

[54] CREASING RULES FOR CUTTING DIES

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[56] References Cited

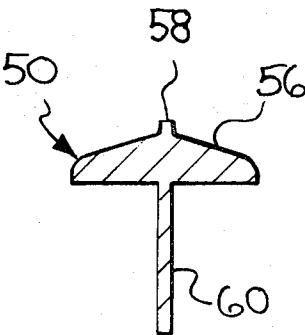
UNITED STATES PATENTS			
2,223,503	12/1940	Wilson.....	93/58.1
3,302,490	2/1967	Bishop.....	93/58.2 F
2,860,555	11/1958	Williamson.....	93/58
2,139,890	12/1938	Fitchett.....	93/58.1

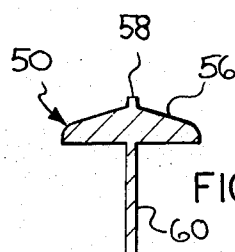
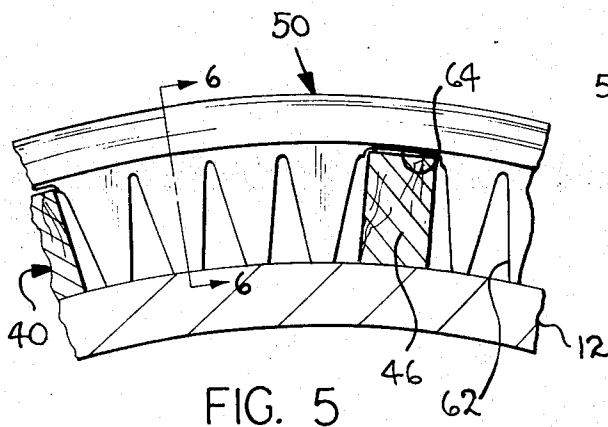
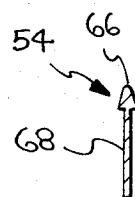
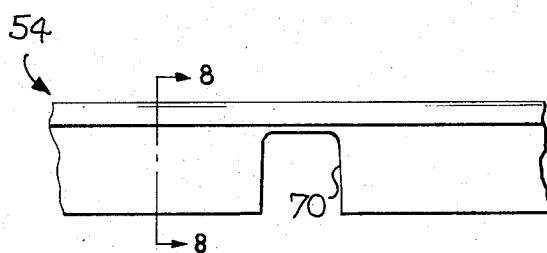
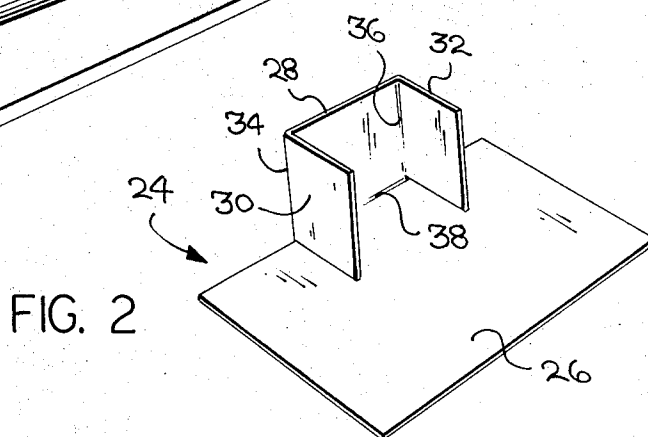
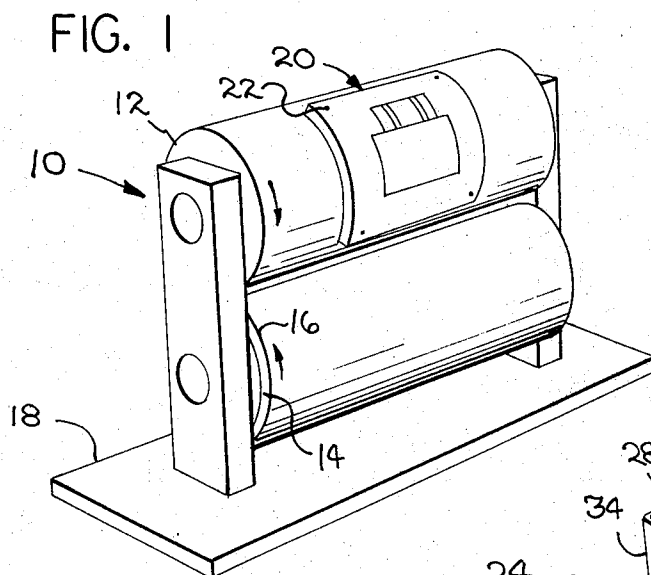
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[57] ABSTRACT

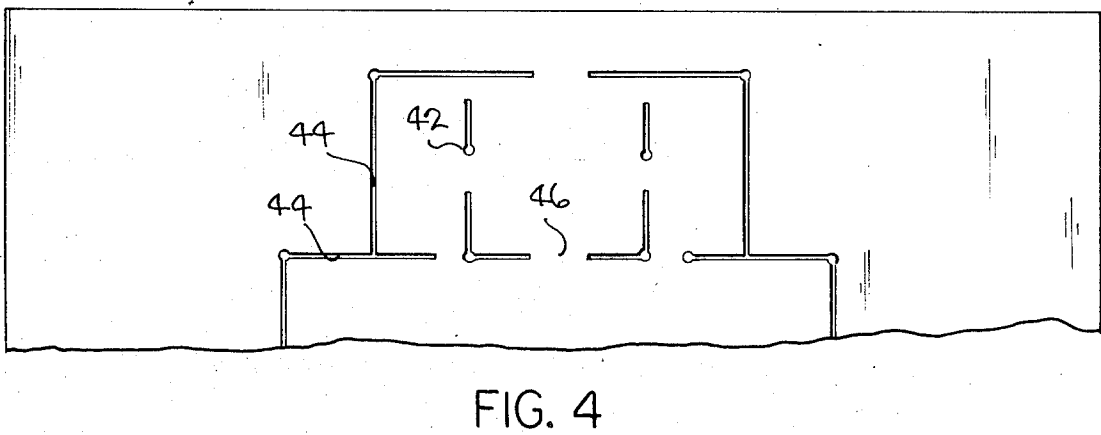
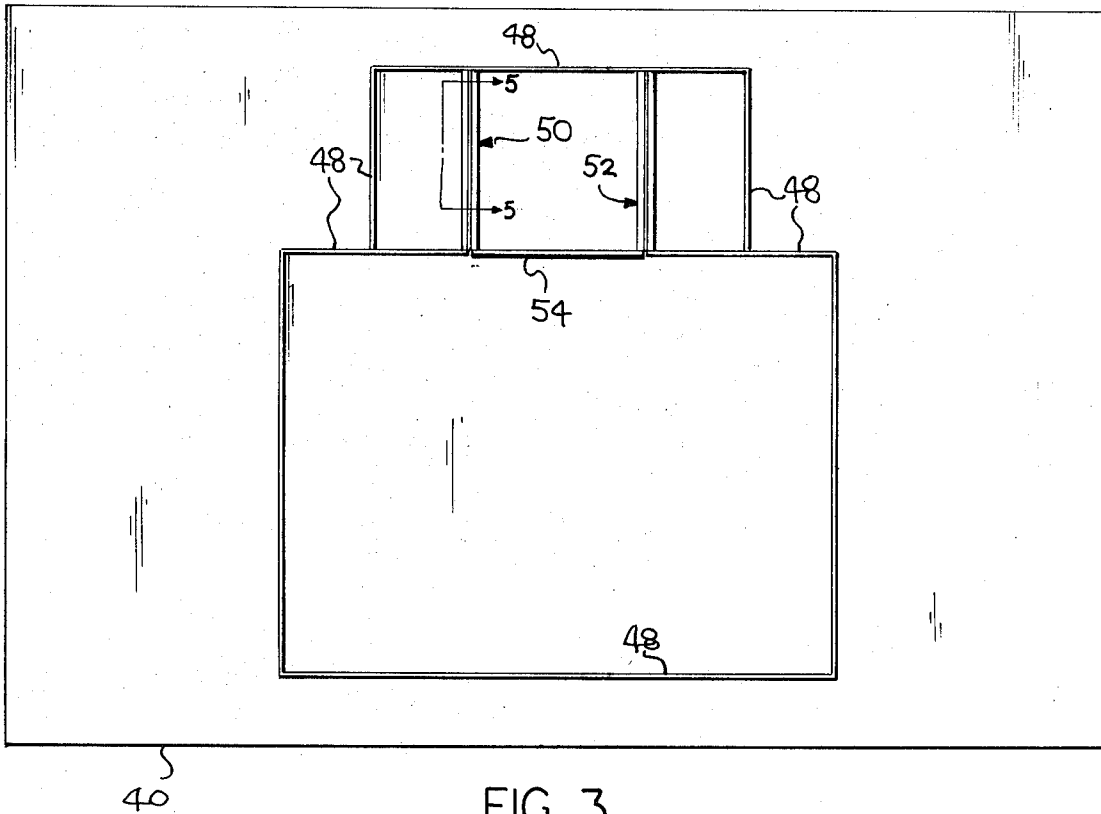
A creasing rule for a rotary cutting die is provided. The creasing rule is used to produce an indented line in a corrugated board, along which line the corrugated board is to be folded subsequently, when formed into a final product, such as a container. The cutting die comprises a curved die plate fastened on a rotatable cylinder with the creasing rule mounted in the die plate. The new creasing rule includes a base or flange which extends through the die plate to contact and be backed up by the cylinder, which then positions the creasing rule at a fixed distance from the surface of the cylinder, even with a variation in the thickness of the die plate. Further, the creasing rule is designed with a broad tapered web on each side of an indenting ridge which produces the indented line, so that the possibility of breaking of the liner of the corrugated board when the indentation is made is minimized.

4 Claims, 8 Drawing Figures





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CREASING RULES FOR CUTTING DIES

This invention relates to cutting dies for cutting and shaping sheet material and particularly to creasing rules for such dies.

Cutting dies for shaping and cutting sheet material, usually corrugated board, can be either flat or rotary, although rotary dies are being increasingly used because of the higher production rates obtainable. With rotary cutting die equipment, a pair of cylinders are mounted in a frame with a gap of predetermined width therebetween. One of the cylinders is of metal on which is mounted a die plate carrying the appropriate cutting rules and creasing rules. The other cylinder has a yieldable surface, usually of a layer of polyurethane plastic material, which supports the corrugated board as it is fed between the cylinders as they rotate in opposite directions. With such rotary cutting dies, production in the order of 6 thousand to 8,000 blanks per hour can be readily attained.

In the fabrication of the cutting dies for this operation, a die plate is first provided on which is laid out the appropriate shape of the blank desired, including cuts, perforations, and fold lines. Saw cuts are then made in the plate, which is usually of plywood, to provide slots in the proper locations, and cutting die rules are then mounted in the appropriate slots. For producing special lines, such as perforations, specially-shaped rules are used in place of the cutting rules. Creasing rules are also mounted on the die plate in the desired slots to produce the fold lines.

Heretofore, some creasing rules have been provided with side flanges which are stapled directly on the surface of the die plate. This has had two disadvantages. First, it has been difficult to accurately position the creasing rules in such instances. Second, and more importantly, if the thickness of the die plate varies, as is not uncommon, then the creasing rules will not penetrate or crush the corrugated board to the proper extent and will improperly form the indentation or fold line. Creasing rules heretofore used also have had a tendency to crack the liner or surface layer of the corrugated board, particularly when the fold lines are made in a direction parallel to the flutes of the core or medium.

The new creasing rule according to the invention employs a rearwardly-extending base or flange which projects through the slot in the die plate and contacts the surface of the metal die cylinder on which the die plate is fastened. The flange is made of a sufficient width or height to at least equal or exceed the thickness of the thickest die plate with which the creasing rule might be used, so that the flange will always contact the cylinder when the die plate is mounted thereon. Consequently, the indenting ridge of the creasing rule is always at a predetermined distance from the cylinder even if the die plate thickness varies. Further, the slots for the creasing rules can be made in the die plate at the same time the slots are made for the cutting rules and these slots can be located more accurately to position the creasing rules more precisely than when creasing rules were fastened to the surface of the die plate through side flanges.

The creasing rule embodying the invention also has a wide web extending from both sides of the indenting ridge with this web tapering continuously from the ridge to the outer edge thereof. The web enables the liner of the corrugated board on each side of the indentation line to bend more smoothly so there is little chance for the liner to unduly stretch and break as has heretofore occurred.

It is, therefore, a principal object of the invention to provide an improved creasing rule for a rotary cutting die, which rule is uniformly positioned relative to a die cylinder on which the cutting die is mounted.

Another object of the invention is to provide a creasing rule which will produce an indentation or fold line in corrugated board or similar sheet material without breaking the liner thereof.

Other objects and advantages of the invention will be apparent from the following detailed description of a preferred embodiment thereof, reference being made to the accompanying drawings, in which:

FIG. 1 is a somewhat schematic view in perspective of rotary cutting die equipment embodying the invention;

FIG. 2 is a view in perspective of a representative corrugated board product bent to shape from a blank formed by a rotary cutting die;

FIG. 3 is a somewhat schematic plan view of a rotary cutting die used with the apparatus of FIG. 1, but shown in a flattened state;

FIG. 4 is an enlarged view of a portion of a die plate shown in FIG. 3;

FIG. 5 is an enlarged view in cross section taken along the line 5-5 of FIG. 3, showing a creasing rule and die plate;

FIG. 6 is a view in transverse cross section taken generally along the line 6-6 of FIG. 5, but showing only the creasing rule;

FIG. 7 is a side view in elevation of another creasing rule used with the cutting die of FIG. 3, and shown on a smaller scale than FIGS. 5 and 6; and

FIG. 8 is a view in transverse cross section taken along the line 8-8 of FIG. 7.

Referring to FIG. 1, a rotary die cutter indicated at 10 includes an upper die cylinder or roll 12 and a lower back-up cylinder or roll 14. A resilient layer 16 of polyurethane plastic or other suitable material is located on the back-up cylinder 14. The rolls are rotatably mounted in a frame or stand 18 and are rotated in the direction of the arrows by suitable means (not shown). Corrugated board or other sheet material is fed between the rolls 12 and 14 where it is engaged by a rotary cutting die 20 and shaped into a blank from which cartons or other desired products can be formed. The cutting die 20 is fastened to the upper cylinder 12 by suitable fasteners 22.

Each rotary cutting die must be specially made for a particular desired product. Solely for illustrative purposes, a corrugated board product indicated at 24 in FIG. 2 includes a large rectangular portion 26 and a tab portion 28 having end portions 30 and 32 which are bent out of the plane of the tab 28 along fold lines 34 and 36. The tab portion 28 itself is bent out of the plane of the rectangular portion 26 along a fold line 38.

In making the rotary cutting die 20 for the product 24, a die plate or board 40 (FIG. 3) of appropriate size and thickness is first selected. This plate usually is made of high quality five-eighths inch plywood formed to the arcuate shape, but can also be of other high strength materials, such as laminated plastic. The shape of the blank to make the product 24 is then laid out on the die plate 40, with care being taken to compensate for distortion in the dimensions due to the arcuate shape of the die plate.

Referring to FIG. 4, holes 42 are drilled in the die plate 40 at appropriate positions on the pattern of the blank in order to receive a saw blade which forms kerfs or slots 44 therein to receive cutting die rules, which cut the corrugated blank, and creasing rules, which form indentations for folds, as will be subsequently discussed. As shown, the slots 44 are not continuous but have gaps to form bridges 46 to enable the die plate to maintain structural integrity throughout. After the slots are formed along the proper lines, including the fold lines 34, 36, and 38, steel cutting rules 48 are inserted in certain ones of the slots 44 with a friction fit. The cutting rules are notched in certain positions to receive the bridges 46. The cutting rules extend above the surface of the die plate 40 about one-fourth inch where they terminate in beveled cutting edges, as is known in the art. Perforating rules specially shaped to form perforations on the corrugated board blank can be similarly employed if needed, none being used in this instance. Joints for the cutting rules can be made according to my U.S. Pat. No. 3,383,969.

To form the fold lines 34, 36, and 38, creasing rules or heads 50, 52, and 54 are inserted in the proper die plate slots 44 of FIG. 4. The fold lines 34 and 36, as shown, are made parallel to the flutes or undulated core of the corrugated board, with the creasing rules 50 and 52 therefor being substantially identical in size and shape, only the rule 50 being discussed in detail. The fold line 38 is made transversely to the flutes and is formed by the creasing rule 54, which is of a different design. The fold lines extending transversely of the

flutes do not present any problem but those parallel thereto must be made carefully in order to avoid breaking of the liner, which is the paper on each side of the fluted core.

The creasing rule 50 is shown in FIGS. 5 and 6. The creasing rule includes a broad web 56 having a centrally located indenting ridge 58 and a rearwardly-extending base or flange 60. The flange 60 contains a plurality of notches 62 which enables the creasing rule 50 to be formed in the arcuate shape. The rule 50 can be extruded, after which the notches 62 are formed and the extrusion then wound around a body of appropriate diameter to provide the arcuate shape, the radius of which is substantially equal to the radius of the outer surface of the die plate 40. Larger notches 64 are then formed at appropriate positions on the flange 60 to receive the bridges 46, with the upper edge or end of the notch 64 commonly engaging, or even penetrating slightly, the upper surface of the bridge 46. The width or height of the flange 60 is at least equal to or greater than the thickness of the thickest die plate 40 which may be used for the rotary cutting die 20. While all of the die plates 40 may have a nominal thickness of five-eighths inch, for example, in practice they will vary sufficiently to hamper proper operation of the creasing rule. Also, a given die plate may vary in thickness over its length or width. With this design of the flange 60, the edge thereof always contacts the surface of the cylinder 12, as shown in FIG. 5. The indenting ridge 58 will always be a constant distance from the surface of the cylinder 12 even though the die plate thickness is not uniform. Consequently, a uniform indentation or fold line will be formed in the corrugated sheet material at all times.

The ridge 58 is actually squared with a flat top, except for fillets being formed at the edges thereof and also along the lines where the ridge meets the web 56. This shape of the ridge achieves a well-formed fold line with minimum tendency to break the liner. The web 56, as shown in FIG. 6, continuously tapers or slopes from the ridge 58 to the edges of the web. With this configuration, the liner of the corrugated board will be pressed more gently and uniformly so that, with this shape of the ridge 58, breaks in the liner will virtually be non-existent. The width of the web 56 also contributes to the effectiveness of the creasing rule in engaging the corrugated board. For this purpose, the ratio of the width of the web 56 to the height of the ridge 58 as measured from the bottom of the web should be at least three to one, and preferably in the order of 3.5 to 1. When the ratio is above 4 to 1, there does not appear to be any improvement in the functioning of the creasing rule.

The creasing rule 54 which forms the indentation or fold lines transversely of the corrugated flutes is shown in FIGS. 7

and 8. The rule 54 includes a squared or blunt ridge 66 which tapers outwardly in a rearward direction to be of a general arrowhead shape. A web is not necessary with the creasing rule 54 since there is substantially no problem in breaking of the liner when forming the transverse fold lines 38. A base or flange 68 extends rearwardly and is of a sufficient width or height below the thick portion of the creasing rule 54 to be in contact with the cylinder 12, positioning the ridge 66 a constant distance from the surface of the cylinder. The flange 68 need not be notched because it is straight; however, the flange does have occasional large notches 70 to receive the bridges 46 of the plate 40.

Various modifications of the above described embodiment of the invention will be apparent to those skilled in the art and it is to be understood that such modifications can be made without departing from the scope of the invention, if they are within the spirit and the tenor of the accompanying claims.

I claim:

1. A rotary cutting die for processing corrugated board, said die including a die plate having a slot therein, a creasing rule comprising an elongate, smooth, unbroken web having a central longitudinally-extending ridge on one side, a longitudinally-extending central flange extending rearwardly from the opposite side of said web, said flange having a width at least as great as the thickness of said die plate and received in the slot in said die plate, said opposite side of said web being positioned adjacent a surface of said die plate.

2. A rotary cutting die according to claim 1 characterized by said die plate being arcuate and said elongate web being arcuate in a longitudinal direction.

3. A rotary cutting die according to claim 1 characterized by said ridge having a flat, squared outer edge.

4. A creasing rule for a rotary die for processing sheet material, said creasing rule comprising an elongate, smooth, unbroken arcuate web having a central longitudinally-extending ridge on one side, said ridge having a squared, flat edge, said web tapering outwardly from said ridge to the edges of said web, a longitudinally-extending, central flange extending rearwardly from the opposite side of said web, said flange having a width at least as great as the thickness of any die plate with which the creasing rule is to be used, said flange further having a plurality of first notches spaced therealong, each of said notches extending substantially the width of said flange and at least one large notch in said flange at a predetermined position, said large notch extending substantially the width of said flange and being at least as wide as two of said first notches.

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