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SHEET FEEDING APPARATUS

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Sheet 2 of 2

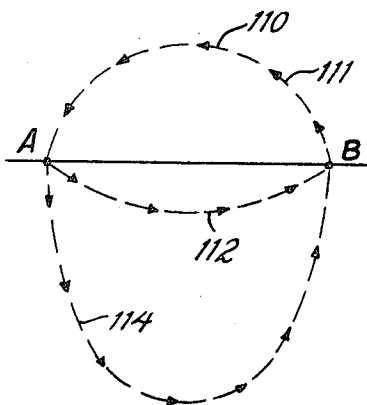


Fig. 4.

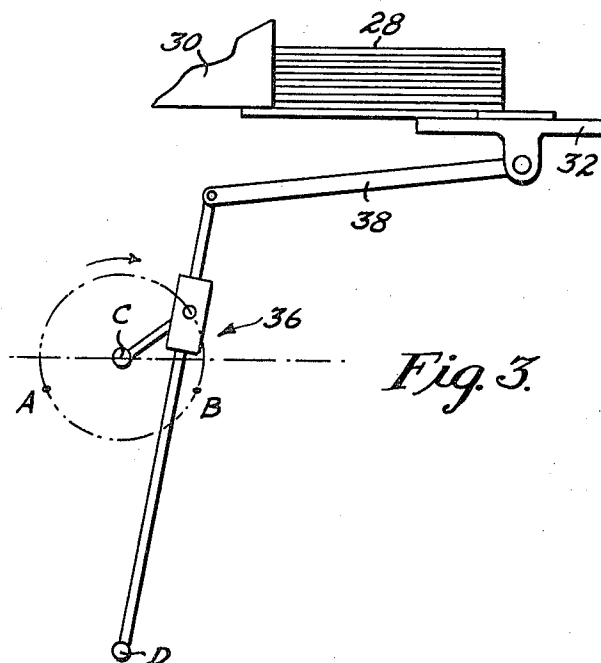


Fig. 3.

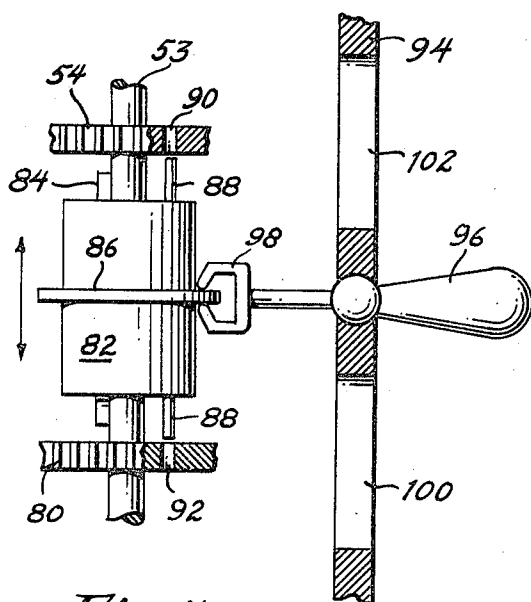


Fig. 5.

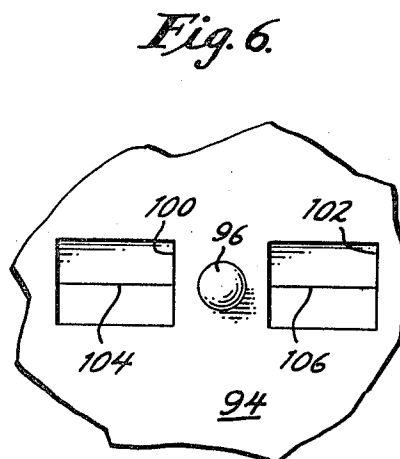


Fig. 6.

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SHEET FEEDING APPARATUS

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6 Claims

ABSTRACT OF THE DISCLOSURE

Sheet feeding apparatus is disclosed for feeding one or two sheets per cycle to a pair of feed rolls at the surface speed of said rolls by means of a reciprocating element driven by a main drive shaft. The rate of feed is doubled while maintaining feeding of the sheets to the rolls at the same surface speed of the rolls by reversing the direction of rotation of the main drive shaft which is then rotated at twice the original speed.

This invention relates to sheet feeding apparatus, and more particularly to apparatus for feeding single sheets of material sequentially in a predetermined manner to other devices for subsequent processing.

The sheet feeding apparatus of the present invention is particularly applicable for use with machines such as folder-glue, printer-slotter, etc., where blanks must be fed in timed sequence through a series of operations. Standard feeding heretofore has been one blank per machine cycle or one blank for every other machine cycle. Quite often the size of the blank will enable the feeding to be accomplished in a more rapid manner whereby it would be desirable to feed two blanks per cycle, thereby increasing machine output and flexibility.

Feeding blanks from a hopper in timed sequence requires a reciprocating element whose characteristics are such that a blank is started from rest and accelerated up to machine board speed at approximately the middle of the forward stroke. Those skilled in the art are familiar with these basic requirements and how they are satisfied by the application of variable velocity mechanisms such as inverted slider crank mechanisms, elliptical gears, drag-link mechanisms, etc. The solution to the problem of feeding two blanks per machine cycle is not accomplished by merely increasing the input speed to the reciprocating element due to the fact that the blanks must be fed to feed rollers at the surface speed of the feed rollers. If the speed of reciprocation of the reciprocating elements were doubled, so as to deliver or feed two blanks per machine cycle, the blanks will not be traveling at the surface speed of the feed rollers when contacting the same.

The apparatus of the present invention is structurally interrelated in a manner so that the blanks or sheets are fed to the feed rollers at substantially the same surface speed of the feed rollers. The blanks are fed from a hopper by a reciprocating slide means connected to a rotating shaft by mechanical linkages. When it is desired to convert from feeding one blank or sheet per machine cycle to two sheets or blanks per machine cycle, we have found that it is only necessary to reverse the direction of rotation of the shaft and double the speed of rotation of the shaft. Hence, it is not necessary to dismantle linkages or make complicated adjustments when it is desired to convert from one timing sequence to another timing sequence.

It is an object of the present invention to provide novel sheet feeding apparatus.

It is another object of the present invention to provide sheet feeding apparatus which is convertible from feeding sheet material at one rate to another rate.

It is another object of the present invention to provide sheet feeding apparatus wherein sheets or blanks may be

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fed to feed rollers at the surface speed of the feed rollers.

It is another object of the present invention to provide sheet feeding apparatus for use with a printer-slotter so that paperboard blanks may be fed to the printer-slotter at a rate of two blanks per revolution of the printing cylinders.

It is another object of the present invention to provide feeding apparatus for feeding paperboard blanks to a printer-slotter in a manner whereby the blanks may be fed at a rate of one blank per revolution of a printing cylinder or converted for feeding two blanks per revolution of the printing cylinder.

Other objects will appear hereinafter.

For the purpose of illustrating the invention, there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIGURE 1 is a partial side elevation view of a printer-slotter connected to a multistage rescoring and gluing section on a folder-gluer for processing blanks of paperboards.

FIGURE 2 is a schematic perspective view of the components of the feeding apparatus of the present invention.

FIGURE 3 is a schematic illustration of a conventional quick return mechanism used for feeding blanks.

FIGURE 4 is a velocity diagram.

FIGURE 5 is a partial plan view of a portion of the apparatus in FIGURE 2.

FIGURE 6 is an elevation view of the apparatus in FIGURE 5.

Referring to the drawing in detail, wherein like numerals indicate like elements, there is shown in FIGURE 1 a printer-slotter designated generally as 10. The printer-slotter 10 includes a feeding section 12, printing sections designated as 14, and a slotting-scoring section designated as 16. The printer-slotter 10 is connected to a multistage rescoring and gluing section 18 of a folder-gluer 20.

The structure illustrated in FIGURE 1 will process paperboard blanks as follows. Paperboard blanks 28 are fed from a hopper 30 by means of a reciprocating slide 32 to the feed rollers 24 and 26. The feed rollers 24 and 26 feed the blanks to a printing roller 22 of the printing section 14. Printing section 14 may have one or more printing rollers in series depending upon the number of colors to be printed on the paperboard blank 28. Thereafter, the blank passes section 16 where it is slotted and scored and fed to section 18. In section 18, the blank is rescoring and glue is applied to a glue flap. From section 18, the thusly processed blank is fed to the folder-gluer 20 which folds the blank so that the glue flap along one edge of the blank is in contact with the opposite edge so as to form a folded paperboard or cardboard box.

Heretofore, it has been proposed to cause the slide 32 to feed one blank 28 to the feed rollers 24 and 26 per revolution of the printing roller 22 at the surface speed of the feed rollers 24 and 26 by way of a quick return mechanism such as the Whitworth type designated generally as 36 in FIGURE 3. The mechanism 36 is connected to the slide 32 by a connecting rod 38.

The Whitworth quick return mechanism 36 as diagrammatically illustrated in FIGURE 3 includes an arm rotatable about point D and connected to a disk rotating about point C by way of a slide on the arm rotatably connected to the disk at a distance radially outwardly from the point C. With the disk rotating in the direction of the arrow in FIGURE 3, the slide 32 will have a forward stroke from point B to point A and a return stroke from point A to point B. The dimensions of the components and the relationships are chosen in a manner known to those skilled in the art so that the blank 28 will be fed to the feed rollers 24 and 26 so that the blank will be trav-

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eling at a velocity corresponding to the surface speed of the feed rollers when contact therebetween is made.

The structure illustrated in FIGURE 3 when constructed to feed blanks 28 to the feed rollers 24 and 26 at a rate of one blank per revolution of the printing roller 22 cannot be utilized to feed two blanks per revolution of the printing roller 22 merely by doubling the speed of rotation of the disk having the point C for its center. The reason being that the blanks 28 will no longer contact the feed rollers 24 and 26 at the surface speed of these rollers. In FIGURE 2, there is illustrated a sheet feeding apparatus which will enable the blanks 28 to be fed from the hopper 30 to the feed rollers 24 and 26 at a rate of one blank per revolution of the roller 22 or two blanks per revolution of the roller 22, while maintaining the relationship that the blanks must pass between the feed rollers at the same surface speed of rotation of the feed rollers 24 and 26.

The slide 32 will be mounted and supported by structure not shown so that it may reciprocate in the direction of the arrow 34. The connecting rod 38 is rotatably connected at one end to the slide 32 and at its other end to a feed lever 40. The feed lever 40 is fixedly secured to a rocker shaft 42. A yoke 44 having arms 46 and 48 is also fixedly secured to the rocker shaft 42. A pin 50 extends into the gap between the arms 46 and 48. Pin 50 is integral at one end with a disk 52 on shaft 53. Pin 50 projects in an axial direction with respect to shaft 53 and is at a location which is intermediate to the periphery and center of disk 52.

A gear 54 is free-wheeling on shaft 53. That is, gear 54 is not directly connected to shaft 53.

Gear 54 is in meshing engagement with gear 56 on shaft 58. Shaft 58 may also be the shaft on which the lower feed roller 26 is supported. The gear 60 on shaft 58 is in meshing engagement with a gear 62 on the shaft 61 for the upper feed roller 24. Shaft 61 is preferably provided with a flexible coupling 63 between gear 62 and feed roller 24 so as to permit adjustment of the gap between the feed rollers.

Gear 62 is in meshing engagement with a gear 64 which in turn is in meshing engagement with gear 66 on shaft 68. Shaft 68 may be the shaft on which the printing roller 22 is supported. Shaft 68 may be driven by a motor 70. The remainder of the gear train or transmission means which facilitates driving the remaining rollers as well as the main drive shaft 72 for the folder-gluer 20 are not shown and may be operatively coupled to shaft 68 for a driven relationship for motor 70. It will be obvious that the motor 70 may be coupled into the system in any one of a variety of locations and need not be coupled directly to the shaft 68 as illustrated. The main drive shaft 72 of the folder-gluer 20 is in driving relationship with a shaft 74 which extends the length thereof so as to facilitate transmission of rotary power to the end of the folder-gluer not shown.

As shown in FIGURE 2, a gear 76 is mounted on shaft 58 for rotation therewith. Gear 76 is in meshing engagement with gear 78 which in turn is in meshing engagement with gear 80. Gear 80 is free-wheeling on shaft 53 and spaced from gear 54. Between the gears 54 and 80, a clutch 82 is reciprocally supported on shaft 53 and connected thereto by a key 84. Clutch 82 has a radially outwardly directed flange 86. A pin 88 extends in an axial direction from the clutch 82 in opposite directions therefrom. Pin 88 is adapted to be selectively inserted into hole 90 on gear 54 or hole 92 on gear 80.

For purposes of illustration, the clutch 82 is illustrated in FIGURES 2 and 5 as being in a mid-position which may be considered neutral. When pin 88 is in hole 90 only, gear 54 will then be coupled to drive shaft 53 in the direction of the arrow superimposed on gear 54 in FIGURE 2. When pin 88 is in hole 92 only, gear 80 will be coupled to drive shaft 53 in the direction of the arrow superimposed on gear 80 in FIGURE 2. If desired, lever 96 and clutch 82 may be prevented from staying in a neutral position by a detent mechanism not shown.

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In FIGURE 5, there is illustrated a portion of the wall 94 for the housing which will enclose gears 54, 56, 76, 78 and 80. A lever 96 is provided to selectively actuate the clutch 82. Lever 96 is suitably journaled in wall 94 for oscillating movement. Lever 96 terminates in a yoke 98 which embraces the flange 86 on clutch 82.

A window 100 having a line 104 thereon is provided in the wall 94 opposite the gear 80. A similar window 102 having a line 106 thereon is provided in the wall 94 opposite the gear 54. A line (not shown) is provided on the periphery of gears 54 and 80 which will be superimposed behind the lines 106 and 104, respectively, in one rotative disposition of the gears 54 and 80. Since the gears 54 and 80 need only be rotated less than 180° in order to cause the lines thereon to be superimposed over the lines on the windows, a detachable handwheel 108 may be provided on shaft 58. Handwheel 108 provides a convenient means for causing the gears 54 and 80 to rotate in opposite directions through an arc of less than 180°. Accordingly, any other equivalent device or means for causing such rotation may be utilized.

The size of disk 52 is chosen so that the length of the stroke of slide 32 will be approximately two-thirds the diameter of roller 22. The radial distance between the longitudinal axis of shaft 53 and pin 50 is chosen so as to be approximately one-third the distance between the longitudinal axes of shafts 53 and 42. In this manner, the maximum instantaneous velocity of the slide 32 on its return stroke will be one-half the maximum instantaneous velocity of the slide 32 on its forward stroke. Hence, rotation of shaft 53 in an opposite direction at twice the speed will result in the slide 32 attaining the same maximum forward velocity which will correspond to the surface speed of the feed rollers 24 and 26.

FIGURE 4 is a diagram illustrating the instantaneous velocities of the slide 32 as a function of the stroke. In FIGURE 4, point A represents the forward portion of the stroke for slide 32 and point B represents the back portion of the stroke for slide 32. When one blank 28 is being fed per revolution of the roller 22, the instantaneous velocity of the slide 32 is represented by line 110 indicative of the feed stroke of the cycle. The return stroke of the cycle is represented by line 112. When feeding two blanks 28 per revolution of the roller 22, the instantaneous forward velocity of the slide 32 will correspond to line 111 and the instantaneous velocity of slide 32 on the return stroke will follow line 114. The instantaneous velocities represented by lines 110 and 111 need not be identical curves as shown in FIGURE 3, they are required only to be similar to each other so that the velocity relationship between blanks 28 and feed rollers 24 and 26 be maintained. On a velocity-time diagram, the lines 110 and 114 would be repeated twice during the time required for one complete revolution of the roller 22.

The operation of the sheet feeding apparatus of the present invention is as follows:

First it will be assumed that the clutch is positioned in neutral as illustrated in FIGURE 5. Handwheel 108 is rotated through an arc of less than 360° so as to cause the lines on the gears 54 and 80 to match the lines 104 and 106 on the windows 100 and 102. Thereafter, the lever 96 can be rotated in a clockwise direction in FIGURE 5 to cause pin 88 to enter hole 90.

With pin 88 extending into hole 90, gear 54 will now be coupled to the shaft 53 instead of free-wheeling thereon. When a motor 70 is started, the feed rollers 24 and 26 will rotate in the direction of the arrows superimposed thereon in FIGURE 2. Also, gear 54 will rotate in a clockwise direction in FIGURE 2, thereby causing shaft 53 to rotate in a clockwise direction in FIGURE 2. Pin 50 will cause the yoke 44 to oscillate rocker shaft 42 which in turn through lever arm 40 and connecting rod 38 will reciprocate the slide 32 in the direction of the double-headed arrow 34. On the forward stroke, that is, movement toward the feed rollers 24 and 26, the slide 32 will feed one of the blanks 28 to the rollers 24 and 26

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per revolution of said roller 22. Slide 32 will have flexible feeders thereon which are conventional in the art to assure that only one blank 28 will be fed for every forward stroke of the slide 32.

When it is desired to convert from one blank 28 per revolution of the roller 22 to two blanks per revolution of said roller 22, the nature of the clutch illustrated in FIGURE 5 requires the motor 70 to be inoperative. The holes 90 and 92 in the gears 54 and 80, respectively, should be lined up as described above. Roller 22 will have two printing dies on its surface. Thereafter, the lever 96 can be rotated in a counterclockwise direction in FIGURE 5 to cause pin 88 to enter hole 92. When motor 70 starts, gear 54 will be free-wheeling on shaft 53 and gear 80 will cause shaft 53 to rotate in a counterclockwise direction in FIGURE 2 at twice its previous speed. The double velocity is attained by a proper selection of gear ratios between gears 56 and 54 on one hand and gears 76, 78 and 80 on the other hand.

As previously mentioned, the maximum instantaneous velocity on the slide 32 on the return stroke when feeding one blank 28 per cycle was one-half the maximum instantaneous velocity on the forward stroke. Hence, when shaft 53 is rotated in an opposite direction at twice the speed, two blanks 28 will be fed by the slide 32 to the rollers 24 and 26 per revolution of roller 22 with each blank being delivered to said rollers 24 and 26 at the surface speed of said rollers.

It will be noted that the conversion from feeding one to two blanks per cycle of revolution of roller 22 was accomplished without dismantling the feeding apparatus or making complicated adjustments.

The above description is directed to a sheet feeding mechanism wherein the feed rollers 24 and 26 feed the blank 28 to the printing roller of a printer-slotter. It will be obvious to those skilled in the art that the feed rollers 24 and 26 may be associated with a device other than a printer-slotter or printing roller 22. That is, the feed rollers 24 and 26 may feed the blanks directly to a rotating member of a folder-gluer, or some other mechanism which will further process the blank 28.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

We claim:

1. A sheet feeding apparatus comprising a rotating member for operating on the sheet, a pair of feed rollers for feeding sheet material to said member, a hopper, a slide reciprocally supported for feeding sheet material from the hopper to said feed rollers during the feeding stroke, means for rotating the feed rollers and the operating member at the same peripheral speed, mechanical means for reciprocating said slide in any one of two set frequencies relative to one revolution of said operating member while maintaining a constant peak velocity of said slide during said feeding stroke, said mechanical means including a main drive shaft and a rocker shaft rotatably mounted on axes fixed relative to one another, a yoke fixed at one end to said rocker shaft, a crank member eccentrically mounted on said drive shaft, a slot in said yoke running in transverse direction to said drive and rocker shafts and slidably receiving said crank member so that said rocker shaft makes one oscillation per revolution of said drive shaft, a connecting rod coupled at one end to said rocker shaft and at another end to said slide means for reciprocating the same, and means for rotating said drive shaft in one direction in timed relation to the rotation of said operating member shaft to maintain one set number of slide reciprocations per revolution of said operating member, and means for selectively rotating said shaft in the opposite direction at a different speed for attaining a second number of reciprocations per revolution of said operating member.

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2. Apparatus comprising a reciprocal slide means for feeding paperboard blanks, a pair of feed rollers for receiving blanks from said slide means and feeding the same to a printing roller rotatable at the same surface speed, and mechanical means connected to said slide means for reciprocating the slide means toward and away from said feed rollers at a first frequency wherein one paperboard blank is fed to the feed rollers per cycle and at a second frequency wherein two paperboard blanks are fed to the feed rollers per cycle with each frequency being characterized by the paperboard blanks moving at the surface speed of the feed rollers when contacting the same, said means including a main drive shaft coupled to said slide means for imparting movement to the slide means, and said mechanical means including a clutch means for rotating said main shaft in one direction when feeding at the first frequency is desired and for rotating the main drive shaft in an opposite direction at twice the rotative speed when feeding at the second frequency is desired.

3. Apparatus in accordance with claim 2 wherein said mechanical means includes an eccentric crank supported by the main drive shaft and coupled directly to a yoke, said yoke being connected to a rocker shaft which is connected to said slide means.

4. Apparatus in accordance with claim 2 including a rocker shaft connected to said main drive shaft by means of a crank mechanism which oscillates the rocker shaft once per revolution of said main drive shaft, a connecting rod coupled to said rocker shaft and the slide means, the stroke of said slide means being approximately two-thirds the diameter of the printing roller, and the distance of the crank mechanism from the axis of said main drive shaft being approximately one-third the distance between the longitudinal axes of said shafts.

5. Apparatus in accordance with claim 2 wherein said mechanical means includes a pair of free-wheeling gears supported on said main drive shaft, and said clutch means includes a clutch for selectively and alternatively coupling only one of the gears in driving relationship with the main drive shaft.

6. Sheet feeding apparatus comprising a pair of feed rollers for feeding sheet material to an operating member, a hopper, a slide reciprocally supported for feeding sheet material from the hopper to said feed rollers during a feeding stroke, means for rotating the feed rollers and the operating member at the same peripheral speed, mechanical means for reciprocating said slide at any one of two set frequencies relative to one revolution of said operating member while maintaining a constant peak velocity of said slide during said feeding stroke, said mechanical means including a main drive shaft coupled to said slide, means for rotating said drive shaft in one direction in timed relation to the rotation of said operating member to attain one set number of slide reciprocations per revolution of said operating member, and means for selectively rotating said shaft in the opposite direction at a different speed for attaining a second number of reciprocations per revolution of said operating member.

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