

Jan. 2, 1940.

H. W. BRUKER ET AL

2,185,885

CUTTING MECHANISM

Filed Sept. 13, 1938

2 Sheets-Sheet 1

Fig. 1.

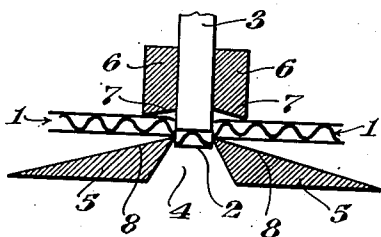


Fig. 3.

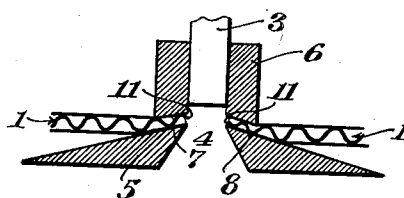


Fig. 2.

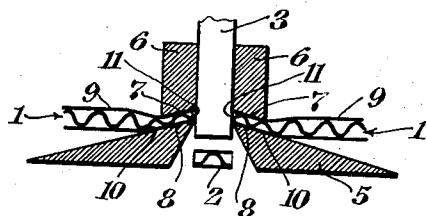


Fig. 4.

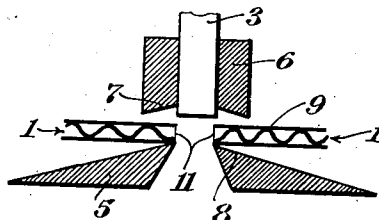


Fig. 5.

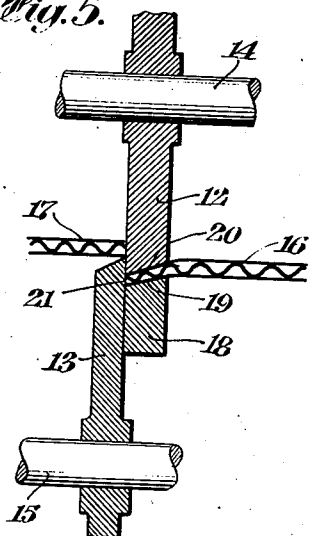
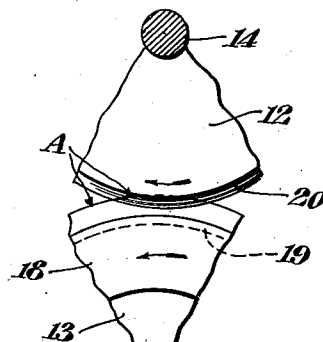


Fig. 6.



INVENTORS
 Holbrook W. Bruker
 Harry F. Black
 BY
 Howard Crosby & Neal
 ATTORNEYS

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2 Sheets-Sheet 2

Fig. 7.

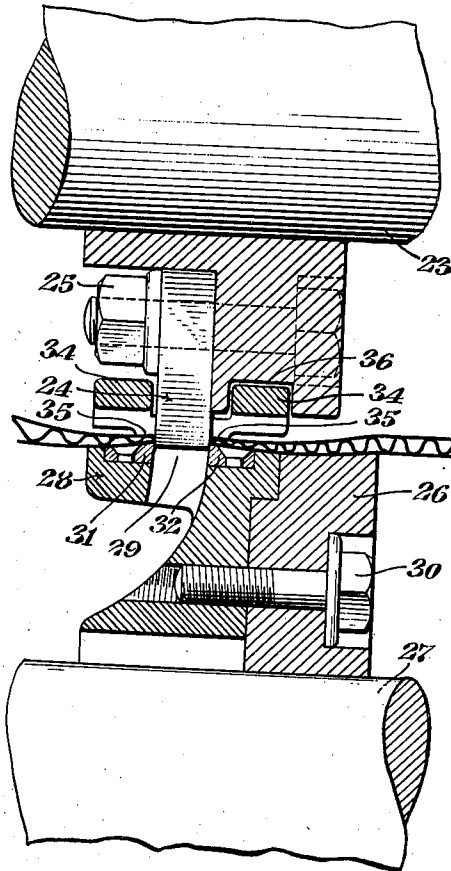
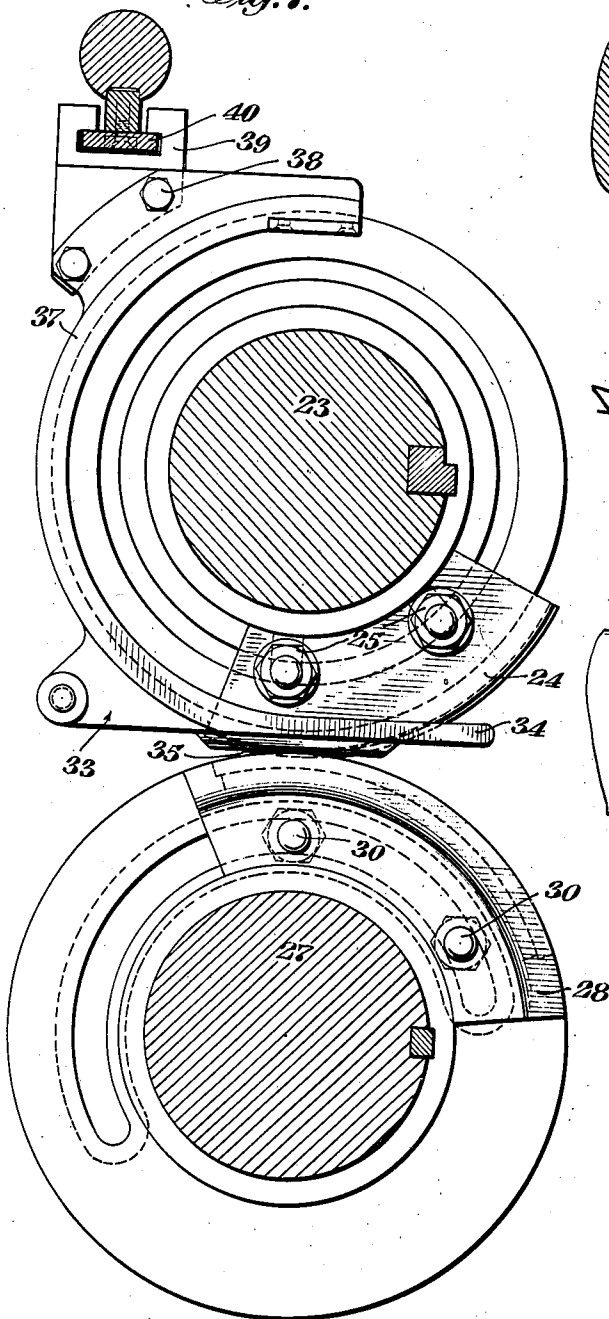


Fig. 8.

INVENTORS
Hubert W. Bruker
Harry F. Black
BY
Ward Crosby & Lued
ATTORNEYS

UNITED STATES PATENT OFFICE

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CUTTING MECHANISM

Hobart W. Bruker and Harry F. Black, Bordentown, N. J., assignor to George W. Swift, Jr. Inc., Bordentown, N. J., a corporation of New Jersey

Application September 13, 1938, Serial No. 229,663

7 Claims. (Cl. 164—60)

In the manufacture of cartons from corrugated paper board or so-called fibre board, it is customary to employ rotary cutters or punches to provide slots in the portions of the container blanks which are thereafter folded to form flaps in the containers. During operation, the cutters in moving out of the slots just after forming them, rub against the walls of the slots thus rendering them irregular or frayed in outline. This has long been recognized as an objectionable feature in the slotted blanks but although many efforts have been made over a long period of time to overcome the defect, none of them have been successful in so far as we are aware.

The primary object of the invention accordingly is to provide a method and mechanism by which cutting or punching operations of the above character may be so carried out as to avoid the frayed and irregular edges above mentioned, and produce a clean cut. Although primarily applicable to slotting operations as carried out upon paper board box blanks as above referred to, the invention in its broader aspects may extend to slotting, punching and similar cutting operations upon other sheet materials which are yieldable in character and prone to the production of frayed edges, in so far as the problems involved are analogous and within the scope permitted by the prior art. Further objects and advantages of the invention will be in part obvious and in part specifically referred to in the description hereinafter contained which, taken in conjunction with the accompanying drawings, discloses the invention as carried out by certain series of steps, and with the aid of apparatus of certain preferred constructions. Such disclosure, however, is to be considered as merely illustrative of the invention in its broader aspects. In the drawings—

Figs. 1 to 4 are simplified sectional views (largely diagrammatic) showing successive stages of a slotting or punching operation upon corrugated paper board, as carried out by one embodiment of the invention.

Fig. 5 is a similar view showing the invention as applied to simple forms of rotary slitting disks such as are used to trim the edges of a corrugated paper board web as it passes from the corrugating machine.

Fig. 6 is a fragmentary side elevation of the rotary slitting disks shown in Fig. 5.

Fig. 7 shows a pair of cooperating rotary slotting heads constructed to operate in accordance with the invention, and

Fig. 8 is a view, partially in section, looking

edgewise at the slotting heads and associated parts of Fig. 7.

In slotting, punching and similar operations as performed on corrugated paper board and fibre board, the cutters of the rotary slotting heads penetrate through the sheet just before the cutters arrive at the point between the centers of the slotting heads, and the frayed irregular edges are largely caused by engagement of the cutter with the walls of the slots after it has completed the cutting operation and is moving out of the completed slot. In slotting corrugated paper board, for example, the facing sheet upon that face of the paper board through which the cutter first penetrates and from which it last emerges when moving out of the slot, is especially likely to be frayed and irregular, and likewise as to the corresponding outside layer of fibre board. Similar difficulties may be encountered with a reciprocating punch or cutter. We have discovered that if the area of the sheet which is being cut, be flexed slightly either prior to or during the cutting operation in such manner that the face of the sheet on the side thereof through which the cutter first penetrates and from which it last emerges is bowed outwardly or convexly (the opposite face of the sheet being accordingly bowed inwardly or concavely), and held in such flexed position until the cutter and cut area have been separated one from the other, the walls of the cut-out portion will be left clean cut and sharply defined; in other words, the production of frayed portions will be avoided. After its separation from the cutter has been completed, the cut portion of sheet may then be released from flexure and will spring back substantially to its original flat condition. The flexing need only be so local and slight as merely to clear the adjacent edge of the paper board, or more particularly the surface thereof through which the cutter first penetrates and from which it last emerges, from rubbing contact with the cutter or punch while the latter is being withdrawn.

A simple form of the invention will now be described by reference to Figs. 1 to 4. In Fig. 1, we have shown a sheet 1 of double faced corrugated paper-board in an initial stage of having a portion 2 cut out therefrom by a punch 3, which latter is advancing into the space 4 between a pair of dies 5. For purposes of the present discussion it is immaterial whether the punch 3 be regarded as a reciprocating punch which coacts with stationary dies 5, or whether the members 3 and 5 be regarded as rotary parts such as are commonly used in so-called rotary slotters. The

punch 3 may also be regarded as shaped to punch out either an elongated plain slot or an opening of other desired shape.

Associated with the punch 3 are pressure members 6 which coact with dies 5 to flex the sheet as above described, in the area of cut. These pressure members 6 in the particular form of the invention now under discussion may be regarded as either fixed or movable with respect to punch 3. In the stage shown in Fig. 1 the active surfaces 7 of pressure members 6 have not yet begun to force the sheet against the opposed faces 8 of dies 5, although the punch 3 has penetrated part way through the sheet.

In the stage shown in Fig. 2 the chip 2 has been completely cut out, and the pressure members 6 have advanced to a position wherein their faces 7 are pressing the adjacent portion of the sheet against the surfaces 8 of dies 5, thus bowing outwardly the facing sheet 9 of web 1 through which the cutter 3 first penetrates and from which it last emerges, and bowing inwardly the opposite facing sheet 10 of the corrugated paper-board. Flexing the sheet as above described causes the walls 11 (Fig. 2) of the cut-out portion of the sheet to tilt slightly from parallelism with punch 3, as indicated in Figs. 2 and 3, in such manner as to clear these walls and particularly the upper corners thereof in Figs. 2 and 3, slightly from the punch, with the result that when the latter is withdrawn or retracted to the position shown in Fig. 3, the punch does not rub frictionally against the walls 11 and particularly the upper corners thereof, during its retracting movement. Thus the edges of the cut-out portion are left clean without the frayed portions which have heretofore been characteristic of slotted paper-board blanks.

As a final step, after the punch 3 has been withdrawn from the paper-board sheet, the pressure members 6 are released from engagement with the sheet, whereupon the latter springs back substantially to its original plane condition, as indicated in Fig. 4, the walls 11 of the punched out portion being then substantially vertical. It is not essential that the step of flexing the paper board by pressure members 6 be performed after the punch has started or completed its travel through the material of the sheet, since particularly if an elongated slot is being cut, flexing the sheet prior to the penetration of the punch into the material will place the surface 9 of the sheet under tension and when the material is severed by the punch to release this tension, the walls 11 of the sheet will tilt slightly to the position shown in Figs. 2 and 3, whereupon the punch may be withdrawn from the material without fraying the edges if the flexing pressure be maintained until the punch is clear of the sheet. As previously stated, only the local area of the sheet which is being or has just been punched need be flexed, and the flexure need be only through a slight angle. For ordinary purposes the angle between the faces 8 of dies 5 and the normal plane of the sheet may be of the order of 10 degrees, the faces 7 of pressure members 6 being likewise directed.

In Fig. 5 we have illustrated the invention as applied to a pair of rotary slitting disks 12 and 13, such as are ordinarily used at the delivery end of a paper-board making machine for trimming the sheet to desired widths. As shown the disks 12 is carried by rotary shaft 14 and disk 13 by rotary shaft 15, the disk 12 acting as a rotary die against which a paper-board sheet 16 rests while an edge portion 17 thereof is being trimmed

off by disk 13. In mechanisms of this character, particularly when used upon freshly made paper board, the arcuate peripheral portion of the disk 13 which has completed its cutting operation and is moving diagonally across the cut edge of the sheet, rubs against the latter so as to produce a frayed and irregular edge, particularly at the lower left hand corner as shown in Fig. 5, where the frictional contact of the upper arcuate portion of disk 13 which is behind the plane of Fig. 5, tends to pull the lower facing sheet of the paper-board away from the remainder of the board so as to loosen up the adhesive bond at the cut edge of the sheet. These frayed edges may be avoided by temporarily flexing the sheet, as indicated in Fig. 5, in the area being cut. As there shown the cutting disk 13 is provided with a pressure member 18, similar in function to the members 6 previously described in connection with Figs. 1 to 4, this pressure member 18 in the present instance, being fixedly mounted on the rotary disk 13 and having a conical active face 19 which presses the edge of the sheet being cut, against the complementary face 20 of disk 12. Thus the edge of the sheet 16 is temporarily flexed by the bite of the surfaces 19 and 20, and particularly at the portion of the edge of the sheet which is indicated by the arrows marked A in Figure 6, where the peripheral portion of disk 13 which has just completed its cutting operation, is moving diagonally to the left and downward across the cut edge of sheet 16. This flexure of the sheet 16 slightly tilts its cut edge 21 with respect to the cutter 13 and thus prevents the rubbing and fraying action above referred to, particularly at the corner of the edge 21 which is lowermost in Fig. 5 and where fraying or loosening of the adhesive bond between the layers of the board is most likely to occur. After any given portion of the sheet 16 has passed the bite of surfaces 19 and 20 and has passed out of the zone of action of disk 13, the cut edge of the sheet gradually resumes a substantially flat condition in the general plane of the sheet.

In Figs. 7 and 8 the invention is shown as applied to a pair of cooperating rotary slotting heads which may be assumed to be of construction well known in the art as to many of their structural details, but which are especially constructed in some respects to operate in accordance with the present invention. As shown the upper rotary slotting head 22 is carried by rotary shaft 23, and is provided with a male sector-like slotting blade 24 adjustable by bolts 25 in the usual manner known in the art, while the female slotting head 26 is carried by rotary shaft 27, and is provided with a sector-like cooperating female cutting member 28 having a slot 29 into which cutting blade 24 penetrates, this member 28 being likewise angularly adjustable in the usual manner by means of bolts 30.

In the form of the invention now under discussion the member 22 above described is provided with arcuately shaped die members 31 and 32 (Fig. 8) which correspond in configuration and function to the members 8 above described in connection with Figs. 1 to 4, and the cooperating pressure member (corresponding to the member 6 above described in connection with Figs. 1 to 4) is constituted by a stationary member 33 having fork-like arms 34 which receive the cutting blade 24 between them, and are provided on their undersides with sheet-engaging surfaces 35 which are parallel to the opposed surfaces of die members 31 and 32, and thus serve

to flex the sheet being slotted, in the area thereof in which the slotting blade is operating, in the area thereof in which the slotting blade is operating, in such manner that the face of the sheet through which the cutter first penetrates and from which it last withdraws, is flexed or bowed outwardly to a slight extent, as shown most clearly in Fig. 8. As also shown in Fig. 8 the opposed surfaces of members 31, 32 and 35 may also act to compress the area of the sheet which is being slotted, temporarily to some extent.

The member 33 above mentioned, or one of its arms 34, preferably engages in a peripheral groove 36 (Fig. 8) of slotting head 22 so as to be adjustable in position simultaneously with slotting head 22, longitudinally of shaft 23, and the member 33 may be carried by an arcuate bracket 37 (Fig. 7) which in turn is clamped by bolts 38 to a slide 39 which is movable along a rail 40 extending crosswise of the machine. The mode of operation of the embodiment of the invention shown in Figs. 7 and 8 is similar to the simpler forms previously described, except that the pressure member 33 and its associated surfaces 35 remain stationary while the sheet travels past them.

While the invention has been disclosed as carried out by certain specific mechanisms it should be understood that many changes may be made therein without departing from the invention in its broader aspects, within the scope of the appended claims.

We claim:

1. The method of cutting flexible frayable sheet material of the class described, which includes passing a cutter into one face of the sheet and through the opposite face thereof to punch out a portion from within the sheet, flexing the sheet adjacent the area of operation of the cutter to bow the first mentioned face of the sheet outwardly and the second mentioned face thereof inwardly, retracting beyond the first mentioned face of the sheet the portion of the cutter which has passed through the sheet while the sheet is flexed as aforesaid, to clear the cut edge of the first mentioned face of the sheet from the above mentioned portion of the cutter during its retracting movement and thereby minimize fraying of the cut edge, and then releasing the aforesaid area of the sheet from said flexed position.

2. The method of cutting flexible frayable sheet material of the class described which includes passing a cutter into one face of the sheet and thru the opposite face thereof to punch out a portion from within the sheet, flexing the sheet adjacent the area of operation of the cutter after the cutting operation has begun, to bow the first mentioned face of the sheet outwardly and the second mentioned face thereof inwardly, retracting beyond the first mentioned face of the sheet the portion of the cutter which has passed through the sheet while the sheet is flexed as aforesaid to clear the cut edge of the first mentioned face of the sheet from the above mentioned portion of the cutter during its retracting movement and thereby minimize fraying of the cut edge, and then releasing the aforesaid area of the sheet from said flexed position.

3. The method of cutting flexible frayable sheet material of the class described which includes progressively feeding a sheet of material past a rotating cutter, passing the cutter into and through the sheet from one face thereof to

the other to punch out a portion from within the sheet and temporarily flexing successive portions of the sheet on both sides of the cutter while traveling past the cutter to bow the first mentioned face of the sheet outwardly and the second mentioned face thereof inwardly, holding the cut portions of the material in the above flexed position until clear of the cutter, to clear the cut edge of the first mentioned face of the sheet from the above cutter and thereby minimize fraying of the cut edge, and then successively releasing the flexure on the aforesaid portions of the sheet after such portions have traveled to positions clear of the cutter.

4. Sheet cutting mechanism of the class described including a rotary cutting member and a cooperating rotary die member positioned to cause a portion of the cutting member to overlap a portion of the die member, a pressure member constructed and arranged to force a portion of the sheet adjacent the overlapping portion of the cutter against said die member, said pressure and die members being constructed and arranged to hold such portion of the sheet in flexed position with its surface through which the cutter member first penetrates bowed outwardly, to clear the cut edge of the above mentioned surface of the sheet from the cutter and thereby minimize fraying of the cut edge.

5. Sheet cutting mechanism of the class described including a rotary slotting blade, spaced rotary die members positioned to receive said rotary blade therebetween, said rotary die members having sheet engaging surfaces oppositely inclined, pressure members disposed on opposite sides of said rotary slotting blade constructed and arranged to press a sheet to be cut against said die members to bow outwardly the surface of the sheet through which the cutter first penetrates, in the zone of operation of the blade, to clear the cut edge of the above mentioned surface of the sheet from the blade while passing out of the zone of operation of the cutter and thereby minimize fraying of the cut edge.

6. Sheet cutting mechanism of the class described including a punch, means to move said punch to penetrate into one face of a sheet to be cut and through the opposite face thereof, and then to retract the punch from the cut portion of the sheet, and means for holding the cut area of the sheet in flexed position with its first above mentioned face bowed outwardly during the retracting movement of the punch, to clear the cut edge of the first mentioned faces of the sheet from the punch during its retracting movement and thereby minimize fraying of the cut edge.

7. Sheet cutting mechanism of the class described including a rotary slotting blade, spaced rotary die members positioned to receive said rotary blade therebetween, said rotary die members having sheet engaging surfaces oppositely inclined, and stationary pressure members disposed on opposite sides of said rotary slotting blade, said pressure members being constructed and arranged to press a sheet to be cut against said die members to bow outwardly the adjacent surface of the sheet through which the cutter first penetrates, in the zone of operation of the cutter, to clear the cut edge of the above mentioned surfaces of the sheet from the cutter and thereby minimize fraying of the cut edge.

HOBART W. BRUKER.
HARRY F. BLACK.