June 28, 1960 C. A. BODDY 2,942,534

ROTARY CUTTER FOR PAPER BOARD BOX MACHINES

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FIG. 1.

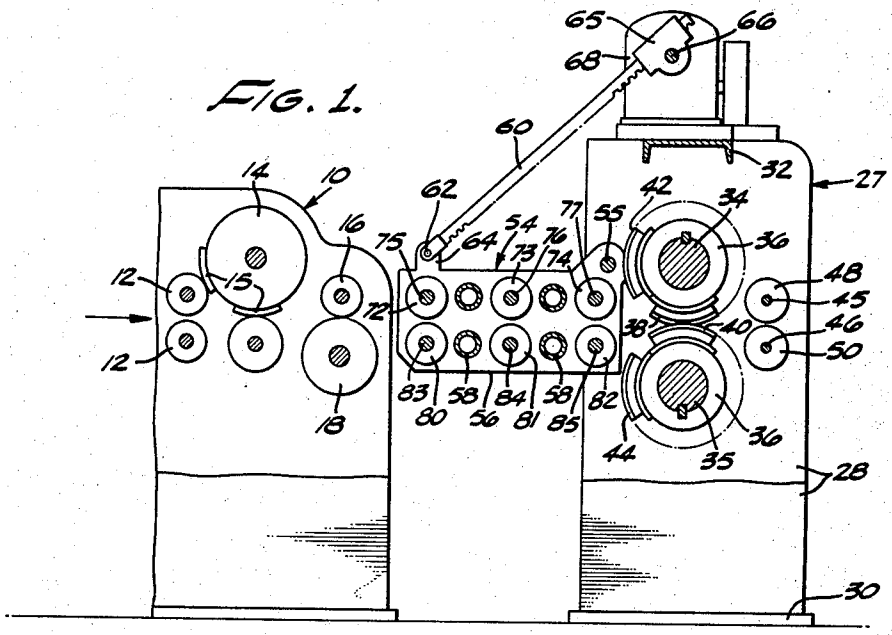


FIG. 2.

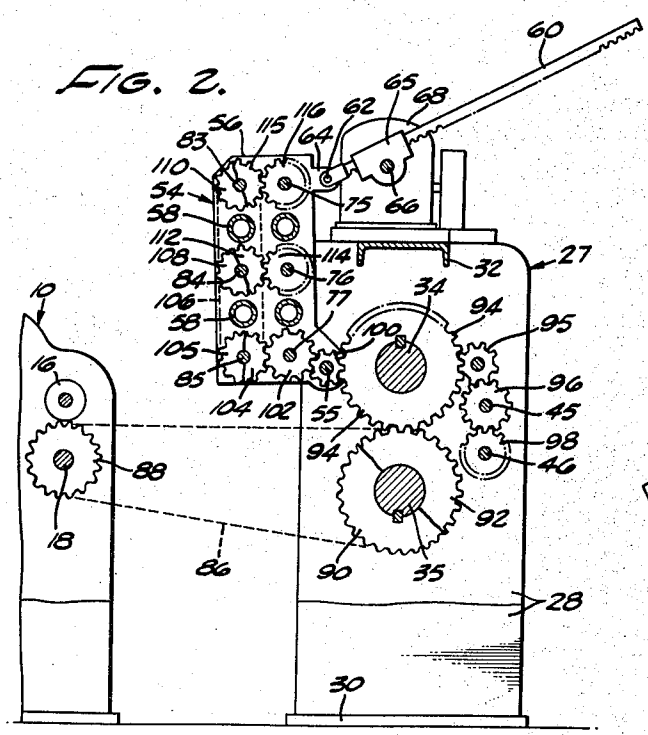


FIG. 3.

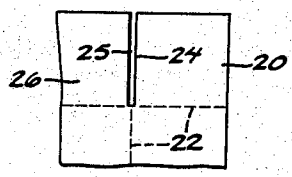
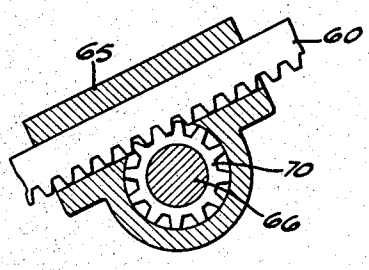


FIG. 4.



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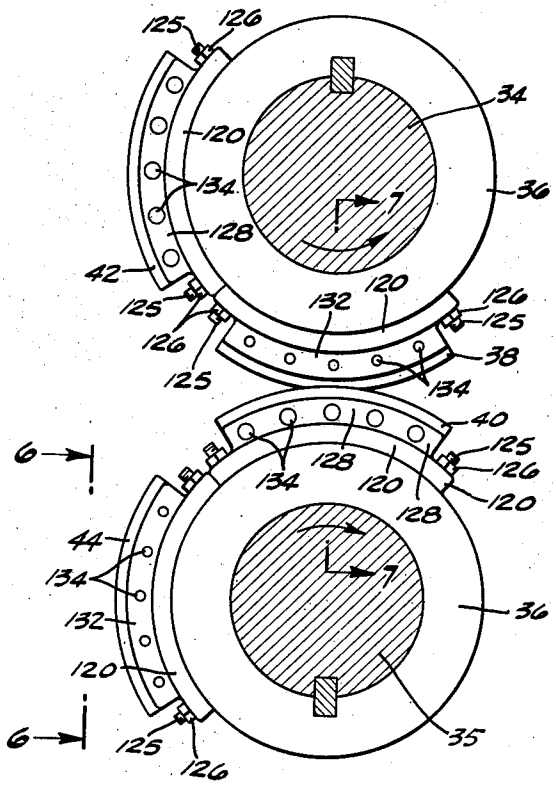
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ROTARY CUTTER FOR PAPER BOARD BOX MACHINES

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2 Sheets-Sheet 2

FIG. 5.



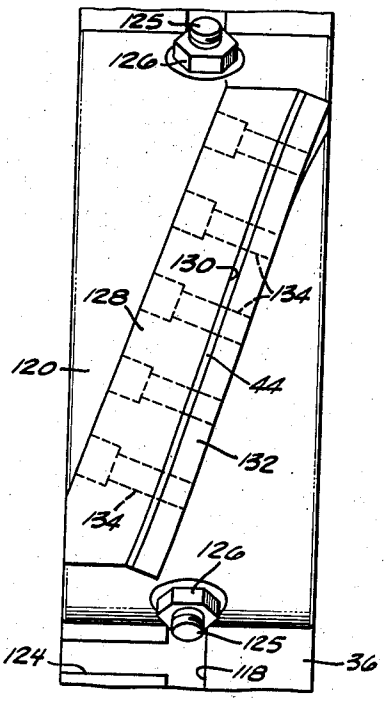
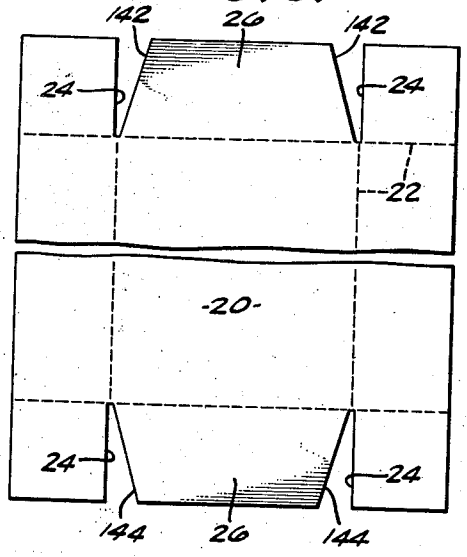


FIG. 6.

FIG. 8.



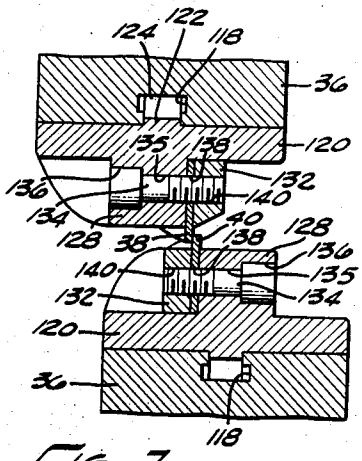


FIG. 7.

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United States Patent Office 2,942,534
Patented June 28, 1960

2,942,534

ROTARY CUTTER FOR PAPER BOARD BOX MACHINES

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Filed June 6, 1955, Ser. No. 513,553

2 Claims. (Cl. 93—58.2)

This invention relates generally to the art of fabricating paper board boxes and is directed specifically to an auxiliary mechanism for use with a printer-slotter to trim the flaps of box blanks to tapered configuration.

A printer-slotter for processing paper board box blanks not only applies printing to the blanks but also trims and creases the blanks and in addition cuts slots in the opposite ends of the blanks to form box flaps of rectangular configuration. In some instances, however, it is desirable to take the further step of trimming the flaps to tapered configuration. In packing heads of lettuce in a shipping container of paper board, for example, the lettuce heads extend above the level of the sides of the box so that the closed container bulges at the top to a substantial degree and all of the box flaps incline upwards towards the middle of the box. The end flaps are tucked under the side flaps and rectangular end flaps are troublesome because they must be bent by hand to fit under the two overlying inclined side flaps. Properly tapered end flaps, however, conform to the inclination of the superimposed side flaps and are conducive both to lowered packaging costs and to superior appearance of the packed containers.

The broad object of the present invention is to provide an auxiliary cutter mechanism for combination with a printer-slotter to receive the flat box blanks therefrom and to trim the end flaps thereof to tapered configuration. Preferably the auxiliary mechanism is operatively connected with the printer-slotter for synchronous actuation thereby and preferably the auxiliary mechanism is permanently installed adjacent the rear end of the printer-slotter in a manner that permits full accessibility to the printer-slotter. As will be shown, further objects of the invention are directed to these preferences.

A special object of the invention is to provide a rotary cutter means for cyclic operation that will make clean diagonal cuts in trimming the end flaps of the box blanks. Such clean diagonal cuts may be made by stamping operations in accord with prior art practices but to my knowledge have not been attained heretofore in the paper board industry by rotary cutting means in a satisfactory manner. Pairs of diagonally positioned circularly curved flat cutting blades have been used but such planar blades cannot match each other in overlapping face-to-face relation as required for clean shearing action and, consequently, more or less tear the paper board to produce ragged cuts.

This special object is attained by using matching pairs of radial blades that are not flat or planar but are spirally or helically curved in configuration. Such a pair of rotary blades progressively overlap in face-to-face relation to produce the desired clean diagonal cuts.

A further specific object of the preferred practice of the invention is to provide such helically curved blades at economical cost. In this regard the invention is characterized by the concept of using relatively thin resilient blades of flat configuration that may be manufactured inexpensively and of further providing blade holders of the

desired helical configuration that clamp the resilient blades in position and thus warp or distort the blades to the desired helical configuration.

The various objects, features and advantages of the invention will be apparent in the following detailed description taken with the accompanying drawings.

In the drawings, which are to be regarded as merely illustrative:

Fig. 1 is a view partly in section and partly in side elevation showing the pull rolls and cutting heads of the presently preferred embodiment of the auxiliary mechanism, the auxiliary mechanism being in operating position adjacent the rear end of a printer-slotter;

Fig. 2 is a similar view showing the driving mechanisms, a portion of the auxiliary mechanism being swung upward for access to the rear end of the printer slotter;

Fig. 3 is a plan view of a portion of a box blank as produced by a printer-slotter;

Fig. 4 is a fragmentary sectional view of a rack and pinion mechanism that may be used to swing the feed portion of the mechanism upward out of the way as shown in Fig. 2;

Fig. 5 is an enlarged end elevation of a pair of rotary cutting heads with the helical blades of the invention mounted thereon;

Fig. 6 is a view of one of the cutting heads with the helical blades shown thereon as viewed along the line 6—6 of Fig. 5;

Fig. 7 is a fragmentary section taken as indicated by the line 7—7 of Fig. 5 showing how the helical blades overlap in face-to-face relation for shearing action; and

Fig. 8 is a broken plan view of a box blank after it has been processed by the auxiliary cutter mechanism.

Figs. 1 and 2 show the rear portion or discharge end of a well-known type of printer-slotter that is generally designated by numeral **10**. This apparatus processes paper board box blanks at a high rate of production and in one operation prints lettering and designs on the blanks, trims the blanks, creases the blanks along desired fold lines and cuts longitudinal slots in the opposite ends of the blanks to form box flaps of rectangular configuration. The machine has the usual printing cylinders and ink rolls (not shown) and the usual series of feed rolls including a pair of feed rolls **12** adjacent a rotary slotting head **14** that carries knives **15** for forming longitudinal slots in the ends of the box blanks. The slotted blanks are then processed by the usual pair of creasing shafts **16** and **18** at the discharge end of the printer-slotter. Fig. 3 shows a portion of a typical paper board box blank that is discharged from the creasing shafts **18**. Fig. 3 shows the usual crease lines **22** and shows an end slot having spaced parallel edges **24** and **25**, edge **25** being a side edge of an end flap **26** of the box blank **20**.

The auxiliary cutter mechanism of the present invention comprises an upright main frame, generally designated **27**, that is permanently installed at a position spaced rearward from the rear end of the printer-slotter **10**. The main frame **27** comprises two side members **28** which extend upward from a base **30** and are interconnected at their top ends by an inverted channel member **32**. Journalled in the main frame **27** is a pair of main shafts comprising an upper main shaft **34** and a lower main shaft **35**. On each of the main shafts is keyed a set of cutting heads **36** carrying helical cutting blades. Since the cutting blades are positioned diagonally, the cutting heads **36** may be aptly termed diagonal cutting heads. The sets of blades carried by the two main shafts are arranged in coacting pairs. Thus Figs. 1 and 5 show an upper blade **38** carried by a cutting head on the upper main shaft **34** in position to mate with a similar lower helical blade **40** carried by a cutting head on the lower main

shaft 35 to make a diagonal cut on the trailing end of a box blank and show a second upper blade 42 to mate with a second lower blade 44 to make a diagonal cut on the leading end of a box blank. Also journalled in the fixed main frame 27 is a pair of shafts 45 and 46 on which are mounted corresponding pull rolls 48 and 50 to draw the box blanks from the diagonal cutting heads and to discharge the blanks rearward from the auxiliary mechanism.

The successive box blanks are taken from the printer slotter 10 and fed to the diagonal cutters by a feeding mechanism incorporated in an auxiliary frame or sub-frame generally designated by numeral 54, which sub-frame is mounted on the main frame 27 by a transverse pivot shaft 55. The sub-frame 54 comprises a pair of side frame members 56 that are rigidly interconnected by transverse tubular members 58 to make a rigid structure.

Any suitable means may be provided to support the sub-frame 54 at its normal horizontal operating position shown in Fig. 1 and to swing the sub-frame upward to a retracted position as shown in Fig. 2 to make the area immediately behind the printer slotter 10 fully accessible. In the arrangement shown in the drawings, for example, a pair of suitable rack members 60, one on each side of the main frame 27, are connected by pivot pins 62 to corresponding ears 64 of the side frame members 56 of the sub-frame 54. The upper ends of the two rack members 60 extend slidingly through corresponding sleeves 65 that are pivotally mounted on an upper cross shaft 66. The cross shaft 66 is journalled in suitable upright members 68 at opposite ends of the main frame 27 and carries two pinions 70 that are housed in the two sleeves 65 in mesh with the corresponding two rack members 60. It is apparent that the cross shaft 66 may be rotated to swing the sub-frame 54 between the lower operating position shown in Fig. 1 and the upper position shown in Fig. 2. The cross shaft 66 may be either manually rotated or adapted for rotation by suitable reversible motor means.

The feeding mechanism carried by the sub-frame 54 may comprise, for example, a series of three upper pull rolls 72, 73 and 74 mounted on corresponding shafts 75, 76 and 77 and three corresponding lower pull rolls 80, 81 and 82 paired therewith and mounted on three corresponding lower shafts 83, 84 and 85. These six shafts are journalled in the two side frame members 56 of the sub-frame 54. It will be noted that this feeding mechanism carried by the sub-frame 54 normally bridges the gap between the printer-slotter 10 and the main frame 27 of the auxiliary mechanism in a position to receive the box blanks from the creasing shafts 16 and 17 of the printer-slotter and to deliver the box blanks to the diagonal cutting heads 36.

Any suitable means may be provided to actuate the main shafts 34 and 35 together with the pull roll shafts 45 and 46 on the main frame 27 and to actuate the various pull-roll shafts on the sub-frame 54, all in proper synchronism with the operation of the printer-slotter 10. In this regard, a feature of the present practice of the invention is that the auxiliary mechanism is operatively connected directly to the printer-slotter 10 for synchronous actuation thereby.

As indicated in Fig. 2, the present driving arrangement includes a sprocket chain 86 that is actuated by a sprocket 88 on the creasing shaft 18 to drive a sprocket 90 on the lower main shaft 35. A gear 92 that is also keyed to the lower main shaft 35 meshes with a similar gear 94 that is keyed to the upper main shaft 36. By virtue of this arrangement the two main shafts 35 and 36 carrying the diagonal cutting knives are actuated in synchronism with the printer-slotter. Preferably gears 92 and 94 are double gears to eliminate backlash between the two main shafts.

To drive the pull rolls 48 and 50 on the two shafts 45 and 46, an idler gear 95 in mesh with the gear 94 on the upper main shaft 36 drives a gear 96 on the pull roll shaft 45. The gear 96 in turn drives a gear 98 that is keyed to the pull roll shaft 46.

For actuating the six pull rolls on the sub-frame 54, a gear 100 that is rotatably mounted on the pivot shaft 55 is in mesh both with the gear 94 on the main drive shaft 36 and with a gear 102 that is keyed to the pull roll shaft 77 to drive the pull roll 74. The gear 102 meshes with a second gear 104 that is keyed to the pull roll shaft 85 to drive the pull roll 82. A sprocket 105 on the pull roll shaft 85 is connected by a sprocket chain 106 with a sprocket 108 on the pull roll shaft 84 and with a sprocket 110 on the pull roll shaft 83, thus driving the two pull rolls 81 and 80. A gear 112 keyed to the pull roll shaft 84 meshes with a similar gear 114 on the pull roll shaft 76 to drive the pull roll 73, and a gear 115 keyed to the pull roll shaft 83 meshes with a similar gear 116 on the pull roll shaft 75 to drive the pull roll 72.

The construction and mounting of the helical cutting blades 38, 40, 42 and 44 may be understood by reference to Figs. 5, 6 and 7. Each of the cutting heads 36 on the two main shafts 34 and 35 is formed with a T-shaped circumferential groove 118, (Figs. 6 and 7) to permit arcuate shoes 120 to be mounted thereon, each shoe having an inner rib 122 to seat in the T-shaped groove. Lateral access to each of the circumferential T-shaped grooves 118 is afforded by short lateral T-shaped grooves 124 each of which terminates at one face of the cutting head 36. This arrangement makes it possible to attach the shoes 120 to the cutting heads 36 by means of bolts 125 and nuts 126, the heads of the bolts engaging in the circumferential T-shaped grooves 118, the shanks of the bolts extending radially outward, and the nuts being threaded onto the bolts in abutment with the outer surfaces of the shoes.

Each of the arcuate shoes 120 has a peripheral rib 128 which has a side face or shoulder 130 that is accurately shaped to the helical configuration that is desired for the corresponding cutting blade. Each of the cutting blades is an arcuate piece of resilient steel made of flat stock and is mounted on the peripheral rib 128 of an arcuate shoe 120 by means of a clamping bar 132 and a series of screws 134. As best shown in Figs. 6 and 7, each of the peripheral ribs 128 has a plurality of bores 135 to receive the screws 134, the bores being counter-bored as shown at 136 to receive the screw heads. For the same purpose, each of the cutting blades has a similar series of bores 138 and each of the clamping bars 132 has corresponding bores 140.

The manner in which the invention serves its purpose may be readily understood from the foregoing description. When the sub-frame 54 is in its operative position shown in Fig. 1 and the printer-slotter 10 is in operation, the various pull rolls carried by the sub-frame are actuated in the manner heretofore described to receive the successive box blanks from the printer-slotter and to feed the box blanks to the diagonal cutting heads 36 in the required synchronism. The two upper helical knives 42 carried by the upper cutter head 36 mate with the two corresponding helical knives 40 on the lower cutting heads 36 in progressive face-to-face overlapping relation for clean shearing action. These mating blades make two diagonal cuts 142 (Fig. 8) on the leading end of a box blank to taper one of the two end flaps 26 and subsequently the two upper helical blades 38 cooperate with the two lower helical blades 40 in the same manner to make the diagonal cuts 144 at the trailing end of the box blank to taper the other flap 26. The completely processed paper blank is discharged from the auxiliary mechanism by the two pull rolls 48 and 50.

If access to the rear end of the printer-slotter 10 is desired or if it is decided to operate the printer-slotter without tapering the end flaps of the paper blanks, the sub-frame 54 may be elevated to the position shown in Fig. 2 by actuation of the upper cross shaft 66 to cause the two pinions 70 to draw the two rack members 60 upward. In the course of this upward pivotal movement of the sub-frame 54, the gear 102 rotates partially around

the gear **100** in a planetary manner. Thus the feed mechanism of the sub-frame **54** is always operatively connected with the printer-slotter.

My description in specific detail of the selected embodiment of the invention will suggest various changes, substitutions and other departures from my disclosure that properly lie within the spirit and scope of the appended claims.

I claim:

1. In a device for cutting sheet material diagonally, the combination comprising: a frame; rotary means journalled in said frame; a shoulder on the peripheral surface of said rotary means having at least one helical surface and having a plurality of holes extending through said helical surface thereof; a normally flat blade member having a width considerably greater than its thickness, said blade member having holes through it and being positioned adjacent said shoulder with the holes of said blade member in registry with those of said shoulder; and screw threaded means extending through said registering holes to draw said blade member tightly against said shoulder,

whereby the surface of said blade member contacting said helical surface of said shoulder will conform to the helical shape thereof.

2. The invention as defined in claim 1, wherein said screw threaded means includes a clamping bar having both a helical surface and a plurality of holes to mate with those of said shoulder so as to clamp said blade member against said shoulder.

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