

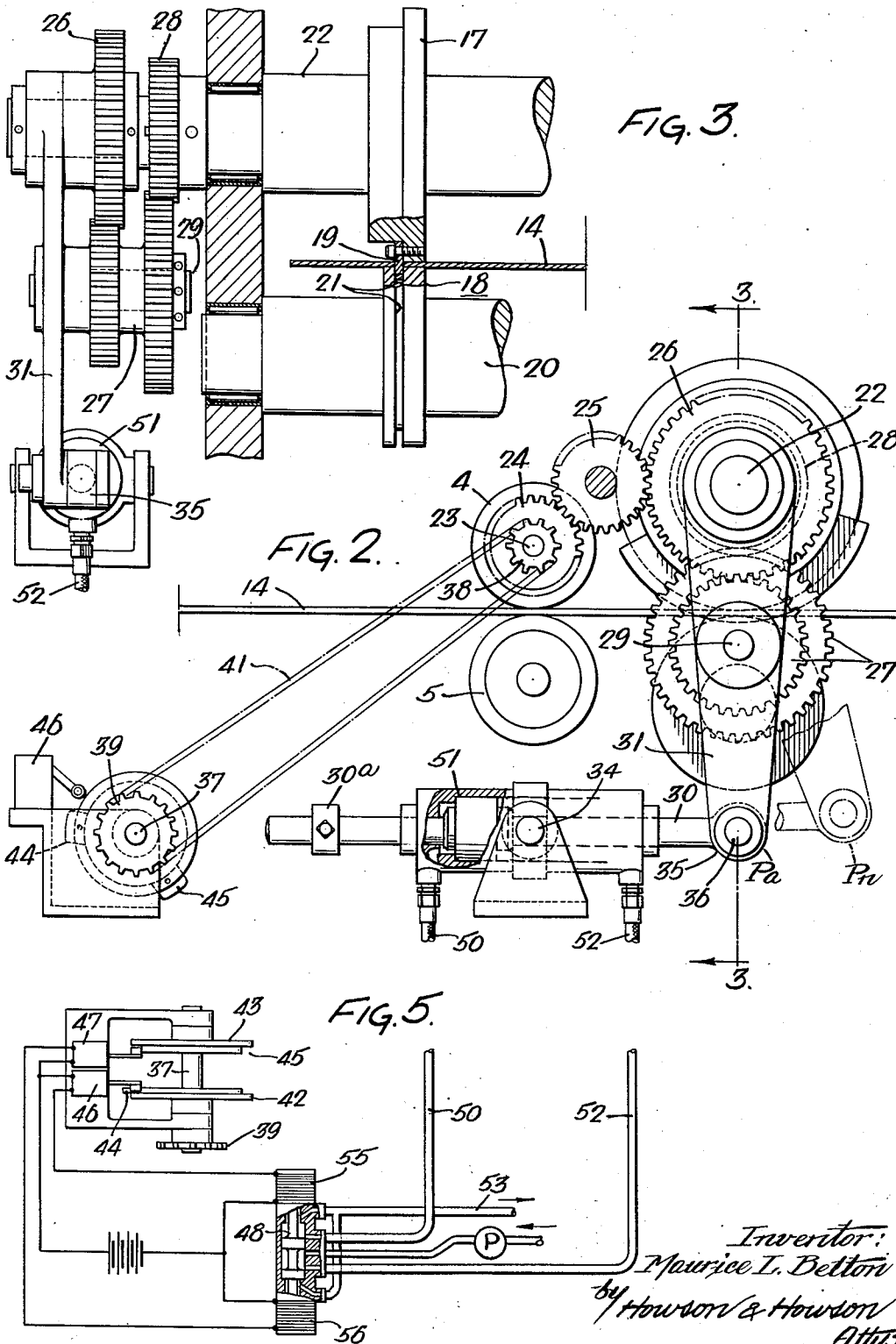
Oct. 1, 1957

M. L. BELTON
SLOTTING DEVICE

2,808,106

Filed April 27, 1955

3 Sheets-Sheet 2



Inventor:
Maurice L. Belton
by Howson & Howson
Attys.

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FIG. 7.

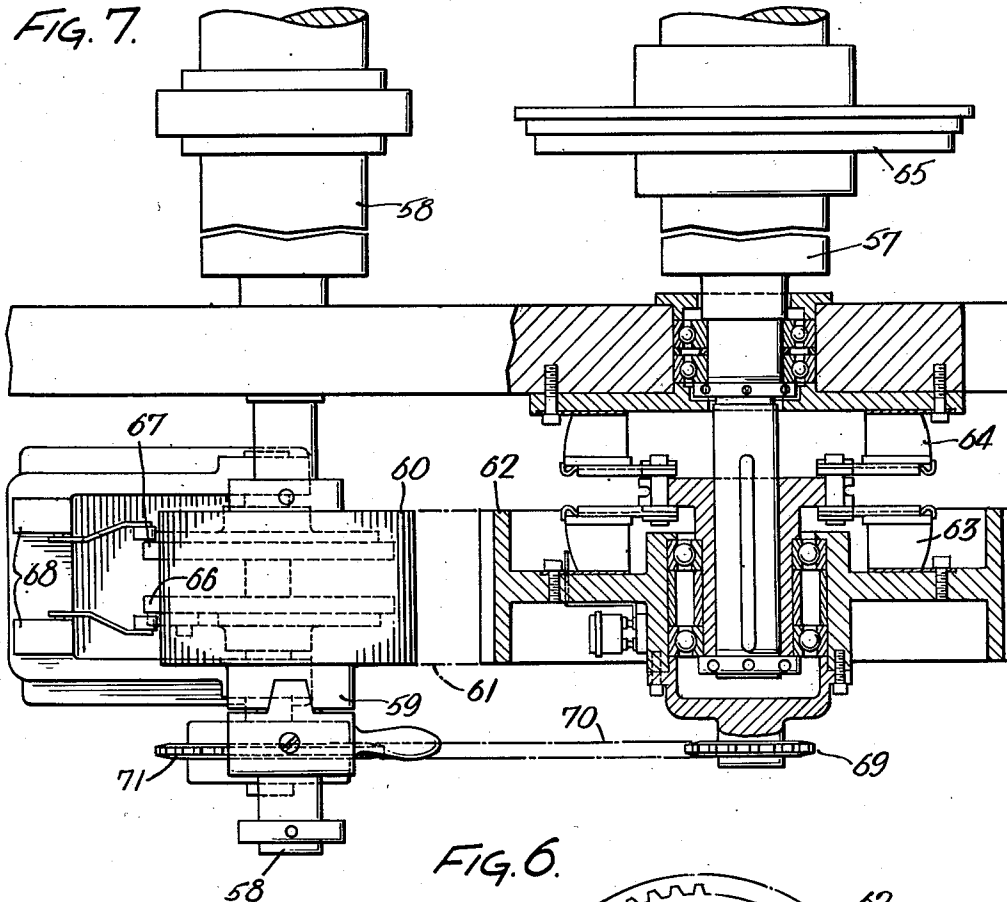
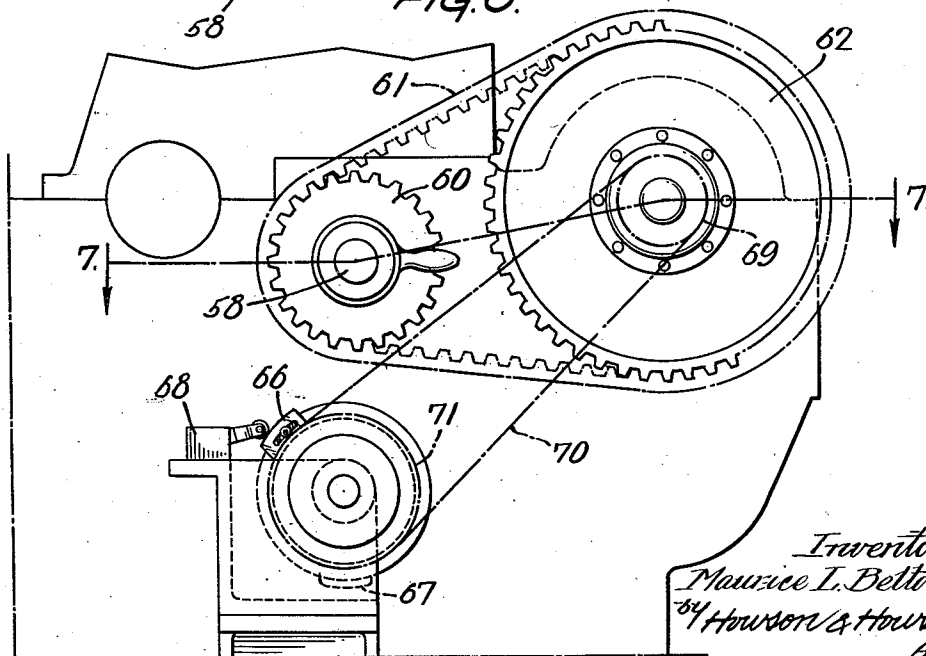


FIG. 6.



Inventor:
Maurice L. Belton
by Howard & Howard
attys.

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2,808,106

SLOTTING DEVICE

Maurice L. Belton, Bogalusa, La., assignor, by mesne assignments, to Crown Zellerbach Corporation, San Francisco, Calif., a corporation of Nevada

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7 Claims. (Cl. 164—64)

This invention relates more particularly to an improvement in printer-slotter machines of the general type disclosed, for example, in the U. S. patent to Sieg No. 2,181,211, such machines being used in the corrugated and fiber box industries.

A principal object of the invention is to provide a device which will increase the dimensional capacity of these machines, i. e., enable the machines to operate on blanks of greater width; said device providing also a simple, effective and highly flexible means for adjusting the machine to blanks of differing widths. As an adjunct of the machine disclosed in the aforesaid U. S. patent, for example, the device will improve the machine materially in respect to the aforesaid characteristics.

The invention will be better understood by reference, to the attached drawing in which:

Fig. 1 is a face view of a typical slotted box blank the slotting and scoring of which is a function in part of the machines with which the invention is concerned;

Fig. 2 is a side elevational view of a machine made in accordance with the invention showing the drive ends of the slotting and scoring shafts;

Fig. 3 is a fragmentary vertical sectional view on the line 3—3 of Fig. 2;

Fig. 4 is a timing chart showing the operation of the slotter shaft with respect to the blank feed;

Fig. 5 is a diagrammatic view of the electro-hydraulic system controlling the actuations of the mechanism illustrated in the preceding figure;

Fig. 6 is a fragmentary side elevational view showing an alternative mechanism within the scope of the invention, and

Fig. 7 is an enlarged sectional view on the line 7—7 of Fig. 6.

The box blank illustrated in Fig. 1 which has been slotted and scored in a machine of the type involved in the present invention for subsequent folding into box form, comprises a central panel 11 of width P, and at each side of this panel 11 a series of flaps 12 and 13 of widths F_1 and F_2 respectively. The panels of series 12 are separated by slots S_1 and the corresponding panels of the series 13 are similarly separated by slots S_2 . The panel 11 is divided into four sections by scored lines designated generally by the reference character L, and similar scored lines L_1 define the lines of juncture between the flaps of the series 12 and 13 and the panel section 11. The total width of the blank, including the dimensions P, F_1 and F_2 , is indicated by the reference letter W. The blank as a whole is designated by the reference numeral 14.

With regard further to the blank 14, the edge 15 thereof constitutes the leading edge with respect to the movement of the blank through the machine; and the numeral 16 therefor designates the trailing edge. In its passage through the machine the slots S_1 and S_2 are formed by the same instrumentality and this may consist of conventional upper and lower co-acting slotter heads, designated in Fig. 4 by the reference numerals 17 and 18 respectively. In the present instance the upper head 17 carries a

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slotting blade 19 which engages a slot 21 in the lower head 18 in the performance of the slotting operation. Slotting devices of this character are conventional.

The general mode of operation of the machine insofar as the slotting operations are concerned will be readily understood by reference to Fig. 4 of the drawings. On every other revolution, a blank 14 is fed to the slotting heads 17 and 18 by feed rolls 4 and 5 which in the present instance also assume the function of scoring rolls. In the present instance the machine is set so that the box blank will pass through the scoring heads from left to right during approximately one and one-half revolutions of the head. In the schematic drawing the blanks should be viewed as stationary and the scoring heads as moving progressively towards the left, whereas in the actual machine the scoring heads are relatively fixed and the blanks are fed progressively therethrough by the feeding rolls 4 and 5. The relative positions of the feed rolls and the scoring heads is shown at the left of the diagram.

In the diagram the slotting heads are shown in five progressively differing positions, A, B, C, D and E, with respect to the uniformly advancing blanks. In position A, the blade 19 of the upper head has just completed cutting a leading slot S_1 of length F_1 in the blank 14. At this point the trailing end of the blade 19 occupies a position at the inner end of the slot S_1 . When the blank has advanced and the slotter head has rotated to position B, the leading end of the blade 19 will again approach the blank preparatory to initiating cutting of the corresponding slot S_2 in the trailing portion of the blank. The position at which such engagement would normally occur is indicated at X. In advance of this position, however, devices hereinafter described operate upon the slotter head 17 to retard its rotation with respect to the forward movement of the blank 14, and as a consequence of this retardation, the magnitude of which is represented by the angle G at position B, the actual engagement between the leading end of the blade 19 and the blank will take place at position Y. In effect, this device makes it possible, all other factors being equal to accommodate in the machine a blank of considerably greater width between the leading and trailing edges than would otherwise be possible.

After the blade 19 has cleared the trailing edge of the sheet, which occurs at position D, the aforesaid retarding device is again actuated, but this time in reverse so as to accelerate the angular movement of the head 17 and to thereby advance the head in the same interval and by the same amount as the previous retardation in excess of its normal movement so that at position E the blade is back in proper timed relation with the feed rolls 4 and 5 to begin its cut at the leading edge 15 of the succeeding blank. During the changes in velocity of the slotter heads, the feeding of the sheet is not effected since this is governed by the scoring shafts and feed rolls 4 and 5.

The mechanical embodiment of the invention may be understood by reference to Figs. 2 and 3 of the drawings. The top slotter shaft 22 which carries the slotting head 17 is shown in Fig. 3, it being understood that the shaft 22 will normally carry a plurality of said heads 17 corresponding to the number of the slots S_1 and S_2 to be formed in the leading and trailing ends respectively of the box blank. Preferably the blade 19 will be mounted on the head for adjustment circumferentially of the latter. As previously set forth the blade 19 cooperates with a groove 21 in the lower slotter head 18 to produce the slots S_1 and S_2 in the blank. Each of the cutter heads 17 on the shaft 22 will have a companion head 18 on the lower shaft 20.

The shaft 22 is driven from the upper scoring shaft 23 which carries the roll 4, the drive consisting in the present instance of gears 24, 25, 26, 27 and 28. Gears 25, 26 and 27 are idlers, while gears 24 and 28 are keyed

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to the shafts 23 and 22 respectively. The double gear 27 is carried on a stud 29 mounted on an arm 31, said arm being pivotally mounted on the end of the shaft 22 so that if the arm 31 is pivoted from position P_n to P_a , see Figure 2, differential action will result in an angular displacement of the shaft 22 out of its normal timed relation to the rotation of shaft 23 which, as described, carries the upper feed-scorer roll 4.

A shaft 37 is driven from shaft 23 through sprockets 38 and 39 and chain 41, so that the shaft 37 will make one revolution for every two revolutions of the shaft 22. The shaft 37 carries cam plates 42 and 43 mounting adjustable cams 44 and 45 which constitute actuating elements for limit switches 46 and 47, see diagrammatic view Figure 5. The switches 46 and 47 will control the operation of a four way electrically-operated valve 48 (see Figure 5), the said valve controlling the connection between a pump 49 and a hydraulic cylinder 51 and associated piston which constitutes the actuating motor for the arm 31. The valve 48 is actuated by electric motor means in the form in the present instance of solenoids 55 and 56. The cylinder 51 is mounted in gimboles 34 and the piston rod 30 connected to the arm 31 through a clevis 35 and pin 36. The opposite end of the rod 30 carries a collar 30a which may be adjusted longitudinally of the rod 30 to limit the stroke of the piston and to establish the P_n position of the arm 31 and the extent of the angular displacement of the arm in its movements between the P_n and P_a positions. Pipes 50 and 52 extend from the cylinder 51 to the valve 48, and through these pipes and by way of the valve the pressure and suction sides of the pump may be connected selectively and simultaneously to the opposite ends of the cylinder, the fluid pressure medium being returned to the pump in either case through pipe 53.

When the slotter head 17 is in position A, Figure 4, the arm 31 will be in the position P_n , Figure 2, and will be held there by hydraulic pressure from the pump applied to the cylinder 51 through the valve 48 and line 50. When position B is reached, cam 44 actuates limit switch 46, which energizes solenoid 55 of the valve 48 shifting that valve to admit oil to line 52 and to exhaust oil from line 50 so that the cylinder 51 moves the arm 31 to position P_a , thus retarding the forward movement of the slotter blade as described above. At position D, cam 45 actuates limit switch 47 to energize solenoid 56 to reverse the solenoid valve 48, thereby returning the arm 31 to position P_n and accelerating movement of the head 17 to the position shown at E where the blade 19 initiates the slot S_1 in the leading edge of the succeeding blank 14. Timing of the valve 48 may be varied by shifting the cam segments 44 and 45 on the cam plates 43 and 44.

A second embodiment of the invention is shown in Figures 6 and 7 in which the upper slotter shaft 57 is driven from the shaft 58, corresponding to shaft 23 of the previously described embodiment, through a jaw clutch 59, sprocket 60, silent chain 61, and sprocket 62, which drives the shaft 57 through an electromagnetic clutch 63. When the clutch 63 is disengaged an electromagnetic brake 64 is simultaneously engaged, thereby to interrupt the rotary movement of the shaft 57 and slotter head 65.

With this arrangement, when the head 65 reaches position B, with reference to the chart of Figure 4, the clutch 63 will disengage and the brake 64 will then hold the shaft 57 for a dwell period and until the brake is de-energized and the clutch is again energized to start shaft 57 in time to cut the slots S_2 at the trailing end of the blank. A further dwell would then be necessary to bring the blade into position for the S_1 slot at the leading edge of the succeeding blank. The timed actuations of the clutch 63 and brake 64 are effected by cams 66 and 67 and switches 68, the cams being driven in this case from the hub of sprocket 62 through sprockets 69, chain 70, and sprocket 71. Since in this embodiment there is no

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provision for advancing the cutter head at an accelerated rate in the interval between successive blanks, the feed rate would have to be adjusted and provision made for an additional dwell in the interval between blanks in order to bring the succeeding blank and the cutter blades into proper initial cutting positions. This would involve a reduction in output of the machine from one finished blank on every other revolution of the cutter head, as in the embodiment initially described, to one blank on every third revolution.

The principle of the aforescribed devices can be used for similarly controlling the operations of the printing cylinders to synchronize their operations with the slotting heads or for independent adjustments of the printing operations with respect to the blank.

I claim:

1. In a machine for performing operations on sheet material, a rotary element having a working portion of limited peripheral extent engageable with said material in successive rotations of said element to perform work on the material, means including a feed roll for the sheet material for relatively traversing said material and said element to relatively space the successive areas of the material within which the said work is performed in direction of the traverse movement, means for operatively connecting the feed roll with the rotary element, differential means for automatically periodically changing the rate of rotary movement of the element independently of the feed roll to vary the linear intervals between said areas, said differential means comprising a driving gear fixed to said rotary element, and idler gear co-axial with said element, a pair of gears meshing respectively with said driving and idler gears and joined to each other for mutual rotation, an arm supporting said pair of gears and pivoted for angular movement about the axis of said element, means for driving said idler gear, means for angularly displacing said arm about the pivotal axis, said means comprising a hydraulic cylinder having a piston connected to the arm, a source of fluid pressure connected to the cylinder, a valve for selectively controlling flow of pressure fluid from said source to the ends of the cylinder and simultaneous discharge of fluid from the opposite end, and means operatively connected to the feed roll for actuating the valve.

2. A machine according to claim 1 wherein the valve actuating means comprises electric motor means connected to the valve, motor-control switch means, and switch actuating means operatively connected to the feed roll.

3. A machine according to claim 2 wherein the switch actuating means are adjustable to vary the timing of the valve actuations with respect to the movement of the feed roll.

4. In a machine for performing operations on sheet material, a rotary element having a working portion of limited peripheral extent engageable with said material in successive rotations of said element for performing work on the material, means including a feed roll for the sheet material for relatively traversing said material and said rotary element to relatively space the successive areas of the material within which the said work is performed in direction of the traverse movement, mechanism for driving the rotary element and feed roll in predetermined timed relation, differential means interposed between said driving means and the rotary element for changing the rate of rotary movement of the element relative to the rotary movement of the feed roll, hydraulic means for actuating the differential means, a valve for controlling the operations of the hydraulic means, and means for periodically actuating the valve in timed relation with the rotary movement of the feed roll to thereby vary the linear intervals between said successive areas.

5. A machine according to claim 4 wherein the valve actuating means comprise electric motor means connected with the valve for actuating the latter, motor-control

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switch means, and means for operatively connecting the switch means with the feed roll for actuation in timed relation with the rotary movement of the latter.

6. In a machine for performing operations on sheet material, a rotary element having a working portion of limited peripheral extent engageable with said material in successive rotations of said element to performing work on the material, means including a feed roll for the sheet material for relatively traversing said material and said element to relatively space the successive areas of the material within which the said work is performed in direction of the traverse movement, mechanism for driving the feed roll, transmission means connecting the feed roll to the rotary element and including a differential means for changing the rate of rotary movement of said element with respect to the rotary movement of the feed roll, hydraulic motor means for actuating the differential

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means, and means geared to the feed roll for controlling the actuations of said hydraulic motor means.

7. A machine according to claim 6 wherein the said control means for the hydraulic motor means comprise a control valve, electrical actuating means for said valve, and rotary switch means geared to the feed roll and operatively connected with the said electrical means.

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