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(54) **Improvements in or relating to apparatus and methods for feeding articles such as sheets or boards.**

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Description

The present invention generally relates to apparatus and methods for feeding articles such as blanks or boards or sheets successively along a horizontal path to a machine such as a box making machine, in which various operations are performed, for example, printing, cutting, slotting, folding, glueing, etc. The present invention relates to methods and apparatus particularly adaptable for successively feeding boards or sheets to a pair of nip rolls which then feed the boards to stations where the various above-indicated operations are performed.

There, of course, exists in the prior art various box-making machines including feeding mechanism for successively feeding the boards to nip rolls preliminary to the box-making operations to be performed on the boards. One conventional feeding mechanism referred to in the art as a "kicker feed" utilizes a reciprocating pusher bar which engages the rear or trailing edge of a board and pushes the board to the nip rolls. Once the board is engaged by the nip rolls, the pusher bar is returned to its starting position to engage the next board and push it to the nip rolls. The pusher bar is reciprocated through a rcckcr shaft which is driven from the main power source of the machine. Examples of such kicker feed mechanisms are disclosed in United States Patent Specificatons Nos. 3,392,973; 3,588,093 and 3,588,095.

Although a kicker feed mechanism has the advantage of being driven through a rocker shaft system which is relatively inexpensive, reliable and capable of providing hign torque outputs as may be needed, it is thought by some to possess certain problems from the standpoint of safety and operation. For example, with a kicker feed, the kicker bar or pusher must be carefully controlled in order to squarely feed a blank or board in proper registry with the nip rolls. Moreover, the trailing edge of the blank or board being fed must be carefully controlled to ensure proper engagement with the feed lips of the kicker bar. Also, if the blank or board or sheet is warped, it may become jammed due to the rear edge feed. Additionally, thin or low-strength sheets may not be able to withstand the column loading applied by the kicker bar.

In an attempt to avoid the above problems with kicker feeds, another type of feed, namely a "rotary feed", has been developed and used in industry. By way of example, it is noted that rotary-type feeders are disclosed in United States patent Specifications Nos. 4,363,478; 4,045,015; 976,640 and 978,702. With a rotary-type feed, a sheet or board is engaged by underlying rotating feed members or endless belts and is fed thereby to the nip rolls adjacent the leading edge area of the sheet or board. Such feeding obviates the rear edge feeding problems of kicker feeds while also utilizing a simple vacuum system to hold a sheet or board down on the feed members or belts. One drawback, however, of a rotary feed system is that heretofore it has required the use of an indexing or geneva-type drive for driving the feed members, which drive is more complicated, expensive and possesses less torque capability than the rocker shaft system used with kicker feeds. The torque capacity of the drive limits the surface area of the rotary feed members which effects the engagement and consequently the feeding of the boards in the manner desired. Moreover, an indexing or geneva drive is not as versatile as a rocker shaft drive in adapting to various torque requirements of different box making or other machines.

Another problem which has attended various feed mechanisms of the prior art including kicker feeds or rotary-type feeds is that the leading edges of the sheets or boards at times become jammed against the gate at which they are stacked, making it difficult to lower a sheet or board onto the support surface for conveyance by the feed mechanism to the nip rolls.

According to a first aspect of the present invention there is provided apparatus for individually feeding articles such as sheets or boards which are stacked behind a gate and wherein the articles are indivdually fed under the gate along a generally horizontal path, comprising feed members movable in a first direction generally along said path to engage and feed an article in a forward direction under said gate and along said path, said feed members having surfaces frictionally engageable with the underside of an article to move the article along said path upon movement of said surfaces, characterised by means for driving said feed members in said first direction and in a second direction opposite to said first direction thereby urging an article away from said gate prior to movement of the article under the gate and by a grate vertically movable above and below said path whereby said feed members can engage and feed an article in said forward direction under said gate when the grate is in a lowered position below surfaces of the feed members, and can urge an article away from said gate prior to movement of the article under the gate when the grate is in said lowered position.

Preferably such apparatus for feeding articles to a pair of nip rolls for conveying articles along said path is characterised in that said feed members are mounted in a vacuum box having an apertured upper surface along said path upstream of said nip rolls, said gate being positioned above the vacuum box upstream of the nip rolls for containing the leading edges of articles to be fed under the gate to the nip rolls.

According to a preferred embodiment of the present invention there is provided feeder apparatus for use in a box-making machine or the like including a generally horizontal path of conveyance and a pair of nip rolls for conveying sheet-like articles along said path is characterised by a vacuum box having an apertured upper surface along said path upstream of the nip rolls, a gate positioned above the vacuum box upstream of the nip rolls for containing the

leading edges of articles to be fed under the gate to the nip rolls, a grate mounted in the vacuum box for vertical movement above and below the path of conveyance, a plurality of feed members mounted in the vacuum box for movement generally along said path to engage and feed articles in a forward direction under said gate and to said nip rolls when the grate is in a lowered position below surfaces of the feed members, and means for driving said feed members to engage and feed articles under said gate to the nip rolls, said drive means including an oscillatable rocker shaft and means operatively interconnecting said rocker shaft and said feed members.

According to a second aspect of the present invention there is provided a method of feeding sheet-like articles to a box-making machine or the like with feeding apparatus including a gate for containing the leading edges of a stack of articles prior to being fed, and a plurality of feed members under the stack for engaging and feeding the articles under the gate, wherein the method comprises moving the feed members in a first direction to feed the lowermost article in the stack under the gate, and is characterised by moving the feed members in a second direction opposite to said first direction to move the lowermost article away from the gate to relieve pressure on the gate to prevent jamming of the article against the gate.

The present invention can provide apparatus and methods for feeding articles such as blanks, sheets or boards such as for example, to a box-making machine and which overcome the above-noted problems and/or limitations of feeder mechanisms and methods of the prior art.

An embodiment of the present invention in the form of a rotary-type feeder mechanism for feeding articles such as boards, sheets or blanks, can be easily incorporated into new or existing conventional box-making machinery.

A preferred embodiment of the invention includes feed members which may be feed wheels, rolls or endless belts that are driven from an oscillating rocker shaft and gearing including a rocker gear connecting the rocker shaft to a gear train that drives the feed members in one of two opposite directions by frictional engagement to nip rolls, to feed sheet or board articles resting thereon. The articles are successively fed from the bottom of a stack overlying the feed members behind a gate. A grate is provided between the feed members for lowering the lowermost article in the stack onto the feed members for feeding and for raising the article from the feed members after the article is received in the nip rolls. The feed members are mounted in the upper portion of a vacuum box which supplies a vacuum to hold the articles on the feed members in proper position. The vacuum is also utilized to hold the boards with sufficient force to produce the necessary friction between the boards and the feed members for feeding.

Once the lowermost article has been fed out from below the stack, the direction of the feed members is reversed and the grate is lowered to engage the next lowermost article in the stack. The reverse direction of the feed members while the article is resting thereon occurs for only a short duration sufficient to relieve the pressure on the gate exerted by the lowermost article to thereby avoid jamming of the article. The direction of the feed members is then reversed to feed the article to the nip rolls after which the cycle is repeated.

In one preferred embodiment, the grate is raised and lowered in the desired timed sequences by means of shafts that are operatively connected to the grate to drive them up and down upon oscillation of the shafts. Such oscillation is achieved by a cam and cam follower assembly driven from gearing including a crank gear that is also employed to oscillate the rocker shaft through a linkage or a quick return slide mechanism. The cam which controls the cam follower has a high dwell surface engageable by the cam follower to determine the raised position of the grate above the upper surfaces of the feed members and a low dwell surface engageable by the cam follower to determine the lowered position of the grate below the upper surfaces of the feed members. The crank gear may be driven from the main power source of the associated machine and in the preferred embodiment, this drive is taken from one of the nip rolls.

The grate may be held above the feed members by a latch device to interrupt the feeding operation. In the preferred embodiment this latch device includes an aperture in a lever which holds the cam follower employed to oscillate the grate actuating shafts as described above. The latch device further includes a pin which is actuated, such as by a small air cylinder into the aperture when the cam follower engages the high dwell surface of the cam which surface determines the raised position of the grate above the upper surface of the feed members as described above. In order to release the grate to resume the feeding operation, the air cylinder is actuated to retract the pin from the aperture in the cam follower lever thereby freeing the latter for normal operation.

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

Fig. 1 is a front elevational view of a feeder mechanism constituting a preferred embodiment of the present invention and with certain parts shown in cross-section;

Fig. 2 is a perspective view of portions of the feeder mechanism of Fig. 1 as would be seen from the front side thereof and with certain parts shown in cross-section and other parts removed for clarity;

Fig. 3 is a cross-sectional view taken along lines extending transversely of the feeder mechanism and with certain parts removed;

Fig. 4 is a fragmental side elevational view as seen from the rear side of the feeder mechanism and showing a drive system for actuating feed members of the feed mechanism;

Fig. 5 is a fragmental side elevational view as seen from the front side of the feeder mechanism

and showing a cam and cam follower assembly which is utilized to drive a grate included in the feeder mechanism;

Fig. 5a is a detailed cross-sectional view showing a latch device incorporated in the feeder mechanism for interrupting the feeding operation;

Fig. 6 is a graph illustrating the relationship between the velocity of the feeder members and the position of the grate included in the feeder mechanism; and

Fig. 7 is a perspective view of a quick return slider assembly that may be substituted for a linkage according to another ebodiment of the invention.

Referring to the drawings in detail and initially to Fig. 1, there is disclosed apparatus embodying the invention for feeding paperboard blanks such as corrugated blanks or sheets, generally designated b, one-by-one to the nip of feed rolls 18 suitably mounted in a main frame 6 which forms part of box-making machinery including other mechanisms for printing, cutting, slotting, folding or glueing and the like, which are not shown. The boards b are, of course, flat, and are stacked one on top of another in a suitable hopper with the lowermost board resting on a feed surface 36a which extends horizontally in the plane between the feed rolls 18. The forwardmost edges of the boards are positioned by one or more gate members 32 (one shown) and by a trailing edge support generally designated 46 having a lower ledge on which the rearmost edges rest. The gates 32 and the trailing edge support 46 are adjustable in the lengthwise direction of the machine to accommodate boards of different lengths. Additionally, they are adjustable in vertical planes so as to precisely set the distance between the lowermost edge of the gate 32 and the feed surface 36a. Additionally, vertical adjustability of the trailing edge support 46 is employed to compensate for warpage occurring in any of the boards. The feed surface 36a is formed by the upper surface of a vacuum box 36 which encloses a vacuum chamber in which a vacuum is created by any suitable source of vacuum which is connected by means of a duct 40 which communicates with the vacuum chamber through apertures 37 formed in the bottom wall of the vacuum box 36 as best shown in Fig. 3.

The boards b are fed one-by-one across the feed surface 36a and into the nip of the feed rolls 18 by nmeans of a plurality of driven feed wheels generally designated 51 mounted for rotation in the vacuum chamber of the vacuum box 36 on shafts 50 which are journalled for rotation in opposite end frame members 34 (see Fig. 3). In the specific embodiment shown, there are three rows of feed wheels 51 extending transversely of the longitudinal or feeding direction of the machine with each row containing ten feed wheels (not all of which are shown) and with the feed wheels in adjacent rows being aligned with each other in the longitudinal or feeding direction of the machine. The feed wheel shafts 50 run parallel to each other and are equally spaced from each other, and the feed wheels in each of the rows are uniformly spaced from each other. The feed wheel shafts 50 are geared to rotate in opposite directions to drive the feed wheels in forward or reverse directions for a purpose to be described below. As seen in Fig. 2, feed wheels 51 are provided with a high friction outer cylindrical surface 51a formed from any suitable material such as rubber or urethane so that the coefficient of friction between the feed wheel surfaces and the boards b wi11 be in the range of 0.7 to 1.0. The friction surface 51a may be provided on aluminium hubs 51b, or any other suitable construction may be employed.

In order to raise and lower the boards b off and on to the feed wheels 51 for purposes which will be explained below, a grate is provided to extend between the feed wheels throughout the extent of the feed wheels. Referring to Figs. 1 and 2, the grate includes a plurality of vertical ribs 56 formed by plate-like structures of any suitable material, such as steel, which extend parallel to each other between the feed wheels 51 in the longitudinal or feeding direction of the machine. Extending between and fixed to the ribs 56 are a plurality of rod members 55 which are recessed slightly downwardly from the upper surface of the ribs 56 as best shown in Figs. 2 and 3.

The grate 55, 56 is mounted and actuated up and down in the vertical direction at the desired time by means of preferably two elongated shafts 52 and 52a which extend transversely of the machine through the vacuum box 36 below the level of the feed wheels and which are journalled at their opposite ends in the frame members 34 at opposite sides of the machine. Shafts 52 and 52a each include mounting lugs 58 fixed thereto and having pins 57 receivable in apertures 53 in depending leg portions of certain grate ribs 56 as best shown in Fig. 2. By structure to be described below, shafts 52 and 52a are rotatable in small amounts in opposite directions in order to raise or lower the grate 55, 56. When the grate 55, 56 is in its lowered position shown in Fig. 1, the upper surface of the grate is below the upper surfaces 51a of the feed wheels which are thus able to contact the underside of the lowermost board b to drive it by friction. When the grate is in its raised position, which occurs after the lowermost board bis engaged and driven by the nip rolls 18, its upper surface is above the upper surfaces 51a of the feed wheels whereby the lowermost board b is out of contact with the feed wheels.

The vacuum box 36 with the feed wheels, grate and grate mounting and actuating means, and the side frame members 34 may be installed as a unit into an existing machine or, of course, incorporated in a new machine. Referring to Fig. 1, such installation is effected by mounting the frame members 34 onto cross-frame members 8 of the existing machine by means of struts 35 fixed to and between frame members 34 and

cross-frame members 8. Cross-frame members 8 are fixed in the main frame 6 which is shown in Fig. 1.

Referring to Fig. 4, feed wheels 51 are driven in opposite rotative directions about the axes of their shafts 50 by mechanism including a plurality of wheel gears 70 fixed to shafts 50 on one of the ends thereof located outwardly of frame 34 (see Fig. 3). Two of the wheel gears 70 are in mesh with a much larger gear 74 to be driven thereby while the remaining wheel gear 70 is driven by means of an idler gear 72 in mesh with two of the wheel gears 70 as shown in the right-hand side of Fig. 4. As shown in Fig. 3, rocker gear 74 is mounted at its centre or axis 85 on a pivot shaft 86 which is journalled in frame 34.

Rocker gear 74 is rotatably oscillated about its axis 85 by means of a rocker shaft 10 and a linkage operatively interconnecting rocker shaft 10 and rocker gear 74. In the specific embodiment shown in Figs. 2, 3 and 4, a mechanism is employed which is the equivalent of a four-bar linkage, the mechanism including a rocker arm 81 fixed to and projecting from a sleeve 81a which, in turn, is mounted about rocker shaft 10 and fixed thereto by means of a key 82 as best shown in Fig. 4. The mechanism further includes a connecting link 80 pivotally connected at one end at pivot 83 to the rocker arm 81 and pivotally mounted at its opposite end by pivot 84 to the rocker gear 74 at a location offset from the axis 85 of the rocker gear 74 as best shown in Fig. 4. This action of the feed wheels 51 and their actuation through the linkage and the rocker shaft is to be contrasted with conventional feed wheels that are driven in one rotative direction by a geneva or indexing drive.

It will be seen that upon rotation of rocker shaft 10 in one direction, the feed wheels 50 will be rotated in one direction, and upon rotation of the rocker shaft 10 in the opposite direction, feed wheels 50 will be rotated in the opposite direction. The forward rotational direction of the feed wheels 51 is, of course, utilized to drive the boards b to the nip rolls 18 when the grate is in its lower position. The reverse or rearward rotational direction of the feed wheels 51 is utilized to urge the lowermost board b away from the gate 32 to relieve pressure against the gate 32 and prevent jamming. This latter action occurs at the end of the reverse rotation phase of the feed wheels when the grate is lowered and just prior to the forward rotational phase of the feed wheels 51 which serves to feed the lowermost board b to the nip rolls 18.

Referring now to Fig. 2, rocker shaft 10 is driven by means of a crank gear 16 which in turn is driven by a gear 20 which, in turn, is driven from the main drive of the associated box-making machinery (not shown). Gear 20 is fixed to the shaft of one of the feed rolls 18 while being in mesh with another feed roll gear 20a which is fixed to the shaft of the other feed roll 18, whereby feed rolls 18 are driven in counterdirections for feeding the boards b into box-making machinery. Crank gear 16 drives rocker shaft 10 in oscillation by means of a mechanism which amounts to a four-bar linkage including a first link generally designated 12 which may be termed a "feed lever" having a passage therein receiving rocker shaft 10 and being fixed thereto through means of a key 1. The mechanism further includes a connecting link 14 having one end pivotally connected by a pivot 3 and having its opposite end pivotally connected by a pivot 22 to the crank gear 16 at a location offset from the axis of rotation 24 of the crank gear 16. It will therefore be seen that rotation of the crank gear 16 by feed roll gear 20 will cause rocker shaft 10 to oscillate by means of the linkage mechanism including links 12 and 14.

Referring to Fig. 7, the rocker shaft 10 may be driven by a quick return slider crank instead of the linkage 12, 14 described above. As shown in Fig. 7, this mechanism includes a slider 12a keyed to rocker shaft 10 and having an elongated slot 12b receiving a block 13 pivoted to crank gear 16 to slide in slot 12b. Block 13 is, of course, mounted on crank gear 16 at a location offset from the centre 24 of crank gear 16. It will be seen that rotation of crank gear 16 will function to oscillate rocker shaft 10 by virtue of the action of the slide 12a.

Referring now to Figs. 2 and 5, shafts 52 and 52a are rotatably oscillated in small increments in order to raise and lower the grate 55, 56 and such action is achieved through a cam follower lever 100, 94 and a cam 90 which is driven by a gear 26 (see Fig. 2) which, in turn, is driven by a gear 23 that is fixed concentrically to the inner surface of crank gear 16 so as to be rotatable therewith. Cam 90 is fixed to a shaft 30 which is journalled in the frame member 34 and which is fixed to gear 26 at the centre axis thereof so as to be driven thereby. Referring to Fig. 5, cam 90 has a circumferential surface portion 92 which may be termed "the high-dwell surface" and a shorter circumferential surface portion 91 which may be termed "the low-dwell surface" extending between the high-dwell surface 90 with transitional surface portions extending therebetween for the extent of the angle. The cam follower lever includes a dog leg portion 100 having a hub receiving the end of shaft 52 to which it is suitably keyed for movement therewith. One side of dog lever 100 has a cam follower or roller 94 which engages on the surface of cam 90. The other shaft 52a is operatively connected to be oscillated in small increments in unison with shaft 52 by means of a link 104, whose opposite ends are pivotally connected by pivots 104a to the dog leg lever 100 and to a follower lever 106 fixed to shaft 52a by means of a hub received about shaft 52 and keyed thereto in any suitable manner.

It will be seen that when cam follower 94 engages the high-dwell surface 92, the grate will be at rest in an elevated position and when the cam follower 94 engages the low-dwell surface 91, the grate will be at rest in a depressed or lowered position.

Additionally, when the cam follower surface 94

engages the transition surface enclosed by the angle α, that is, between the high-dwell and low-dwell surfaces 90 and 91, the cam follower will be lowered or raised depending on the particular transition surface engaged which, in turn, will slightly rotate the dog leg lever 100 and, in turn, the associated shaft 52 to actuate the grate 55 and 56. Motion of the dog leg lever 100 is transmitted to the adjacent shaft 52a by means of the link 104 and follower lever 106 to rotate shaft 52a in unison with shaft 52. In the latter regard, dog lever 100, link 104 and follower lever 106 act as a parallelogram linkage with the pivots of the parallelogram linkage lying at 52, 104a and 52a.

Referring now to Fig. 5 cam follower 94 is urged onto the surface of cam 90 by a spring mechanism including a coil compression spring 110 having one end bearing against a block 112 fixed to the frame 34 and having an opposite end bearing against a nut and washer assembly 111 received on a rod 114 which extends through the axis of the coil spring 110 and through the block 112 after which it is pivotally connected by pivot 116 to the dog leg lever 100 as shown in Fig. 5. It will be seen that spring 110 urges the rod 114 in the direction to impose a clockwise (as viewed in Fig. 5) bias on dog leg lever 100 which, of course, urges cam follower roller 94 into engagement with the surface of cam 90.

In order to interrupt the feeding of the boards b, it is necessary to position the grate 56 spaced above the feed wheels 51, that is, when the cam follower 94 is engaged on thhe high-dwell surface 92 of the cam 90. For this purpose, a latch mechanism is provided. As shown in Fig. 5a, in the preferred embodiment the latch mechanism includes an aperture 126 formed in the lower leg portion of dog leg lever 100 for receiving a pin 122 that is mounted for reciprocal movement in a housing 120 fixed in the frame 34. Housing 120 has an elongated passage receiving a rod 124 of an air cylinder 125 with the pin 122 being fixed to the extremity of the rod 124. When the cam follower is positioned on the high-dwell surface 92 of cam 90, the aperture 126 in dog leg lever 100 will be aligned with pin 122, whereupon, if it is desired to interrupt the sheet feeding by virtue of the grate 56 being positioned above the feed wneels 51, air cylinder 124 is energized to extend pin 122 into the aperture 126. When received in the aperture 126, the latch pin 122 holds the cam follower 94 at the level of the high dwell surface of the cam 90 which thus maintains the grate in the raised position regardless of the rotation of cam 90. When in its raised position, the grate prevents contact of the lowermost board with the feed wheels 51 and thus feeding of the boards is interrupted. Only a small air cylinder 124 is needed to actuate pin 122 and therefore such action can occur quickly and efficiently to interrupt sheet feeding at precisely the desired point. When sheet feeding is to be resumed, air cylinder 125 is actuated to retract pin 122 from aperture 126 in the dog leg lever 100, thereby freeing the latter for operation as described above. Retraction of pin 122 must be effected when the cam follower is positioned above the high-dwell surface.

Fig. 6 shows two graphs whichh illustrate the relationship of the velocity of the feed wheels 51 to the position of the grate 55, 56 throughout a full cycle of operation. The upper graph shows the relationship of rocker shaft (10) velocity versus crank gear (16) angle while the lower graph shows grate level versus the crank gear angle. The solid lines in the graphs refer to the embodiment of Figs. 1 to 5, utilizing a four-bar linkage to drive the rocker shaft 10 while the dotted lines refer to the embodiment which utilizes a quick return slider crank as shown in Fig. 7 to drive the rocker shaft 10. The contact period shown in the graphs refers to the phase when a board b is contacting the feed wheels 51. Note, however, that the smaller portion of the contact period (during negative velocity) occurs when the feed members 51 are rotating in a reverse direction which is utilized, as indicated above, to relieve the pressure of the board b against the gate 32. That is to say that the positive velocity values depicted on the graph refer to rotation of the feed wheels 51 in the forward or board-feeding direction, while the negative velocity values refer to the rotation of the feed wheels in the reverse direction. Additionally, the positive values for the grate level refer to when the grate is above the surface of the feed wheels 51 while the negative values refer to when the grate is below the surface of the feed wheels.

It will therefore be seen from Fig. 6 that when the feed members are increasing in velocity during the contact period, the grate 55, 56 is in its lowered position and therefore, the board is being conveyed to the nip rolls 18. As the feed wheels 51 approach their peak velocity, the board begins to enter the nip rolls 18 and the grate begins to rise. The board enters the nip rolls near the point at which the feed wheels 51 reach a peak velocity which is matched to the constant velocity of the nip rolls. After the board is engaged in the nip rolls, the grate rises above the surface of the feed wheels 51 after which the grate reaches its uppermost level as the feed wheels decelerate and the board is being conveyed by the nip rolls 18 off the surface of the grate. The grate remains in its elevated position when the velocity of the feed wheels 51 changes from positive to negative (when the direction of the feed wheels 51 is reversed). However, at the end of this reversing phase of the feed wheels as they approach zero velocity, the grate begins to lower until the next board to be fed engages the feed wheels 51 at a very low negative velocity at which time the reversing feed wheels function to urge the board away from the gate 32 to relieve pressure until the feed wheels come to zero velocity and then rotate in the forward direction to drive the board toward the nip rolls 18. The above cycle is then repeated. The board is displaced the distance from gate 32 to the nip rolls 18 to arrive at the same velocity as the nip rolls by virtue of the proper selection of

the four bar linkage and gear ratio shown in Fig. 4 as described above. The grate is lowered and raised at the appropriate time as described above and this timing is governed by the length of the low-dwell surface 91 and the extent of transition angle α which are selected accordingly. At any time during the relatively long phase when the grate is elevated, if it is desired to interrupt the cycle of operation, the air cylinder 125 (Figs. 5 and 5a) need only be actuated to extend latch pin 122 into aperture 126 of cam follower lever 100 which will thus hold the grate in the elevated position. When it is desired to resume operation, the air cylinder is actuated to retract latch pin 122 from the cam follower lever 100 during the same relatively long phase when the grate is elevated.

It will be seen that among its several advantages the illustrated feeding mechanism not only employs a conventional rocker shaft to drive the feed wheels in two opposite directions, but also may be easily adjusted to various new or existing box-making machine drives to provide the desired timing, sequencing and torques by substituting different size linkages between the rocker shaft 10 and the rocker gear 74 or between the crank gear 16 and the rocker shaft 10. This is an advantage over the indexing or geneva drive systems heretofore employed with rotary feeders, which systems are more complex and require the substitution of different gears or gear arrangements in order to adapt to different drive systems. Additionally, it will be appreciated that the rocker shaft drive utilized in the illustrated embodiment will provide sufficient torque capacity to enable larger surfaces to be utilized on the feed wheels 51 to increase speed and accuracy of feeding.

It should be pointed out that although the preferred embodiment of the invention described and illustrated above utilizes feed members in the form of rotatable wheels or rolls, other types of feed members such as, for example, endless belts that move in horizontal paths below the boards to be fed may be utilized. Therefore, it should be understood that the term "rotary feeder" as used herein is not limited to the specific rotatable feed members 51.

Claims

1. Apparatus for individually feeding articles such as sheets or boards (6) which are stacked behind a gate (32) and wherein the articles are individually fed under the gate (32) along a generally horizontal path, comprising feed members (51) movable in a first direction generally along said path to engage and feed an article (6) in a forward direction under said gate (32) and along said path, said feed members (51) having surfaces (51a) frictionally engagable with the underside of an article (6) to move the article (6) along said path upon movement of said surfaces, characterised by means (70, 72, 74) for driving said feed members (51) in said first direction and in a second direction opposite to said first direction thereby urging an article (6) away from said gate (32) prior to movement of the article (6) under the gate (32) and by a grate (55, 56) vertically movable above and below said path whereby said feed members (51) can engage and feed an article (6) in said forward direction under said gate (32) when the grate (55, 56) is in a lowered position below surfaces of the feed members (51), and can urge an article (6) away from said gate (32) prior to movement of the article (6) under the gate (32) when the grate (55, 56) is in said lowered position.

2. Apparatus according to claim 2, for feeding articles to a pair of nip rolls (18) for conveying articles along said path, characterised in that said feed members (51) are mounted in a vacuum box (36) having an apertured upper surface (37) along said path upstream of said nip rolls (18), said gate (32) being positioned above the vacuum box (36) upstream of the nip rolls (18) for containing the leading edges of articles (6) to be fed under the gate (32) to the nip rolls (18).

3. Apparatus according to claim 1 or 2, characterised in that said drive means (70, 72, 74) includes an oscillatable rocker shaft (10).

4. Apparatus according to claim 3, characterised in that said drive means (70, 72, 74) further includes a rocker gear (74) driven by said rocker shaft (10) and gear means (70, 72) operatively interconnecting said rocker gear and said drive members.

5. Apparatus according to claim 4 characterised in that said drive means (70, 72, 74) further includes a link (80, 81) connected to said rocker shaft (10) and pivotally connected to said rocker gear (74) eccentrically of the axis of the rotation of the rocker gear (74).

6. Apparatus according to any of claims 1 to 5 characterised in that said feed members (51) are rotatable wheels.

7. Apparatus according to any of claims 1 to 6 characterised by an oscillatable shaft (52, 52a) for driving the grate (55, 56) between upper and lower positions relative to the surfaces of the feed members (51) and a pin (57) fixed to a side of the shaft (52, 52a) to oscillate therewith, and received in an aperture (53) in a depending leg of said grate (55, 56) for transmitting motion from the oscillatable shaft (52, 52a) to the grate (55, 56).

8. Apparatus according to claim 7, characterised in that there are two oscillatable shafts (52, 52a) and means (90, 94, 104, 106) for driving both of said oscillatable shafts (52a, 52) in a predetermined sequence relative to each other from the same power source.

9. Apparatus according to any of claims 1 to 8, characterised by means for driving said grate (55, 56) between said raised and lowered positions including a cam (90) having on its periphery a high-dwell surface determining the raised position of the grate (55, 56) and a low dwell surface recessed inwardly from the high dwell surface and determining the lowered position of the grate (55, 56), and a cam follower (94) engaged on the periphery of the cam (90) and operatively connected to the grate (55, 56) to drive the same

between the raised and lowered positions thereof.

10. Apparatus according to claim 9, characterised by a latch means (100, 120, 122, 124, 126) for holding the cam follower (94) at the level of the high-dwell surface of the cam (90) to maintain the grate (55, 56) in the raised position thereof, said latch means including a latch member (122) engagable with said cam follower (94) to hold the cam follower (94) at the level of the high-dwell surface of the cam (92) said latch member (122) being disengagable with the cam follower (94) to permit the cam follower (94) to move between the high and low dwell surfaces of the cam (92).

11. Apparatus according to claim 10, characterised in that the cam follower (94) includes a lever (100) with an aperture (126), and the latch member (122) is a pin movable into the aperture (126) to hold the cam follower (94) at the level of the high-dwell surface of the cam (92) and the latch pin (122) is movable out of the aperture (126) to release the cam follower (94) for the movement between the high and low-dwell surfaces of the cam (92).

12. Apparatus according to claim 11, characterised by a fluid motor (124) for driving said latch pin (122), said fluid motor (124) having an extendable and retractable rod fixed to the latch pin (124) to drive the same into or out of said aperture (126) in the cam follower lever (100).

13. A method of feeding sheet-like articles to a box-making machine or the like with feeding apparatus including a gate for containing the leading edges of a stack of articles prior to being fed, and a plurality of feed members under the stack for engaging and feeding the articles under the gate, wherein the method comprises moving the feed members in a first direction to feed the lowermost article in the stack under the gate, and is characterised by moving the feed members in a second direction opposite to said first direction to move the lowermost article away from the gate to relieve pressure on the gate to prevent jamming of the article against the gate.

14. A method according to claim 13, characterised by the step of utilizing rotatable wheels as the feed members and frictionally engaging an article with the surfaces of the wheels to move an article in the aforesaid manner.

Patentansprüche

1. Vorrichtung zur einzelnen Zufuhr von Gegenständen, wie Blätter oder Platten (6), die hinter einem Gatter (32) gestapelt und unter diesem Gatter (32) hindurch einzeln entlang einem ganz allgemein horizontalen Weg transportierbar sind, mit Vorschubelementen (51), die in einer ersten Richtung ganz allgemein des Transportweges zum Eingriff mit dem Gegenstand (6) sowie zu dessen Transport in einer Vorwärtsrichtung unter dem Gatter (32) hindurch sowie entlang des Transportweges bewegbar sind, wobei die Vorschubelemente (51) Oberflächen (51a) aufweisen, die in Reibeingriff mit der Unterseite eines Gegenstandes (6) bringbar sind, um diesen bei in Bewegung gesetzten Oberflächen (51a) entlang des Transportweges zu bewegen, gekennzeichnet durch eine Einrichtung (70, 72, 74) zum Antreiben der Vorschubelemente (51) in der ersten Richtung sowie in einer zu der ersten Richtung entgegengesetzten zweiten Richtung, um hierdurch einen Gegenstand (6) vor seiner Bewegung unter dem Gatter (32) hindurch vom Gatter (32) wegzudrükken, und durch ein Gitter (55, 56), das vertikal oberhalb sowie unterhalb des Transportweges bewegbar ist, wodurch die Vorschubelemente (51) in Eingriff mit einem Gegenstand (6) bringbar sind und diesen in der Vorwärtsrichtung unter dem Gatter (32) hindurchtransportieren, wenn sich das Gitter (55, 56) in einer bis unter die Oberflächen der Vorschubelemente (51) abgesenkten Stellung befindet, und wodurch die Vorschubelemente (51) einen Gegenstand (6) vor dessen Transport unter dem Gatter (32) hindurch von dem Gatter (32) wegdrücken können, wenn sich das Gitter (55, 56) in der abgesenkten Stellung befindet.

2. Vorrichtung nach Anspruch 1, zur Zufuhr von Gegenständen zu zwei Quetschwalzen (18), um Gegenstände entlang des Transportweges zu befördern, dadurch gekennzeichnet, daß die Vorschubelemente (51) in einem Vakuumgehäuse (36) angeordnet bzw. befestigt sind, das eine mit Öffnungen versehene Oberseite (37) entlang des Transportweges stromaufwärts in bezug auf die Quetschwalzen (18) aufweist, wobei das Gatter (32) oberhalb des Vakuumgehäuses (36) stromaufwärts in bezug auf die Quetschwalzen (18) angeordnet ist und die Führungskanten der unter dem Gatter (32) hindurch zu den Quetschwalzen (18) zu transportierenden Gegenstände (6) aufnimmt.

3. Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Antriebseinrichtung (70, 72, 74) eine hin- und herschwingbare Schwing- bzw. Kipphebelwelle (10) aufweist.

4. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß die Antriebseinrichtung (70, 72, 74) ein durch die Schwinghebelwelle (10) angetriebenes Schwingzahnrad (74) und eine Getriebeeinrichtung (70, 72) aufweist, welche die Wirkverbindung zwischen dem Getriebezahnrad und den Antriebselementen bildet.

5. Vorrichtung nach Anspruch 4, dadurch gekennzeichnet, daß die Antriebseinrichtung (70, 72, 74) ein Verbindungsgelenk (80, 81) aufweist, das mit der Schwinghebelwelle (10) verbunden und an das Schwingzahnrad (74) exzentrisch zu dessen Drehachse angelenkt ist.

6. Vorrichtung nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die Vorschubelemente (51) drehbare Räder sind.

7. Vorrichtung nach einem der Ansprüche 1 bis 6, gekennzeichnet durch eine hin- und herschwingbare Welle (52, 52a) zum Antrieb des Gitters (55, 56) zwischen einer oberen sowie einer unteren Stellung in bezug auf die Oberflächen der Vorschubelemente (51) und durch einen Zapfen (57), der an einer Seite der Welle (52, 52a) bewe-

gungsfest mit dieser befestigt und in eine Öffnung (53), die in einem nach unten ragenden Schenkel des Gitters (55, 56) vorgesehen ist, eingreift, um die Bewegung von der hin- und herschwingbaren Welle (52, 52a) auf das Gitter (55, 56) zu übertragen.

8. Vorrichtung nach Anspruch 7, dadurch gekennzeichnet, daß zwei hin- und herschwingbare Wellen (52, 52a) sowie Einrichtungen (90, 94, 104, 106) vorgesehen sind, mittels denen die beiden hinund herschwingbaren Wellen (52a, 52) in einem vorbestimmten Ablauf zueinander durch die gleiche Antriebsquelle antreibbar sind.

9. Vorrichtung nach einem der Ansprüche 1 bis 8, gekennzeichnet durch eine Einrichtung zum Antreiben des Gitters (55, 56) zwischen der angehobenen und der abgesenkten Stellung, wobei die Einrichtung versehen ist mit einem Nocken (90), der an seinem Umfang eine die angehobene Stellung des Gitters (55, 56) bestimmende Hochnockenbahn (92) sowie eine gegenüber der Hochnockenbahn nach innen eingezogene, die abgesenkte Stellung des Gitters (55, 56) bestimmende Niedernockenbahn (91) aufweist, und mit einem Nockenstößel (94), der mit dem Umfang des Nockens bzw. der Nockenscheibe (90) in Eingriff steht und in Wirkverbindung mit dem Gitter (55, 56) steht, um dieses zwischen seiner angehobenen und abgesenkten Stellung anzutreiben.

10. Vorrichtung nach Anspruch 9, gekennzeichnet durch eine Klinkeneinrichtung (100, 120, 122, 124, 126), mittels der der Nockenstößel (94) auf dem Niveau der Hochnockenbahn des Nockens (90) haltbar ist, um das Gitter (55, 56) in der angehobenen Stellung zu halten, wobei die Klinkeneinrichtung ein Klinkenglied (122) aufweist, das einerseits mit dem Nockenstößel (94) in Eingriff bringbar ist, um diesen auf dem Niveau der Hochnockenbahn (92) des Nockens (90) zu halten, und das andererseits mit dem Nockenstößel (94) außer Eingriff bringbar ist, um diesen zwischen der Hochnockenbahn (92) und der Niedernockenbahn (91) des Nockens (90) zu bewegen.

11. Vorrichtung nach Anspruch 10, dadurch gekennzeichnet, daß der Nockenstößel (94) einen Hebel (100) mit einer Öffnung (126) aufweist und daß das Klinkenglied (122) ein Zapfen ist, der einerseits in die Öffnung (126) hineinbewegbar ist, um den Nockenstößel (94) auf dem Niveau der Hochnockenbahn (92) des Nockens (90) zu halten, und der andererseits aus der Öffnung (126) herausbewegbar ist, um den Nockenstößel (94) zur Bewegung zwischen der Hochnockenbahn (92) und der Niedernockenbahn (91) des Nockens (90) freizugeben.

12. Vorrichtung nach Anspruch 1, gekennzeichnet durch einen zum Antrieb des Klinkenzapfens (122) dienenden Fluidmotor (124), der eine am Klinkenzapfen (122) befestigte, herausschiebbare sowie zurückziehbare Stange aufweist, mittels welcher der Klinkenzapfen (122) in die Öffnung (126) des Nockenstößelhebels (100) hineinbewegbar bzw. aus dieser herausbewegbar ist.

13. Verfahren zur Zufuhr von blattähnlichen Gegenständen zu einer Behälterherstellungsmaschine oder dgl., mit einer Zufuhrvorrichtung, die versehen ist mit einem Gatter, an das die Vorderkanten eines Stapels von Gegenständen vor ihrem Weitertransport anschlagen, und mit einer Vielzahl von unter dem Stapel der Gegenstände vorgesehenen Vorschubelementen zum Eingriff mit den Gegenständen sowie zu deren Transport unter dem Gatter hindurch, wobei die Vorschubelemente in einer ersten Richtung bewegt werden, um den untersten Gegenstand des Stapels unter dem Gatter hindurchzutransportieren, dadurch gekennzeichnet, daß die Vorschubelemente in einer zur ersten Richtung entgegengesetzten zweiten Richtung bewegt werden, um den untersten Gegenstand vom Gatter wegzubewegen und das Gatter von dem hierauf ausgeübten Druck zu entlasten, so daß ein Blockieren des Gegenstandes am Gatter verhindert wird.

14. Verfahren nach Anspruch 13, dadurch gekennzeichnet, daß als Vorschubelemente drehbare Räder verwendet werden, die an ihren Oberflächen in Reibeingriff mit einem Gegenstand gebracht werden, um diesen Gegenstand in der vorerwähnten Weise zu transportieren.

Revendications

1. Dispositif pour distribuer individuellement des articles, tels que des feuilles ou des plaques (6), qui sont empilés derrière une porte (32) et dans lequel les articles sont avancés individuellement sous la porte (32) le long d'un chemin sensiblement horizontal, comprenant des organes d'alimentation (51) déplaçables dans une première direction sensiblement suivant ledit chemin pour attaquer et déplacer un article (6) vers l'avant sous ladite porte (32) et le long dudit chemin, lesdits organes d'alimentation (51) présentant des surfaces (51a) qui peuvent venir en contact de friction avec la face inférieure d'un article (6) pour déplacer l'article (6) le long dudit chemin lors du mouvement desdites surfaces, caractérisé par des moyens (70, 72, 74) pour entraîner les dits organes d'alimentation (51) dans ladite première direction et dans une deuxième direction opposée à ladite première direction de façon à éloigner un article (6) de ladite porte (32) avant le mouvement de l'article (6) sous la porte (32), et par une grille (55, 56) déplaçable verticalement au-dessus et au-dessous dudit chemin de sorte que lesdits organes d'alimentation (51) peuvent attaquer et distribuer un article (6) dans ladite direction vers l'avant sous ladite porte (32) lorsque la grille (55, 56) est dans une position abaissée au-dessous des surfaces des organes d'alimentation (51), et ils peuvent éloigner un article (6) de ladite porte (32) avant le mouvement de l'article (6) sous la porte (32) lorsque la grille (55, 56) est dans ladite position abaissée.

2. Dispositif suivant la revendication 1, pour amener des articles à une paire de rouleaux de pincement (18) afin de transporter les articles le

long dudit chemin, caractérisé en ce que lesdits organes d'alimentation (51) sont montés dans un carter sous vide (36) présentant une surface supérieure perforée (37) le long dudit chemin et en amont desdits rouleaux de pincement (18), ladite porte (32) étant placée au-dessus du carter sous vide (36) en amont des rouleaux de pincement (18) pour retenir les bords de tête des articles (6) à distribuer sous la porte (32) vers les rouleaux de pincement (18).

3. Dispositif suivant la revendication 1 ou 2, caractérisé en ce que lesdits moyens d'entraînement (70, 72, 74) comprennent un arbre oscillant (10).

4. Dispositif suivant la revendication 3, caractérisé en ce que lesdits moyens d'entraînement (70, 72, 74) comprennent en outre un engrenage oscillant (74) entraîné par ledit arbre oscillant (10) et des pignons (70, 72) interconnectant fonctionnellement ledit engrenage oscillant et lesdits éléments d'entraînement.

5. Dispositif suivant la revendication 4, caractérisé en ce que lesdits moyens d'entraînement (70, 72, 74) comprennent en outre une biellette (80, 81) reliée audit arbre oscillant (10) et reliée de façon pivotante audit engrenage oscillant (74) à une position excentrée par rapport à l'axe de rotation de l'engrenage oscillant (74).

6. Dispositif suivant l'une quelconque des revendications 1 à 5, caractérisé en ce que lesdits organes d'alimentation (51) sont des roues rotatives.

7. Dispositif suivant l'une quelconque des revendications 1 à 6, caractérisé par un arbre oscillant (52, 52a) pour entraîner la grille (55, 56) entre une position supérieure et une position inférieure par rapport aux surfaces des organes d'alimentation (51), et une tige (57) fixée à un côté de l'arbre (52, 52a) pour osciller avec lui et reçue dans un trou (53) d'une branche descendante de ladite grille (55, 56) pour transmettre le mouvement de l'arbre oscillant (52, 52a) à la grille (55, 56).

8. Dispositif suivant la revendication 7, caractérisé en ce qu'il est prévu deux arbres oscillants (52, 52a) et des moyens (90, 94, 104, 106) pour entraîner les deux arbres oscillants (52a, 52) dans une séquence prédéterminée l'un par rapport à l'autre, à partir de la même source d'énergie.

9. Dispositif suivant l'une quelconque des revendications 1 à 8, caractérisé par des moyens pour entraîner ladite grille (55, 56) entre ladite position relevée et ladite position abaissée, comprenant une came (90) dont la périphérie présente une surface en relief déterminant la position relevée de la grille (55, 56) et une surface en creux, en retrait vers l'intérieur par rapport à la surface en relief et déterminant la position abaissée de la grille (55, 56), et un palpeur de came (94) appliqué sur la périphérie de la came (90) et relié fonctionnellement à la grille (55, 56) pour déplacer celleci entre ses positions relevée et abaissée.

10. Dispositif suivant la revendication 9, caractérisé par des moyens de verrouillage (100, 120, 122, 124, 126) pour retenir le palpeur de came (94) au niveau de la surface en relief de la came (90) afin de maintenir la grille (55, 56) dans sa position relevée, lesdits moyens de verrouillage comprenant un verrou (122) qui peut venir en prise avec ledit palpeur de came (94) pour retenir le palpeur de came (94) au niveau de la surface en relief de la came (92), ledit verrou (122) pouvant être dégagé du palpeur de came (94) pour permettre au palpeur de came (94) de se déplacer entre la surface en relief et la surface en creux de la came (92).

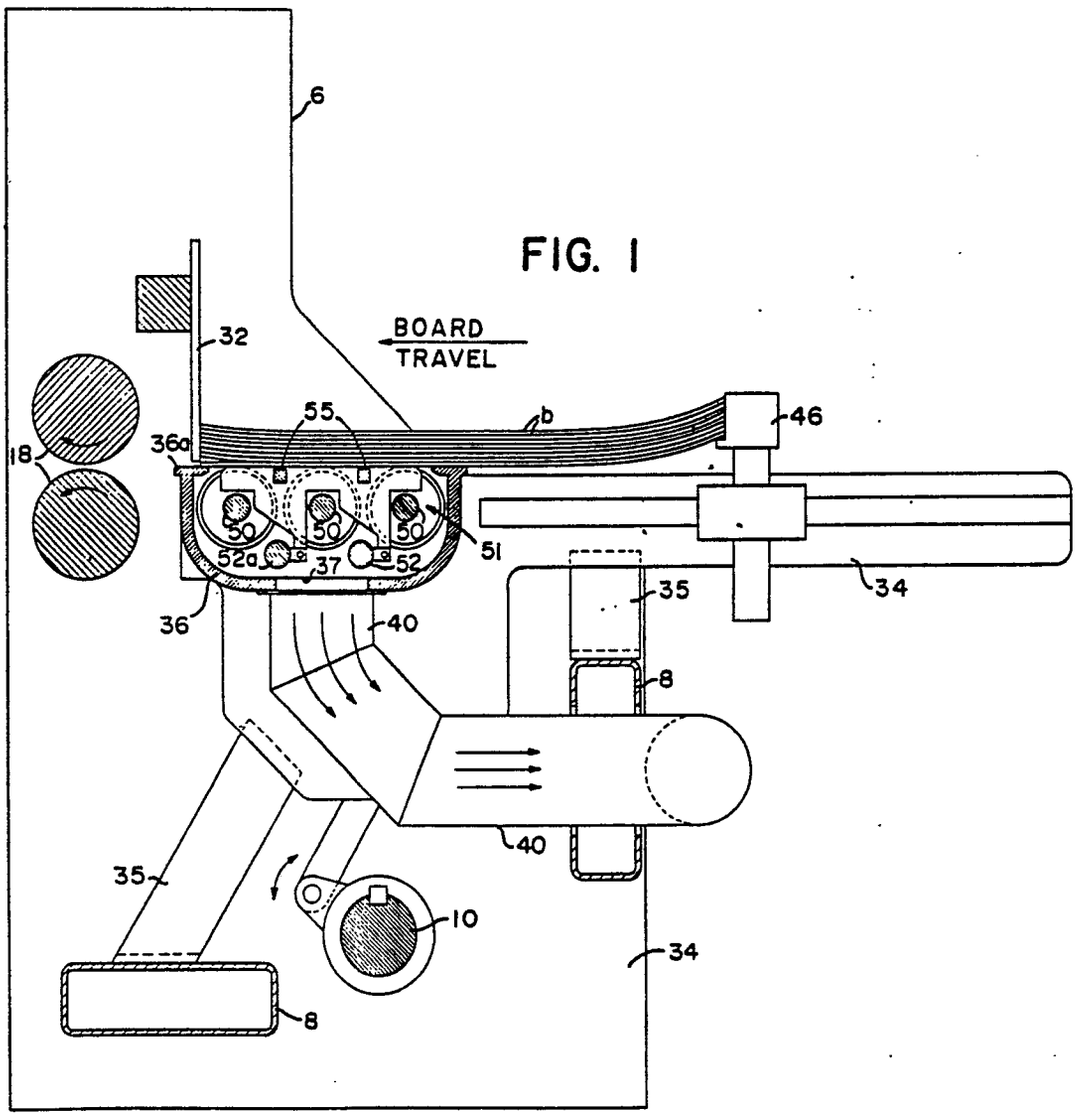
11. Dispositif suivant la revendication 10, caractérisé en ce que le palpeur de came (94) comprend un levier (100) comportant un trou (126), et le verrou (122) est une broche qui peut pénétrer dans le trou (126) pour retenir le palpeur de came (94) au niveau de la surface en relief de la came (92), et la broche de verrouillage (122) peut être sortie du trou (126) pour libérer le palpeur de came (94) et permettre son mouvement entre les surfaces en relief et en creux de la came (92).

12. Dispositif suivant la revendication 11, caractérisé par un moteur à fluide (124) pour entraîner ladite broche de verrouillage (122), ledit moteur à fluide (124) comportant une tige extensible et rétractable fixée à la broche de verrouillage (124) pour introduire cette dernière dans ledit trou (126) du levier (100) du palpeur de came, ou pour l'extraire de ce trou.

13. Procédé de distribution d'articles en forme de feuille à une machine de fabrication de boîtes ou analogue au moyen d'un dispositif de distribution comprenant une porte pour retenir les bords avant d'une pile d'articles avant leur distribution, et une pluralité d'organes d'alimentation placés sous la pile pour venir en contact avec les articles et les faire avancer sous la porte, le procédé comprenant le déplacement des organes d'alimentation dans une première direction pour distribuer l'article inférieur de la pile sous la porte, caractérisé par le déplacement des organes d'alimentation dans une deuxième direction, opposée à ladite première direction, pour éloigner l'article inférieur de la porte afin de réduire la pression sur la porte pour éviter un coincement de l'article contre la porte.

14. Procédé suivant la revendication 13, caractérisé par l'opération d'utilisation de roues rotatives comme organes d'alimentation, et de mise en contact de friction d'un article avec les surfaces des roues pour déplacer un article de la manière précitée.

FIG. 1


6
32
BOARD
TRAVEL
55
b
46
18
36a
50
50
50
51
52a
37
52
34
35
36
40
8
40
35
10
34
8

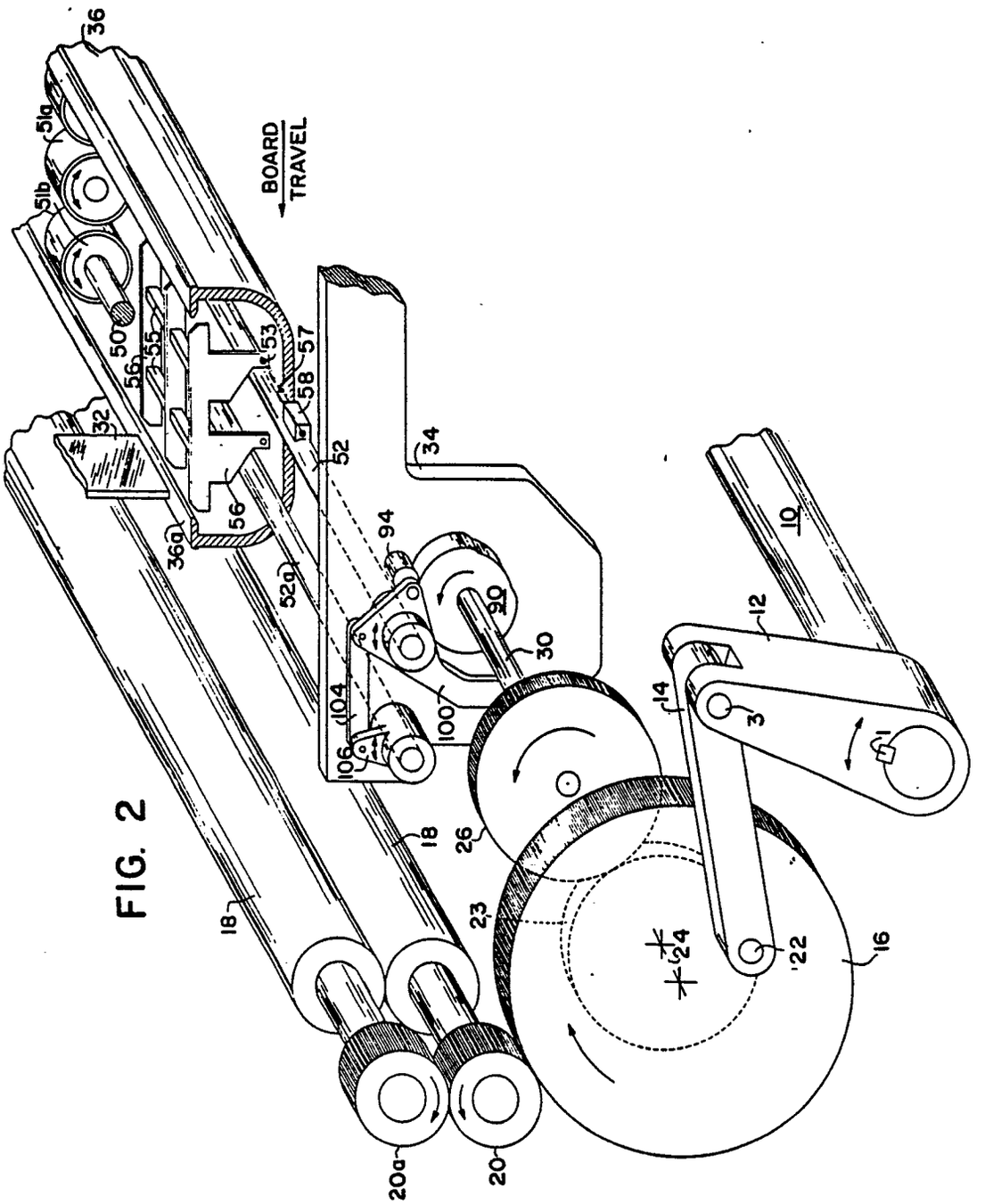

BOARD TRAVEL
36
51a
51b
50
55
56
53
57
58
32
52
34
94
52a
90
30
104
100
106
10
12
14
3
11
18
26
23
24
22
16
20a
20

FIG. 2

FIG. 3

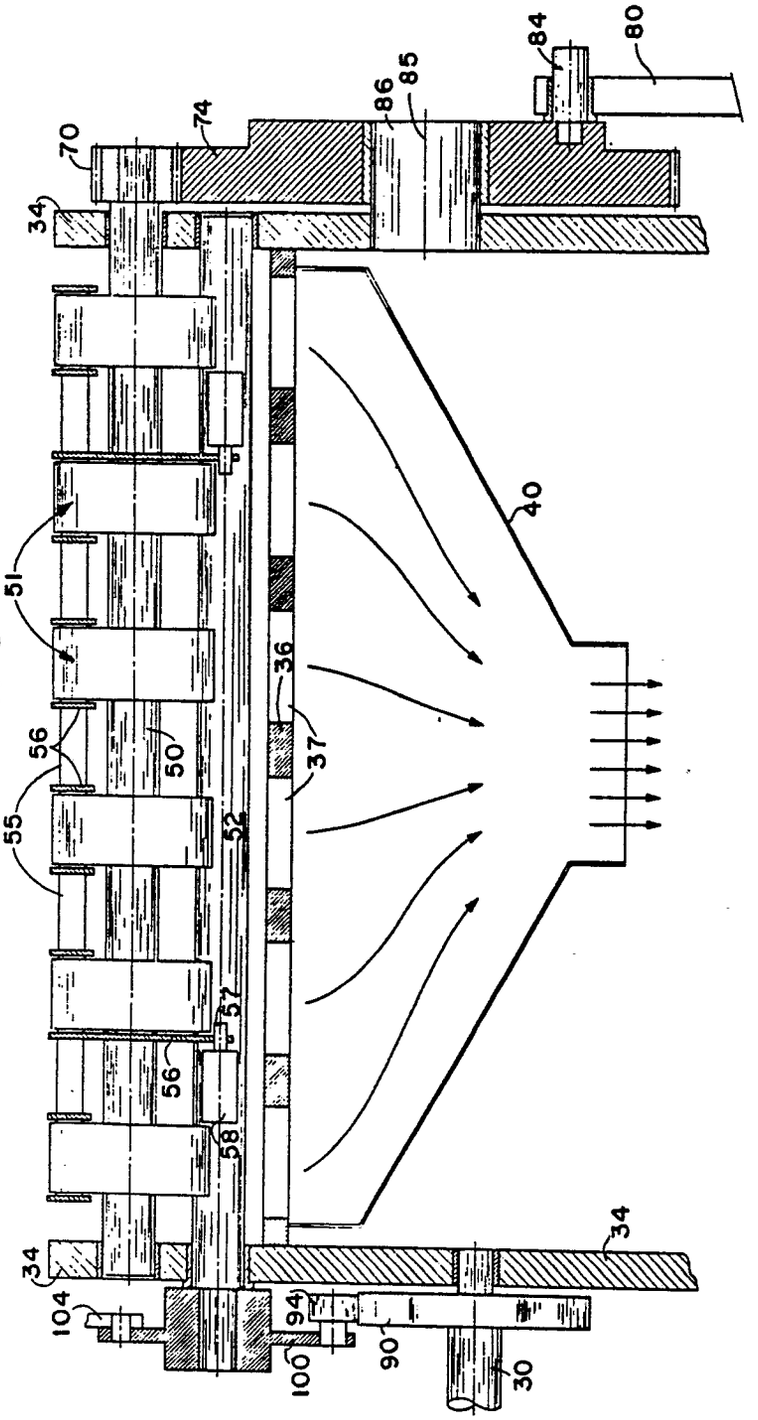

84
80
86
85
74
70
34
40
51
36
56
50
37
55
52
57
56
58
34
34
104
94
90
100
30

FIG. 4

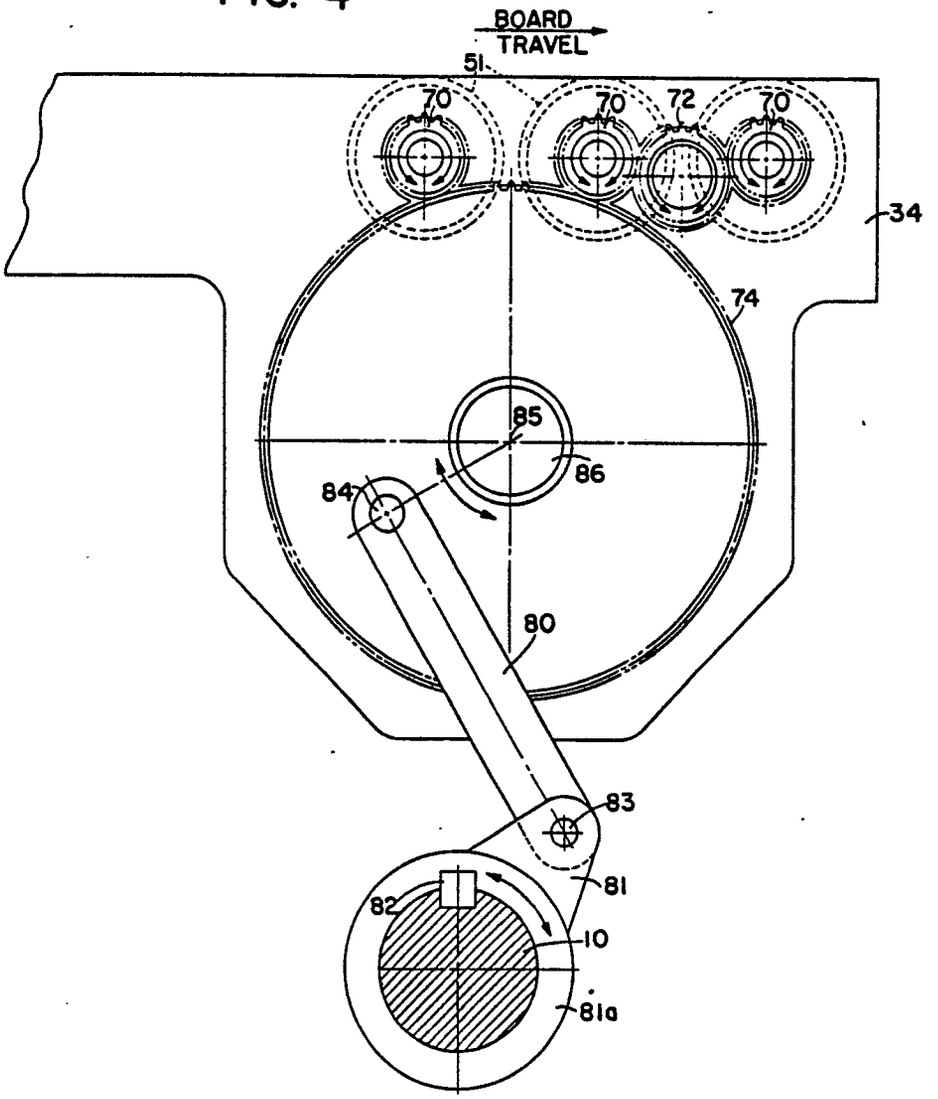


FIG. 5

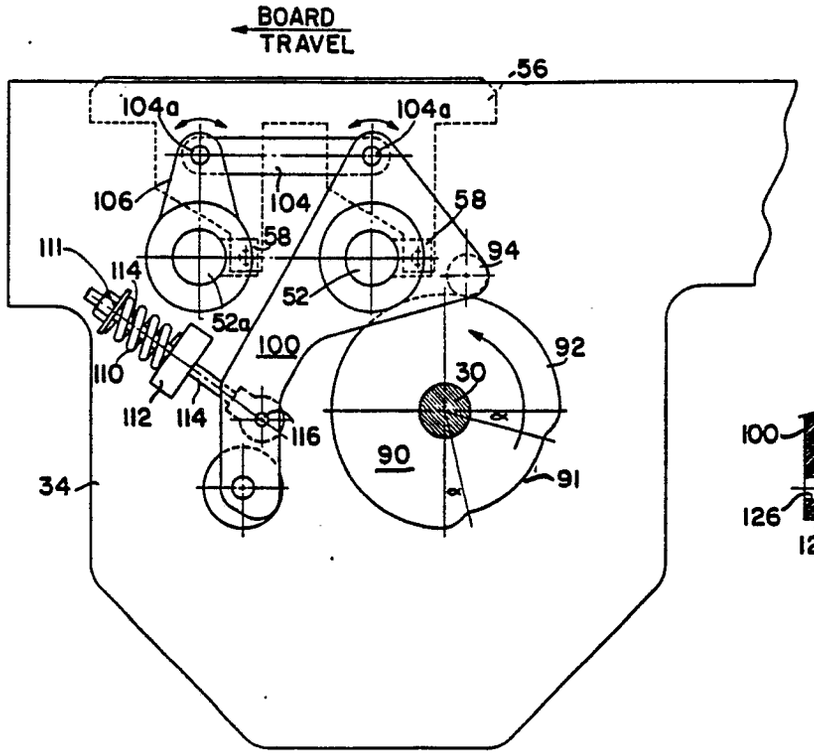


FIG. 5a

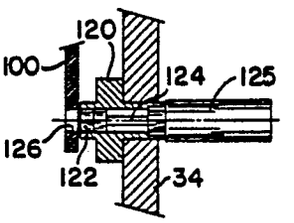


FIG. 7

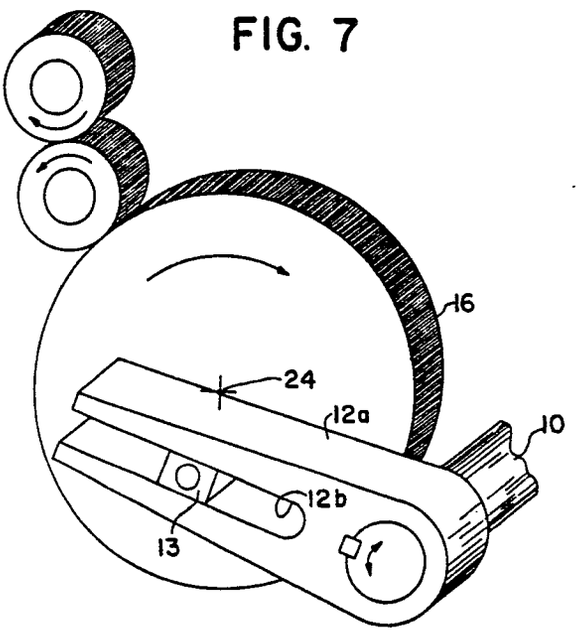
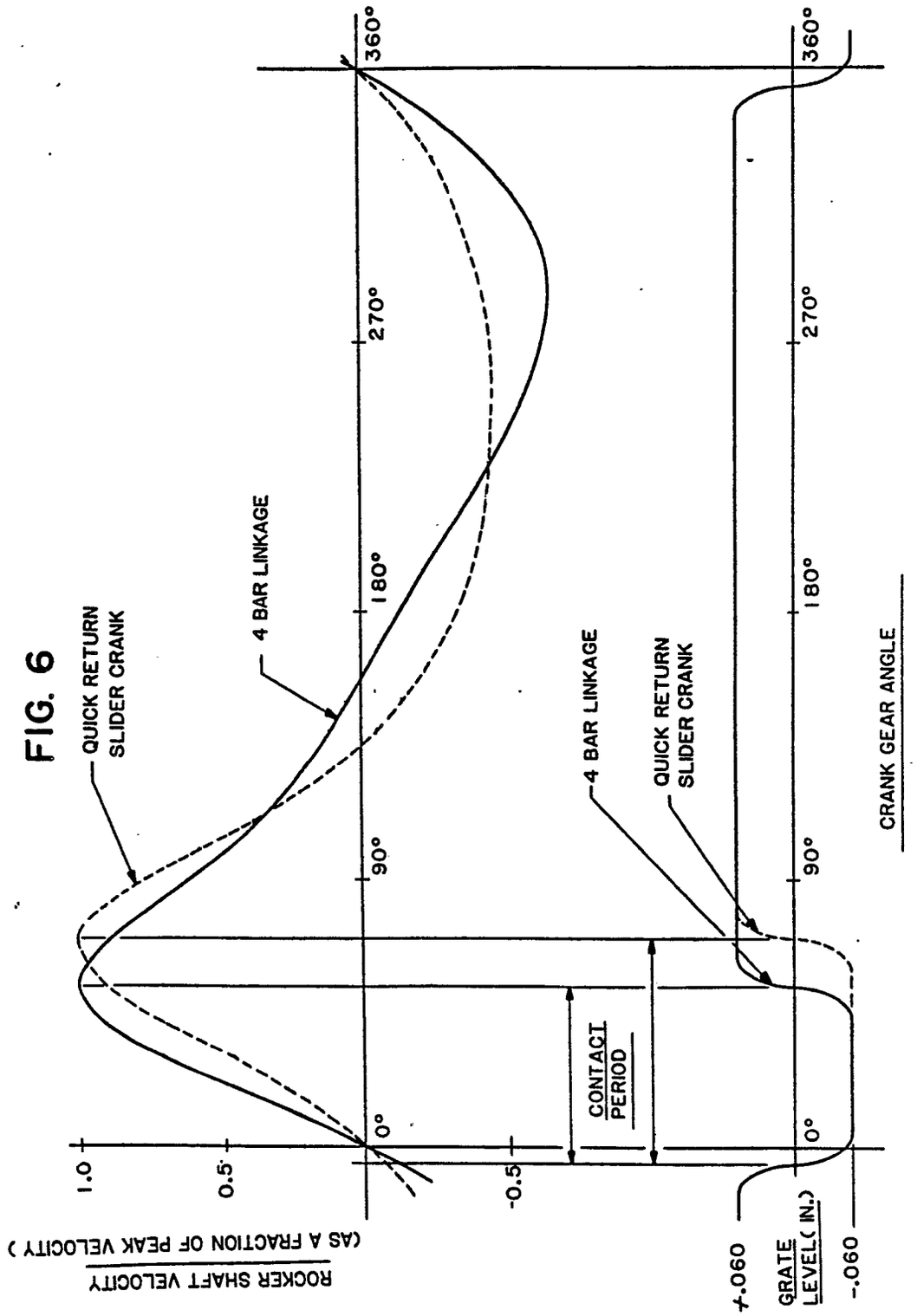


FIG. 6


QUICK RETURN SLIDER CRANK
4 BAR LINKAGE
4 BAR LINKAGE
QUICK RETURN SLIDER CRANK
CONTACT PERIOD
ROCKER SHAFT VELOCITY (AS A FRACTION OF PEAK VELOCITY)
1.0
0.5
-0.5
0°
90°
180°
270°
360°
CRANK GEAR ANGLE
GRATE LEVEL (IN.)
+.060
-.060