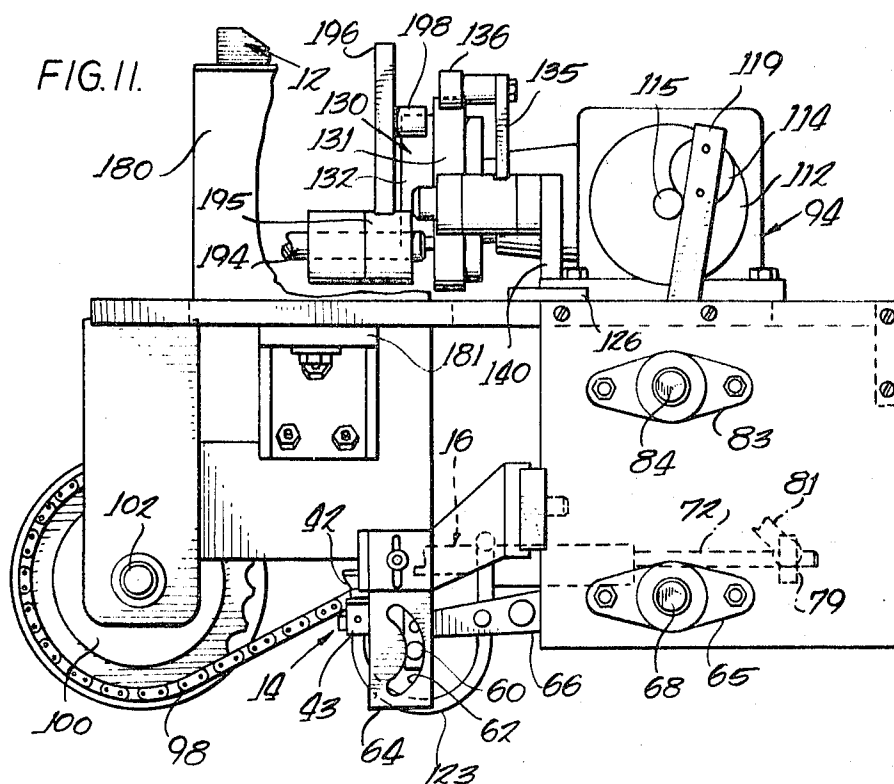
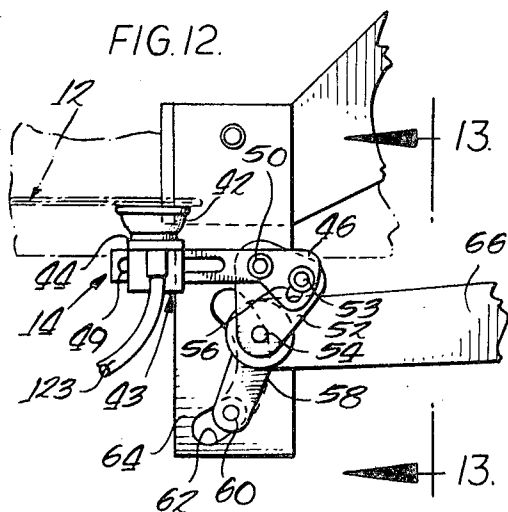
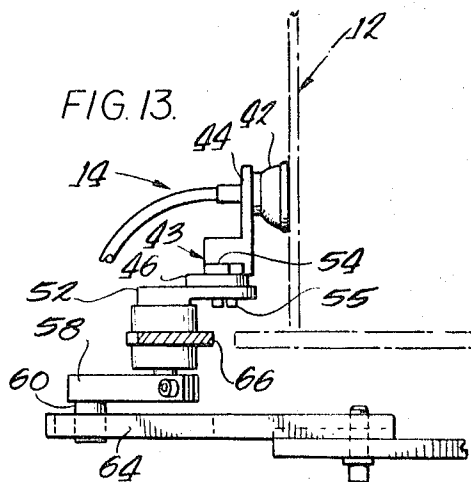
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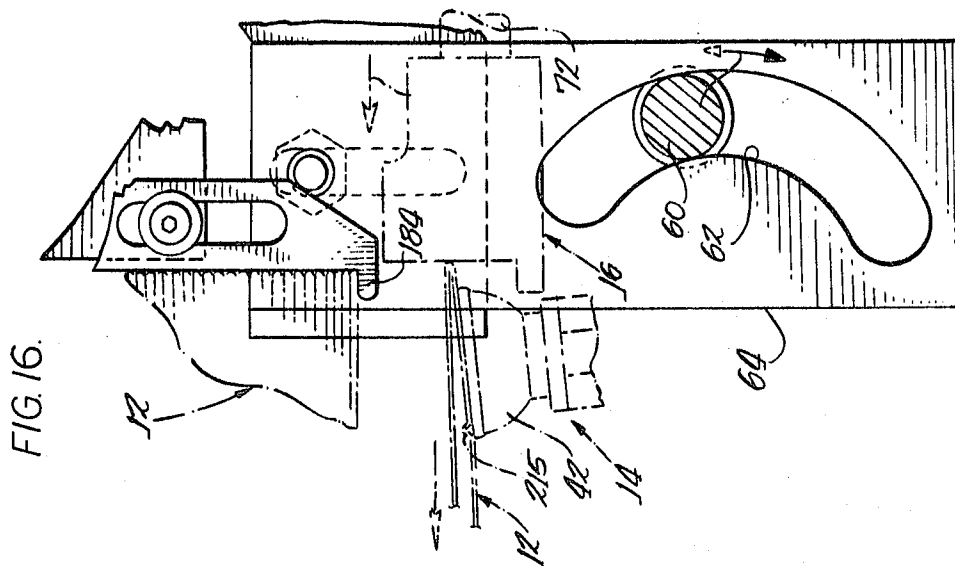
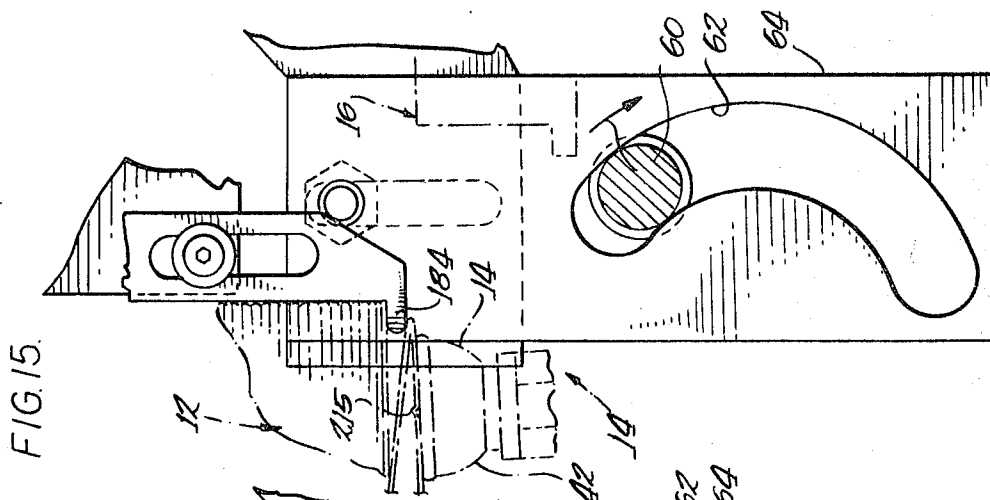
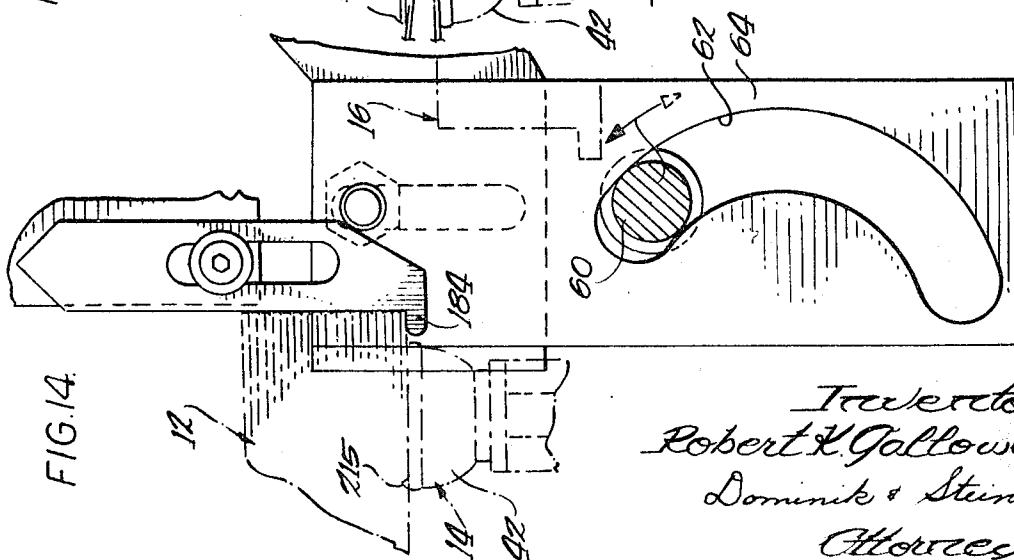
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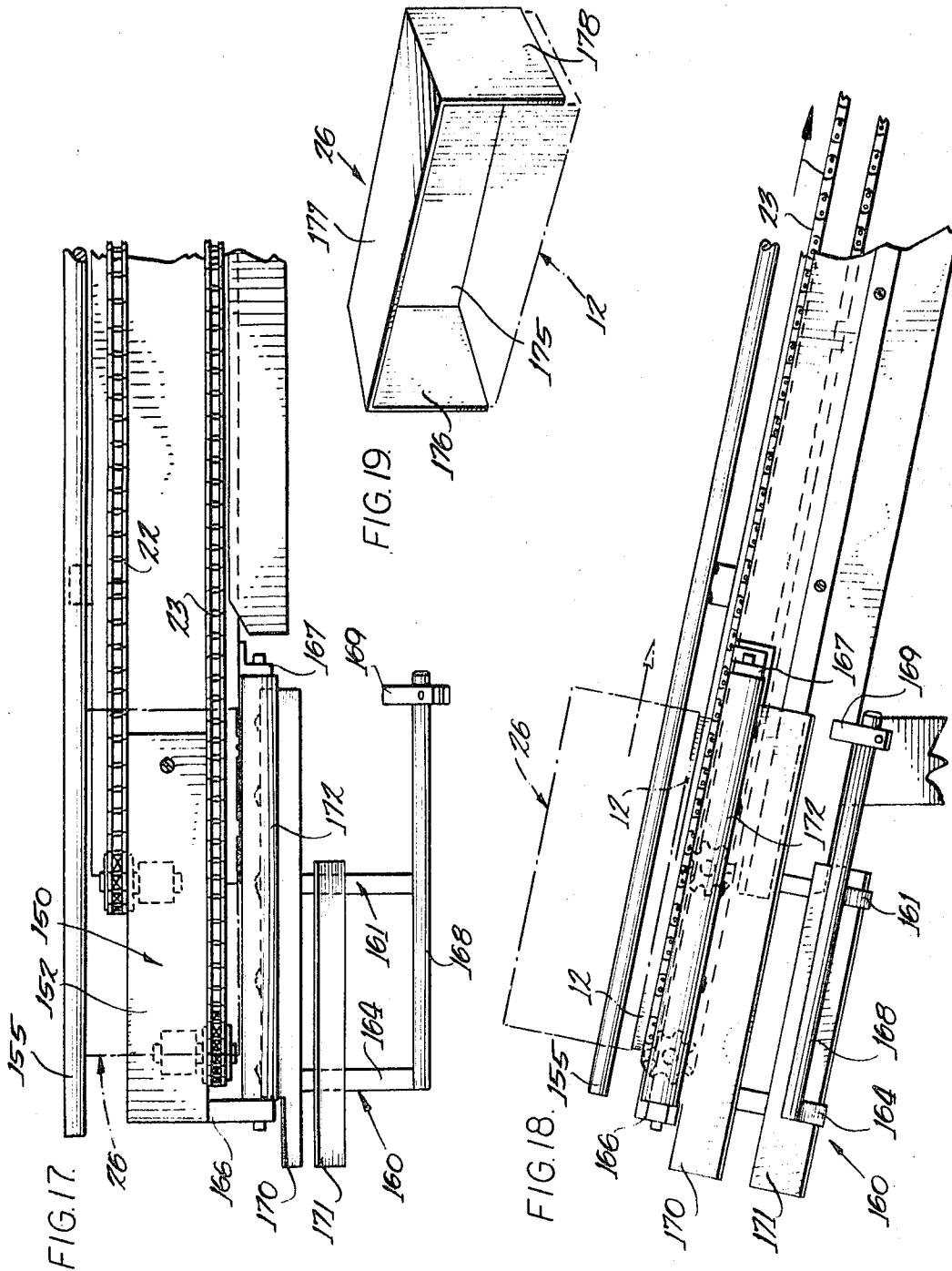
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Filed Dec. 1, 1965

8 Sheets-Sheet 8



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3,456,816

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Filed Dec. 1, 1965, Ser. No. 510,840

Int. Cl. B65g 47/91, 47/06, 47/57

U.S. Cl. 214—8.5

15 Claims

2

ABSTRACT OF THE DISCLOSURE

Apparatus and method for transferring articles comprising spaced apart vacuum heads with pusher means passing between such heads to yield high speed transfer of such articles.

The invention is particularly adapted, and is herein-after described, for use in transferring collapsed cartons, such as frozen food cartons, from a supplied source of cartons to apparatus for erecting and for filling them. It will be apparent from the description, however, that the method of the invention is equally applicable for transferring any type of flat articles which must be individually handled for a subsequent operation. For example, the method may be used for transfer carton blanks to apparatus for cutting and for forming the blanks into cartons.

Many different types of apparatus for transferring flat articles, in particular, collapsed cartons, have been designed. Each of them, however, has been generally unsatisfactory, for one reason or another. For example, most of them have been too slow in operation in comparison to the operation of the subsequent apparatus with which they are used. The subsequent apparatus, therefore, cannot be operated at full capacity. Also, most of them are designed for only one particular application and therefore cannot be used for others or, for that matter, with cartons of different sizes. And still, most of them are rendered inoperative, due to jamming for example, when irregular cartons are encountered during the transfer operation.

Accordingly, it is an object of the present invention to provide improved methods and apparatus for transferring flat articles, such as carton blanks, collapsed cartons and the like, in a rapid and continuous fashion, from one station to another.

It is a further object to provide improved methods and apparatus for conveying flat articles to the transfer mechanism of the apparatus. In this respect, a new and improved magazine and magazine loader is contemplated, both of which are effective to increase the handling capacity of the apparatus, with a substantial reduction in the manual labor generally required with other related types of apparatus.

It is a still further object to provide an improved transfer mechanism for the transfer apparatus, which transfer mechanism employs a vacuum operation to effect the transfer of individual ones of the articles.

It is a still further object to provide improved apparatus of the above generally described type which is adaptable for use in different applications and, in particular, with flat articles of different sizes.

It is a still further object to provide improved apparatus of the type described which is self-contained, having its own source of power, and which is easily adapted for use with different types of subsequent apparatus.

It is a still further object to provide an improved transfer mechanism which is operable to pre-break defective glue seams by partially opening all cartons before feeding the cartons to a subsequent position to preclude malfunctioning in filling.

It is a still further object to provide improved transfer apparatus wherein the movement of the flat articles is accelerated to the feed speed of the apparatus, to prevent destruction or disfigurement of the flat articles during the transfer operation.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The above objectives are accomplished by, generally, continuously feeding the flat articles into a transfer mechanism employing a vacuum operation to release individual ones of the articles and transferring the individual articles into a pair of counter-rotating yieldable rollers which pass them to the subsequent apparatus with which the transfer apparatus is used.

The transfer apparatus, in the disclosed embodiment, includes an inclined conveyor having a magazine loader into which either the flat articles or a specially designed loading magazine containing the flat articles can be loaded for rapid delivery onto the conveyor.

The flat articles are fed to the transfer mechanism which includes a pair of vacuum heads adapted to engage the exposed faces of the articles and to release individual ones of them from the stack on the conveyor. The articles are presented to the vacuum heads in a plane parallel with them, through the cooperative action of a restriction plate which engages and restricts the movement of the upper edge of the articles and a pair of chain belts which engage and advance the movement of the lower edge of the articles. A pushing head passes the individually released articles to a pair of counter-rotating yieldable rollers which, in turn, pass them on to the subsequent apparatus.

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others and the apparatus embodying features of construction, combination of elements and arrangement of parts which are adapted to effect such steps, all as exemplified in the following detailed disclosure, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

FIG. 1 is a front perspective view of the transfer apparatus;

FIG. 2 is a side perspective view of the transfer apparatus of FIG. 1;

FIG. 3 is a partial front view of the transfer apparatus, illustrating the transfer mechanism and its associated linkage.

FIGS. 4 and 5 are a top and a side view, respectively, of the pushing head;

FIGS. 6 and 7 are a top and a side view, respectively, of an alternate construction of a pushing head;

FIG. 8 is a partial side view illustrating the linkage and driving arrangement for the transfer mechanism;

FIG. 9 is a partial view of the back side of the transfer apparatus illustrating the driving arrangement for the transfer mechanism and for the chain belt;

FIG. 10 is a partial side view of the chain belt driving mechanism;

FIG. 11 is a partial top view of the transfer apparatus, partially sectioned to illustrate the drive for the chain belt and the transfer mechanism;

FIGS. 12 and 13 are a partial top and side view illustrating the vacuum heads and a portion of the linkage for driving them;

FIGS. 14, 15 and 16 are enlarged diagrammatic views illustrating the operation of the vacuum heads and their linkages, in releasing a carton;

FIGS. 17 and 18 are a partial top and side view, respectively, of the transfer apparatus, illustrating the conveyor and its magazine loader; and

FIG. 19 is a perspective view of a loading magazine.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now to the drawings, in FIG. 1 there is shown a transfer machine 10 which is particularly adapted to feed collapsed cartons such as frozen food cartons to other apparatus for, for example, erecting and for filling them. Individual ones of the cartons 12 are seized by a transfer mechanism 13 having a pair of vacuum heads 14 and 15, pulled from the stack and delivered to a pushing head 16 which then pushes the carton between a pair of counter-rotating rollers 18 and 19. The rollers 18 and 19 pass the carton to the subsequent apparatus.

The cartons are fed to the transfer mechanisms 13 along an inclined conveyor 20 (FIG. 2). A restriction plate 180 is positioned atop the cartons near the end of the conveyor 20, and is engaged by the upper end of the cartons to restrict their forward movement. A pair of chain belts 22 and 23 (FIG. 17) are positioned on the track 150 of the conveyor 20, and are engaged by the lower edge of the cartons. The chain belts 22 and 23 are intermittently advanced and function to advance the lower edge of the cartons slightly ahead of their upper edges so that the cartons are generally in a plane parallel with the vacuum heads 14 and 15 of the transfer mechanism 13 by the time they reach the end of the conveyor and can be easily seized by them.

A unique magazine loader 24 is provided for the conveyor 20 which permits cartons which are stacked in a specially designed loading container or magazine 26 to be placed in mass on the conveyor. The loading magazine 26 can be provided integrally with a shipping carton which is pre-formed so that upon opening the shipping container the cartons are ready to be loaded onto the magazine loader 24. Alternatively, the loading magazine 26 can be fabricated of metal or a sturdy plastic for a more permanent use. The cartons 12 are left in the loading magazine 26 until its leading edge is adjacent the upright frame 28 of the feeding machine 10. The cartons 12 retained within the loading magazine 26 also function as weights to assist in pushing the balance of the cartons 12 toward the end of the conveyor so that the weights which were generally used in the past can be eliminated. The loading magazines therefore have a dual function of loading the cartons on the conveyor 20 and of weights for assisting in advancing the cartons.

More specifically, the feeding machine 10 is supported on a base which may include a pair of spaced upright supports 30 and 31 and a pair of horizontally disposed supports 33 and 34 fixedly secured to the opposite sides of the supports 30 and 31. A pair of fastening plates 35 and 36 may be secured to the base of the upright supports 30 and 31, respectively, for securing the feeding machine 10 to the floor by means of fastening means, such as the threaded bolts 37.

The transfer machine is adjustably secured to the upright supports 30 and 31, so that the height of the transfer machine and the angular position of the inclined conveyor 20 can be easily and quickly adjusted. This can be accomplished by fixedly securing plates 39 (FIG. 2) having elongated apertures 40 formed therein to the upper end of the upright supports 30 and 31. Threaded bolts 41 are passed through the upright frame 28 of the feeding machine 10 and the frame of the conveyor 20 and the apertures in the plates 39 to adjustably secure them to one another. Of course, many other arrangements can be used also.

The conveyor 20 for delivering cartons to the transfer mechanism 13, as can be best seen in FIGS. 2, 17 and 18, has a flat base or track 150 and a guard rail 154 which may be a rod 155 supported some distance above the track 150 by vertically disposed supports 156 (one shown)

affixed to a side wall 157. The guard rail 154 extends along the length of the track 150, along its one side, and functions to prevent cartons from falling off the track and to keep them substantially aligned with one another, at least along the edges which engage the guard rail. The chain belts 22 and 23 are spaced apart and ride on the track 150. A flat plate 152 is positioned between them, at the upper end of the track and has a thickness which substantially corresponds to the thickness of the chain belts 22 and 23. The cartons therefore rest on the plate 152 and will advance more rapidly to abut the preceding cartons on the conveyor.

The magazine loader 24 (FIGS. 17 and 18) is pivotally affixed along the side of the track 150, at its end. The magazine loader 24 includes a pair of spaced L-shaped bars 161 and 164 which have the ends of one pair of the arms thereof pivotally affixed to the side of the track 150 by a pair of brackets 166 and 167, respectively. The ends of the other arms 164 and 161 thereof have a rod 168 fixedly secured between them. A stop 169 is affixed to one end of the rod 168, and is adapted to both retain a loading container 26, or cartons, on the magazine loader 24 and to engage the track 150 when the magazine loader 24 is pivoted in the manner described below. Also secured across the top of arms 162 and 163 of the bars 160 and 161, in spaced relation, are a pair of flat plates 170 and 171 for supporting the loading containers 26 placed in the magazine loader 24. Above the plates 170 and 171 is a roller 172 for assisting in placing the loading containers 26 onto the track 150 of the conveyor. While reference is made to placing loading containers 26 on the magazine loader 24, it is apparent that cartons can also be stacked on it and placed onto the track 150.

The magazine loader 24 is preferably normally disposed at an angular position with respect to the vertical axis of the transfer machine 10 so that it can be more easily loaded and the weight of a loading container 26 bears toward the conveyor 20, to prevent the loading container from accidentally falling off of the loader.

The loading containers 26 (FIG. 19) resemble a rectangular-shaped carton having the top and one side wall removed so that only a bottom wall 175 and three side walls 176-178 remain. The cartons 12 are stacked in the loading containers inverted from the ultimate desired position in which they are fed on the conveyor 20. A date code may be placed on either the front or the back of the cartons, as desired, in a manner described below, and the cartons are accordingly placed in the loading containers so that they are properly fed to achieve this result. It may also be noted that the walls of the loading containers are preferably substantially shorter in length than the cartons so that the edges of the cartons are exposed. With this construction, the loading containers are easier to load and will not interfere with the operation of the conveyor 20.

As indicated above, the loading containers 26 may be of metal, heavy plastic or the like for repeated use. In such a case, the cartons are removed from their shipping boxes and stacked in the loading containers. On the other hand, the shipping boxes may be advantageously preformed with serrated lines or a pull thread or the like so that a portion of the box can be easily and quickly removed to provide a loading container 26 of the construction shown. Of course the shipping boxes can be cut to provide a loading container, however, the cartons therein may be damaged in the process.

In operation, a loading container 26 is placed on the magazine loader 24, with the walls 175-178 resting against the loader so that the exposed edges of the cartons 12 face away from the conveyor 20, as illustrated in FIG. 2. The forward edge of the loading container 26 will rest against the stop 169. The magazine loader 24 is then pivoted about the brackets 166 and 167, to position the loading container on the track 150, atop the

chain belts 22 and 23 and the plate 152. The magazine loader is next returned to its normal loading position and, in doing so, the loading container 26 is freed from the stop 169. The loading container 26 will advance quite rapidly to abut the cartons preceding it since the plate 152 supports them slightly above the chain belts 22 and 23 so that the latter do not restrict their motion to any degree.

The loading container 26 is advantageously left about the cartons 12 since it will function as a weight or biasing means to urge the cartons forward on the conveyor. In the past, additional weights or biasing means of some type normally had to be used for this purpose, however, they may now be eliminated. When there is sufficient space on the conveyor for another loading container, the one nearest the upright frame 28 of the transfer machine 10 is removed, to permit the cartons to advance to the end of the conveyor.

As soon as the magazine loader is returned to its loading position, another loading container 26 can be loaded onto it. When there is sufficient space on the conveyor, the magazine loader can be again pivoted to position the loading container on the conveyor 20. The cartons can therefore be easily and quickly loaded on the conveyor to maintain a constant delivery of them to the transfer mechanism 13. In addition, a ready supply can be maintained on the magazine loader 24.

While it is preferred that a loading container 26 be used because of the above described advantages provided by it, the cartons also can be stacked on the magazine loader 24 and positioned on the conveyor 20. Rapid loading can still be provided in this manner.

As the cartons on the conveyor 20 approach its end, their upper edges engage a substantially rectangular shaped restriction plate 180 (FIGS. 3 and 8) positioned above the track 150, in a plane substantially parallel with it. The restriction plate 180 is fixedly secured to and supported by a supporting plate 181 which is adjustably secured to the upright frame 28 of the feeding machine 10 so that the restriction plate 180 can be positionably adjusted to a height whereby the movement of the upper edges of the cartons 12 can be restricted. The leading edge 183 of the restriction plate 180 may be slightly angled upwardly, so that the cartons can easily pass beneath it, and its end 188 is bent so that it extends perpendicularly to a vertical plane through the vacuum heads 14 and 15 of the transfer mechanism 13. A feeder plate 179 (FIG. 8) is fixedly secured to the end of the track 150 and its end 189 is likewise bent so that it is parallel with the end 188 of the restriction plate 180. The distance between the ends 188 and 189 should be just slightly less than the cartons, as fed therebetween, for best operation of the transfer machine 10, as explained more fully below.

The chain belts 22 and 23 engage the lower edges of the cartons and function to advance them on the conveyor 20, after leaving the plate 152. As the cartons pass under the restriction plate 180 and their upper edges engage its lower surface, the forward motion of the upper edges is restricted. The lower edges of the cartons, however, are engaged and intermittently urged forward by the chain belts 22 and 23 so that the lower edges are advanced more rapidly than the upper edges. As the cartons advance between the ends 188 and 189 of the restriction plate 180 and the feeder plate 179, they will have been caused to assume a vertical position, parallel to the vacuum heads 14 and 15.

The restriction plate 180, in conjunction with the chain belts 22 and 23, therefore, functions to assure that the cartons 12 are delivered to the vacuum heads 14 and 15 in a plane parallel with the vacuum heads, so that the edges of the vacuum heads are pressed flatly against the cartons and a good seal is provided between the vacuum heads and the cartons. As will be apparent from the description below, this is essential to the proper operation of the feeding machine.

The supporting plate 181 for the restriction plate 180 is adjustably secured to frame 28 of the feeding machine 10 so that the restriction plate can be positionably adjusted to function with different size cartons. The supporting plate 181 may have an elongated slot formed in it, for receiving a threaded bolt which is threadably received in the frame 28. Alternatively, the supporting plate 181 may be provided with micrometer type adjusting means so that it can be easily and quickly positionably adjusted.

Intermittent movement of the chain belts 22 and 23 is provided by a sprocket clutch 190 which is cam operated. The gear 191 for driving the chain belts 23 and 24 is fixedly secured to a shaft 193 secured for rotation within the frame of the conveyor 20. The end of the shaft 193 is secured to the sprocket clutch 190. Another shaft 194 is secured to the opposite side of the sprocket clutch 190 and has a collar 195 fixed about it. A lever arm 196 has one end secured to the collar 194 and has a cam 198 which is adapted to engage a cam surface 132 on a cam wheel 130. The cam wheel 130 is fixed to and rotated by an output shaft 133 of a gear box 94. Biasing means such as a spring 199 is secured to the lever arm 196 and to the frame 28 for urging the cam 198 against the cam surface 132. As the cam wheel 130 is rotated, the cam 198 being in engagement with the cam surface 132 causes the lever arm 196 to pivot up and down (as shown in FIG. 6) to operate the sprocket clutch 190. The sprocket clutch, in turn, intermittently rotates the driving shaft 193 through a predetermined number of degrees, thereby causing the chain belts 22 and 23 to be intermittently advanced. The lower edges of the cartons 12 being in engagement with the chain belts, are urged forward, while the upper edges are restricted by the restriction plate 180.

A pair of stops, such as the stop 184 (FIG. 1), are secured along each side of the conveyor 20 at its end. The stops are each generally L-shaped having a leg approximately $\frac{1}{8}$ to $\frac{1}{4}$ inch in length which is adapted to engage the cartons and to prevent them from moving forward. When engaged against the stops, the individual cartons are pulled free of the stops by the vacuum heads 14 and 15 of the transfer mechanism 13 and subsequently pushed by the pushing head 16 between the rollers 18 and 19, in the manner described below.

The transfer mechanism 13, as indicated, includes the vacuum heads 14 and 15, a pushing head 16, a pair of rollers 18 and 19 and the associated linkage for operating them. The linkages for the vacuum heads 14 and 15 are identical in construction, except that the linkage for the vacuum head 14 is preferably inverted, as illustrated in FIG. 3, for ease of construction and operation. As can be best seen in FIGS. 12 and 13 wherein the vacuum head 14 is shown, each of them consists of a vacuum or suction cup 42 affixed to a vertically disposed arm 44 of an L-shaped bracket 43. As indicated above, the vacuum heads are in a plane parallel with the cartons 12. The bracket 43 is adjustably secured to one end of a crank arm 46, by a fastener such as the threaded bolt 55. The bolt 55 is extended through an elongated slot 49 in the crank arm 46 and threadably received in an aperture (not shown) in the bracket 43. The position of the bracket 43 and hence the suction cup 42 can be positionably adjusted by moving the bolt 55 in the slot 49 so that the suction cup 42 engages the carton 12 to provide the most efficient feed.

The opposite end of the crank arm 46 is pivotally affixed by a pivot pin 50 to a plate 52 which is fixedly secured to one end of a pivot shaft 54. However, the crank arm 46 is also prevented from pivoting by a fastener such as the threaded bolt 53 which is passed through an arcuate aperture 56 in the crank arm 46 and secured by a nut 55. With this arrangement, the crank arm 46 can easily be adjusted so that the rim of the suction cup 42 is pressed flat against the cartons 12.

The opposite end of the pivot shaft 54 is fixedly secured to one end of another crank arm 58 having a cam 60. The cam 60 is engaged within an arcuate cam slot 62 in a cam plate 64, and is oscillated back and forth therein by a rocker arm 66. Rocker arm 66 is rotatably secured at its one end to the pivot shaft 54 and is fixedly secured at its opposite end to a vertically disposed drive shaft 68 (FIG. 3) secured within bearing assemblies 67 and 68.

The pushing head 16, as can be best seen in FIGS. 4 and 5 is substantially rectangular in shape, having a lip 70 extending from and along one side thereof. The pushing head 16 is affixed to the ends of a pair of rods 72 and 73, and for this purpose, may have rod receiving cavities (not shown) and a slot 75 formed therein. The ends of the rods 72 and 73 are inserted in the cavities and securely clamped therein by threaded bolts 76 and 77 which function to close the slot 75.

The opposite ends of the rods 72 and 73 are fixedly secured within a rod support block 79 and are adjustable to properly position the pushing head 16 to engage the cartons 12 removed by the vacuum heads 14 and 15. One end of a lever arm 80 is pivotally secured to the block 79 and its other end is pivotally secured to an apertured flange portion 82 of clamp 81. The clamp 81 is fixedly secured to another vertically disposed shaft 84 secured for rotation within bearing assemblies 83 and 85 (FIG. 8).

The shaft 84 has a double gear assembly 88 having gears 89 and 91 thereon freely retained on its lower end so that it may rotate on the shaft 84. The gear 89 is coupled by a gear chain 90 to a gear 92 secured to an input shaft 95 of the gear box 94.

The gear 91 is coupled by a gear chain 98 to a gear 100 (FIG. 3) secured to the shaft 102 which carries the roller 18. Secured to the lower end of the shaft 102 is a friction wheel 104 which is coupled by a belt 106 to another friction wheel 108. The friction wheel 108 is affixed to the output shaft 109 of a motor 110 which is preferably an electric motor. The motor 110 drives the shaft 102 via the belt 106 and the friction wheels 104 and 108. The rotation of the shaft 102 is, in turn, coupled via the gear chain 98 and the gears 91 and 100 to the gear assembly 88. The rotation of the gear assembly 88 is, in turn, coupled to the input shaft 95 of the gear box 94. The output of the gear box 94 functions to drive the conveyor 20, as explained, as well as remaining components of the transfer machine 10, as will be evident from the description which follows. It may therefore be noted that only a single source of power is required to operate the transfer machine 10.

Secured to an output shaft 115 of the gear box 94 is a wheel 112 having a cam wheel 114 eccentrically and rotatably affixed to it (FIGS. 8 and 11). The gear box 94 translates the input of the input shaft 94 and applies it to the output shaft 115 to rotate the wheel 112. The cam wheel 114 has a cam slot (not shown) formed therein and a slider block 117 is slidably retained in the cam slot. One end of a rocker arm 119 is fixedly secured to the slider block 117 and its other end is fixedly secured to the shaft 84. As the wheel 112 is rotated, the slider block 117 in the eccentrically mounted cam wheel 114 slides in the cam slot and follows its movement to cause the rocker arm 119 and hence the shaft 84 to oscillate back and forth, through predetermined angular positions. The movement of shaft 84 is coupled by the lever arm 80 to the rods 72 and 73, to move the pushing head 16 in a reciprocating fashion.

A similar cam wheel 120 having a slider block 122 slidably retained within a cam slot (not shown) formed in it is eccentrically secured to the gear 92. A rocker arm 124 has one end of its ends secured to the slider block 122 and its other end secured to the drive shaft 68. The drive shaft 68 is therefore rotated back and forth in much the same fashion as the shaft 84, as the gear 92 is rotatably driven. The rotary motion of the shaft 68 causes the lever

arms 66 to pivot back and forth, and this movement of the lever arms 66, in turn, moves the vacuum heads 14 and 15 to engage the cartons 12.

Vacuum is supplied to the vacuum heads 14 and 15 through a pair of vacuum lines 123 and 125 coupled to a junction 129 which is, in turn, coupled by a vacuum line 127 to a vacuum breaker valve 126 (FIGS. 8 and 9). A vacuum source (not shown) is also coupled to the breaker valve 126. The breaker valve 126 is operated to supply vacuum to the vacuum heads 14 and 15 by a lever arm 135 having a cam 136 which is adapted to engage the cam surface 131 on the cam wheel 130 affixed to the output shaft 133 of the gear box 94. The lever arm 135 is affixed to a collar rotatably secured to a support shaft 139. Another lever arm 140 is affixed to the collar 137 and is adapted to engage the breaker valve 126 to operate it, as the cam wheel 130 is rotated. The lever arm 140 may have an adjustable screw 141 affixed to its end which may be threaded into or out of the lever arm to provide proper engagement with the breaker valve to operate it.

The individual cartons 12 upon being pulled from the stack of cartons on the conveyor 20 are accelerated and pushed by the pushing head 16 between the pair of counter-rotating rolls 18 and 19. The roller 18 is secured to the shaft 102 and is rotated by it. The roller 19 is an idler roller which is rotatably mounted so that it engages, and is rotated by, the roller 18. The rollers 18 and 19 are preferably driven at a peripheral speed which corresponds to the speed at which the subsequent station operates so that the cartons enter this station at this established rate. The friction wheel 104 is accordingly selected to rotate the roller 18 at this speed. The rollers 18 and 19 can be coated with neoprene rubber to provide better friction contact with the cartons to pass them through the rollers.

The pushing head 16, as indicated above, accelerates the lateral movement of the cartons 12 as the cartons are pushed toward the rolls 18 and 19. The reciprocal movement of the pushing head 16 is preferably coordinated with the feed speed, that is, the peripheral speed, of the rolls 18 and 19 so that the cartons are traveling at the same speed, as they enter between the rolls 18 and 19. When the lateral movement of the cartons and the peripheral speed of the rolls 18 and 19 are coordinated in this fashion, the cartons freely enter and pass between the rolls. If the cartons are moving at a greater speed, the pushing head will force them between the rolls 18 and 19. The resulting frictional engagement between the cartons and the rolls will damage or disfigure the cartons. The same is true if the cartons are moving slower, due to the rapid acceleration of the cartons which occurs when the cartons are frictionally grabbed by the rolls 18 and 19 and passed through them to the subsequent apparatus. This feature is particularly important in cases where the cartons have a thin plastic coating of the like on their exterior surface so that the coating is not damaged, or in cases where the cartons are fed shortly after the printed material is applied so that the printed material is not obliterated.

A date coder 205 having changeable date inserts 206 also can be affixed to the shaft 102, either above the roller 18, as illustrated, or below it. The date coder 205 engages the cartons as they are passed between the rollers 18 and 19 and impresses the coded date into an end flap of the cartons.

A circular knife 210 having a beveled scoring blade 211 also can be affixed to the shaft 102. The knife 210 is positioned to engage the cartons so that the scoring blade 211 will re-score the score lines previously formed on the cartons during manufacture.

OPERATION

The operation of the transfer machine 10 in transferring a flat article, such as the collapsed cartons 12, to another station or machine may be described as follows. The cartons 12 are placed on the magazine loader 24, prefer-

ably in a loading container 26, and the magazine loader 24 is pivoted to stack them on the conveyor 20. The magazine loader is returned to its loading position. When the loading container 26 is free of the stop 169 on the magazine loader, it will slide down the track 150 until it is free of the plate 152. At this point, the chain belts 22 and 23 will engage the lower edges of the cartons and impede their forward movement. Another loading container 26 is preferably placed on the conveyor as soon as there is sufficient room, to function as biasing means for urging the cartons preceding it to move down the conveyor. If the individual cartons are stacked on the conveyor, additional weights or biasing means may be required to urge them forward. As soon as the loading container 26 nears the frame 28, it is removed from about the cartons.

Assume that the motor 109 has been energized and that vacuum is being supplied to the vacuum breaker valve 126, via a vacuum source (not shown), a vacuum tank 200 (FIG. 2) and vacuum line 201. The output of motor 109 is coupled to the friction wheel 104 via the belt drive 106 and rotates the shaft 102 and hence the rollers 18 and 19 and the gear 100. The rotation of the gear 100 is coupled by the chain belt 98 to the double gear assembly 88 to rotate it on the shaft 84, and the rotation of the gear assembly 88 is likewise coupled by the chain belt 90 to drive the gear 92 affixed to the input shaft 95 of the gear box 94. The gear box 94 may be of the standard catalogue type 137, manufactured by the Boston Gear Works of Quincy, Mass., having output shafts 115 and 133.

Secured to the output shaft 133 of the gear box 94 and driven by it is the double cam wheel 130. The cam 198 affixed to the lever arm 196 rides on the cam surface 132 on the cam wheel 130 and intermittently drives the chains 22 and 23 of the conveyor 20, through the operation of the sprocket clutch 190. When the upper edges of the cartons on the conveyor 20 engage the restriction plate 180, the forward movement of the upper edges is restricted, in the manner described above, while the lower edges of the cartons are advanced so that upon reaching the end of the conveyor the cartons are aligned in a vertical plane which is parallel to the vertical plane of the vacuum heads 14 and 15.

The cam wheel 120 rotatably secured to the gear 92 drives the rocker arm 124 as the gear 92 is rotated to, in turn, oscillate the shaft 68 back and forth through predetermined angular positions. The rocker arms 66 secured to the shaft 68 are therefore likewise oscillated. These rocker arms 66 control the movement of the vacuum heads 14 and 15 to engage and to remove the individual cartons from the end of the conveyor 20, through the action of the cams 60 within the cam slots 62 formed in the cam plates 64. The action of the cams 60 and the vacuum heads 14 and 15 are diagrammatically illustrated in FIGS. 14-16. Only one cam 60 and the vacuum head 14 is illustrated, however, the action of the vacuum head 15 and its associated cam 60 is the same.

In FIG. 14, it can be seen that the suction cup 42 is pressed against the surface of the carton 12 held by the stops 184 (only one shown) when the cam 60 is in a forward position (as shown) in the cam slot 62. The operation of the transfer machine 10 is coordinated so that during the time the suction cups 42 are pressed against the surface of the carton 12, the lever arm 140 operates the vacuum breaker 126 to supply vacuum to them. The suction cups 42 lock onto the carton and, as the rocker arms 66 move the cams 60 backwardly in the cam slots 62, the left edge (as shown) of the carton is pulled free of the stops 184, as illustrated in FIG. 15.

In many cases, when cartons are formed and glue sealed, the glue applied to the seal flap spreads and the side walls of the cartons are sealed to one another on the interior of the carton. In the past, whenever this occurred the transfer machine would not break this undesired glue seal and would feed the cartons in this condition to the succeeding station. At this point, the cartons would cause

jamming, or if they succeeded in passing this station, could not be filled. The transfer machine 10 can be adapted to overcome this undesirable result, with little, if any, sacrifice in its speed of operation.

Initially, the lever arms 46 upon which the vacuum heads 14 and 15 are mounted are adjusted so that the vacuum heads are pressed against the cartons in the position which provides the best operation, and hence the best rate of transfer. This is generally a position to the right of the glue seams 215 (FIG. 14) on the cartons. If during the transfer operation, a series of cartons are encountered having their side walls glued to one another, as described above, the lever arms 46 are readjusted so that the vacuum heads 14 and 15, upon being pressed against the cartons overlap the glue seams 215, as illustrated in FIGS. 15 and 16. It is found that the flexibility of the suction cups 42 permits them to distort sufficiently, without breaking the vacuum seal with the cartons, to pull the cartons free of the stops 184 in a "snap-action" which flexes the cartons and breaks the seal between the side walls. The operational speed may have to be reduced to provide satisfactory transfer; however, in most cases, it is not necessary.

As can be seen in FIG. 16, as the cams 60 are moved backward in the cam slots 62 by the rocker arms 66, the carton which has been pulled free of the stack of cartons on the conveyor 20 is moved to the right (as shown) to pull its opposite side edge free of the oppositely disposed stops 184. As the cams 60 continue moving backwardly in the cam slots 62, the carton is pulled into engagement with the lip 70 on the pushing head 16.

The operation is synchronized so that at the precise time that the cams 60 reach their extreme positions within the cam slots 62, the lever arm 140 operates to cut off the vacuum supplies to the suction cups 42. The carton is then released.

The rocker arm 81 oscillates the shaft 84 back and forth through predetermined angular positions. This action, in turn, moves the lever arm 80 to move the rods 72 and 73, and hence the pushing head 16, back and forth in a reciprocating fashion. The movement of the pushing head 16 is synchronized with the operation of the vacuum heads 14 and 15 and is established so that the lateral movement of the carton is accelerated to the feed speed, or peripheral speed, of the rollers 18 and 19 before the carton is pushed between them. A guard rail 220 (FIG. 3) is mounted to a bottom plate 221, outwardly of the carton (as shown), and a smaller guard rail (not shown) to assure that the cartons are pushed by the pushing head 16, between the rollers 18 and 19.

The rollers 18 and 19 frictionally grip the cartons as they are pushed between them and pass them on the subsequent station. If a date coder 205 is affixed to the shaft 102, a coded date will be impressed into the end flap of the carton as it is passed through the rollers 18 and 19. The score line will also be simultaneously re-scored if the knife assembly 210 is used.

The use of a single source of power, i.e., motor 110, and driving the transfer mechanism 13, the pushing head 16 and the conveyor 20 by means of a single gear box 94 permits the speed of operation of the transfer apparatus 10 to be changed, without disturbing the synchronous operation of the various components, since any increase or decrease in the speed of operation is either applied directly to the components or is proportionately applied via the output shafts 115 and 133 of the gear box 94. A variable speed control (not shown) therefore can be advantageously provided for the motor 110. Also, it is apparent that the same variable speed control can be adapted to control both the motor 110 of the transfer apparatus 10 and the subsequent apparatus with which it is used so that the speed of operation of both of them can be simultaneously and synchronously controlled.

With the above described arrangement, the transfer apparatus 10 is capable of feeding flat articles, such as frozen

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food cartons, at a variable rate of from 1 or 2 articles a minute to about 600 articles a minute, depending upon the particular type article being transferred. It may therefore be noted that the speed of operation is very flexible, permitting as few or as many (within the operational limits of the transfer apparatus) articles to be transferred per minute, as desired. This is possible because of the simplicity of the construction which permits synchronization at any speed and the fact that each of the articles is securely held by the vacuum heads 13 and 14, during its removal from the conveyor 20 and while it is being moved to the pushing head 16.

In FIGS. 6 and 7 there is illustrated a pushing head 230 which may be advantageously used in place of the pushing head 16. The pushing head 230 includes a rod receiving member 232 having a resilient angularly bent and reversely folded arm 234 affixed thereto. The end 235 of the arm engages and restrains the movement of one side of a carton 12 (shown in phantom) while the vacuum heads 14 and 15 pull the opposite side of the carton into engagement with the reversely folded end 237. The carton's configuration, particularly at the glue seam 239, is distorted so that a defective glue seam is definitely broken loose, if it was not previously broken when the carton was removed from the stops 184.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Now that the invention has been described, what is claimed as new and desired to be secured by Letters Patent is:

1. Apparatus for removing individual ones of a plurality of flat articles from a supply of said articles and for transferring said articles to another station comprising, in combination: a transfer mechanism including extracting means operated to engage and to lock to individual ones of said articles to remove them from said supply of articles wherein said extracting means comprises a pair of spaced vacuum heads adapted to be pressed and vacuum sealed against an exposed surface of said articles to remove individual ones of them from said supply and to thereafter release them; gripping means for seizing and passing said articles to said other station, and passing means for engaging the individual ones of said articles removed by said extracting means and for passing them to said gripping means; linkage means operable to engage said vacuum heads with said articles and to move said vacuum heads upon being vacuum sealed to said article to position said article for engagement by said passing means, and a source of vacuum supplied to said vacuum heads operated when said vacuum head is engaged with said articles to lock it to said articles and operated to release said articles when positioned for engagement by said passing means and wherein said passing means comprises a pushing head positioned to engage the individual ones of said articles removed from said supply by said vacuum heads, and linkage means for supporting and for reciprocally operating said pushing head to pass between said spaced vacuum heads to pass said individual ones of said articles to said gripping means; and drive means for operating said extracting means, said gripping means and said passing means in synchronism.

2. Apparatus, as claimed in claim 1, wherein said vacuum heads are adjustably positionable to engage a predetermined area of said articles.

3. Apparatus, as claimed in claim 1, wherein each of said vacuum heads includes a suction cup and wherein said linkage means are adjustable to press the rim of said suction cups flat against the surface of said articles.

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4. Apparatus, as claimed in claim 1, wherein said linkage means includes, for each of said vacuum heads, a lever arm support plate having a pivot shaft secured thereto, a lever arm adjustably secured to said lever arm support plate, a vacuum head adjustably secured to said lever arm, a cam plate having a cam slot formed therein, cam means affixed to said pivot shaft and engaged within said cam slot, and a pivotally operated rocker arm coupled to said pivot shaft.

5. Apparatus, as claimed in claim 1, wherein said gripping means comprises a driven roller and an idler roller in engagement with and driven by said driven roller, said articles being passed between and seized by said rollers to forward them to said other station.

6. Apparatus, as claimed in claim 1, further including conveyor means for retaining and conveying said supply of articles to said transfer mechanism.

7. Apparatus for removing individual ones of a plurality of flat articles from a supply of said articles and for transferring said articles to another station comprising, in combination: a transfer mechanism including extracting means operated to engage and to lock to individual ones of said articles to remove them from said supply of articles; gripping means for seizing and passing said articles to said other station, and passing means for engaging the individual ones of said articles removed by said extracting means and for passing them to said gripping means; and drive means for operating said extracting means, said gripping means and said passing means in synchronism; further including conveyor means for retaining and conveying said supply of articles to said transfer mechanism wherein said conveyor means includes a magazine loader pivotally affixed thereto, said magazine loader being adapted to support a plurality of said articles and to stack said articles on said conveyor means upon being pivoted.

8. Apparatus, as claimed in claim 7, wherein said magazine loader comprises a pair of spaced apart L-shaped members, each having one arm thereof pivotally secured to said conveyor means, roller means rotatably affixed between said arms at their ends, the other arm of each of said members having a bar having a stop on one end thereof affixed between them on their ends, and support plates affixed between the arms of said L-shaped members so as to support articles placed on said loader.

9. Apparatus for removing individual ones of a plurality of flat articles from a supply of said articles and for transferring said articles to another station comprising, in combination: a transfer mechanism including extracting means operated to engage and to lock to individual ones of said articles to remove them from said supply of articles; gripping means for seizing and passing said articles to said other station, and passing means for engaging the individual ones of said articles removed by said extracting means and for passing them to said gripping means; and drive means for operating said extracting means, said gripping means and said passing means in synchronism; further including conveyor means for retaining and conveying said supply of articles of said transfer mechanism wherein said conveyor means includes: a track; and means positioned at the end thereof for aligning each of said articles in a plane parallel with a plane extending through the vertical axis of said extracting means.

10. Apparatus for removing individual ones of a plurality of flat articles from a supply of said articles and for transferring said articles to another station comprising, in combination: a transfer mechanism including extracting means operated to engage and to lock to individual ones of said articles to remove them from said supply of articles; gripping means for seizing and passing said articles to said other station; and passing means for engaging the individual ones of said articles removed by said extracting means and for passing them to said gripping means; and drive means for operating said extracting

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means, said gripping means and said passing means in synchronism; further including conveyor means for retaining and conveying said supply of articles to said transfer mechanism wherein said conveyor means includes: a track; a positionably adjustable restriction plate positioned to overlie said track to engage and to restrict the forward movement of the upper edges of said articles; advance means positioned on said track and engaged by the lower edges of said articles, said advance means being operated to advance the lower edges of said articles whereby said articles are caused to assume a vertical position parallel to a plane extending through the vertical axis of said extracting means.

11. Apparatus, as claimed in claim 10, wherein said advance means comprises a pair of spaced apart chain belts.

12. Apparatus, as claimed in claim 10, wherein said advance means are intermittently advanced and wherein said drive means for operating said extracting means, said gripping means and said passing means in synchronism is also coupled to and intermittently operates said advance means.

13. Apparatus, as claimed in claim 10, wherein said drive means includes a source of power; said extracting means being coupled to said source of power; a gear assembly having an input shaft coupled to said source of power and a pair of output shafts; said passing means being coupled to one of said pair of output shafts; and said conveyor means being coupled to the other one of said pair of output shafts.

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14. Apparatus, as claimed in claim 1, further including stop means adapted to engage the side edges of said articles and wherein said extracting means have a reversing movement whereby the side edges of said articles are sequentially released from said stop means.

15. Apparatus, as claimed in claim 1, wherein said passing means accelerate the movement of said articles during the time said articles are passed by said passing means to a speed corresponding to the feed speed of said gripping means before said articles are engaged with said gripping means.

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U.S. Cl. X.R.

221—225, 221, 236; 71—5, 28