

[54] DIE AND METHOD FOR CUTTING LABELS AND THE LIKE

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[75] Inventor: Pierson S. Kang, Pennsauken, N.J.

[73] Assignee: Chempar Corporation, Montgomeryville, Pa.

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[51] Int. Cl..... B26f 1/44, B26d 3/08

[58] Field of Search..... 83/6, 8, 9, 11, 12, 663, 83/667-675, 684, 346, 347, 7

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Primary Examiner—J. M. Meister  
Attorney, Agent, or Firm—Seidel, Gonda & Goldhammer

[57] **ABSTRACT**

A die is provided for cutting at least one but less than all of the layers of a plurality of layers of paper such as a sheet of labels or the like. A raised cutting edge of the die is rounded so that the portions of the cut layer or layers on either side of a cut made by the cutting edge are cammed away from each other so that the backing or other layers are neither cut nor crushed. The die may be made by etching according to conventional procedures followed by moving the usual cutting edge obtained through a spray of etching fluid at such a rate that the cutting edge is naturally rounded.

5 Claims, 10 Drawing Figures

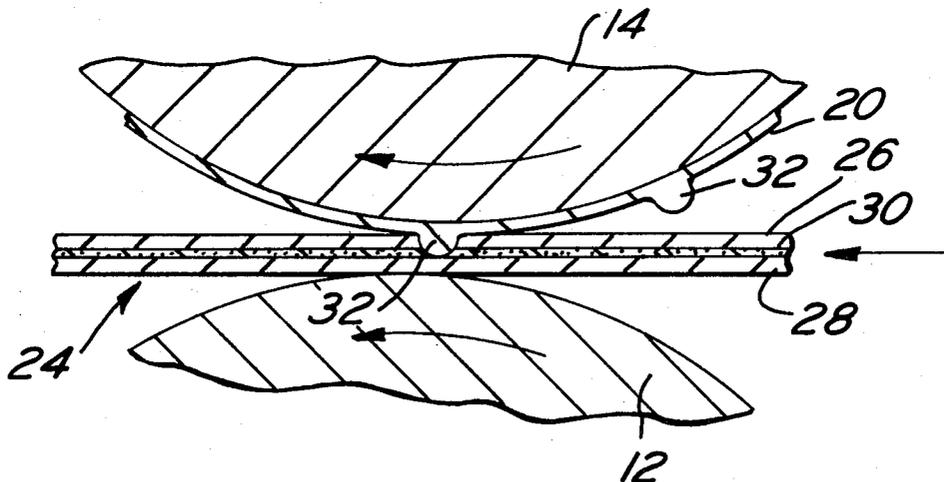


FIG. 1

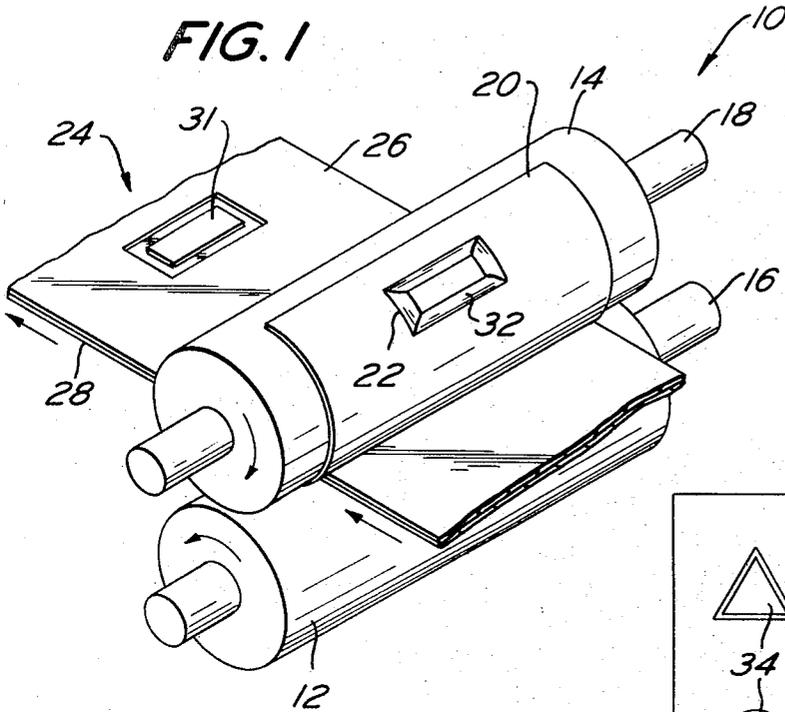


FIG. 3

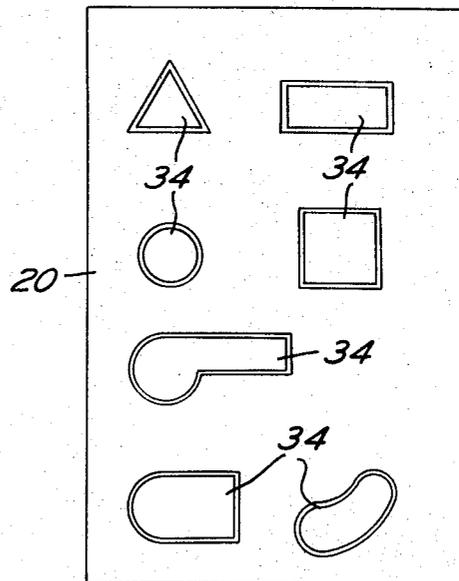


FIG. 2

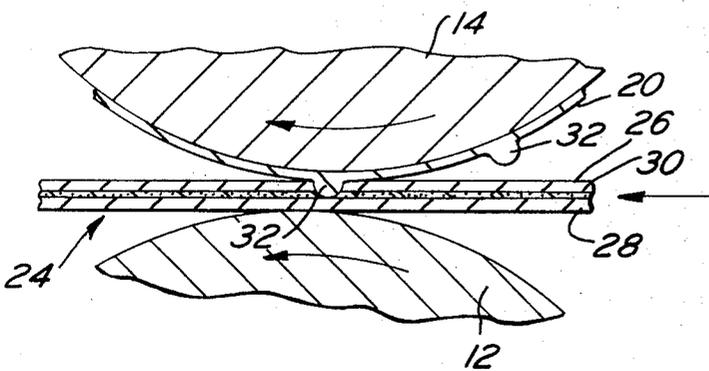


FIG. 4

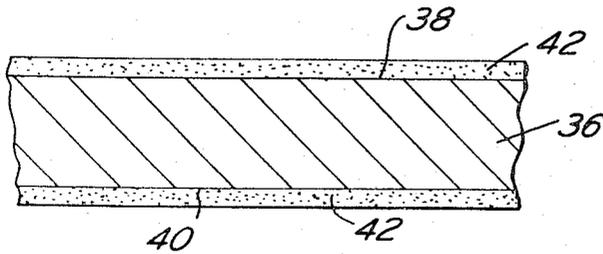


FIG. 5

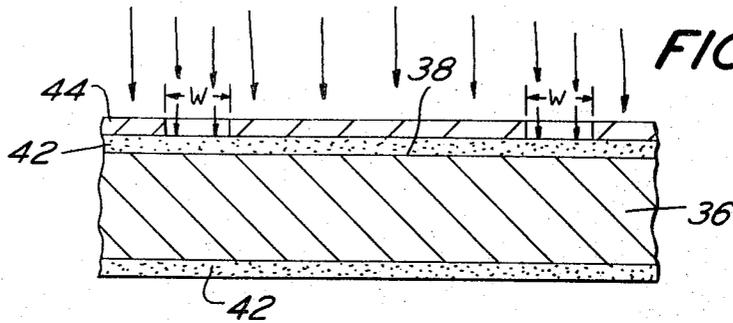


FIG. 6

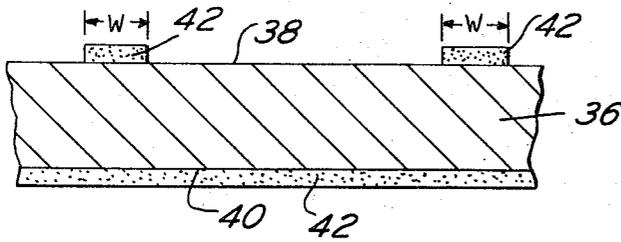


FIG. 7

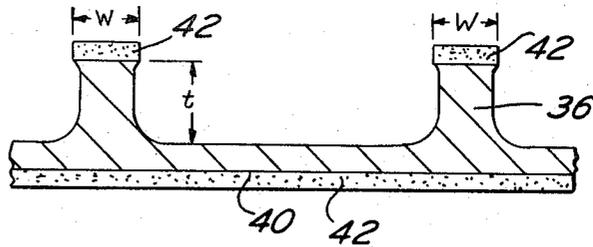


FIG. 8

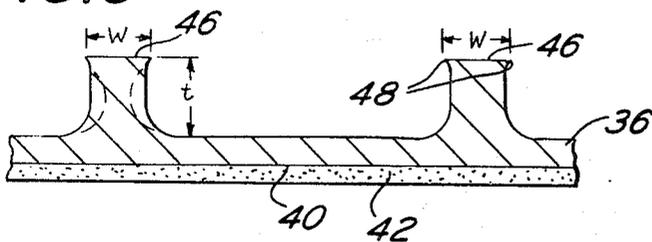


FIG. 9

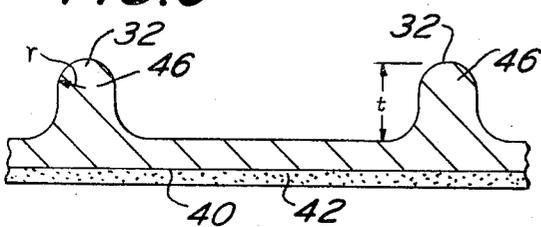
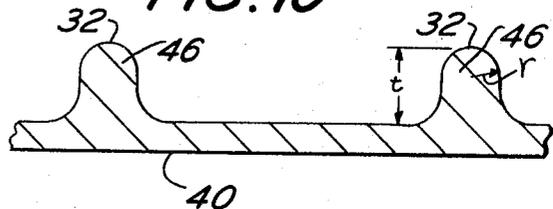


FIG. 10



## DIE AND METHOD FOR CUTTING LABELS AND THE LIKE

The present invention relates to a die and method for cutting labels and the like. More particularly, the invention relates to a means and method of cutting labels or the like in a sheet comprising a plurality of layers of paper.

Labels, markers and other similar articles are usually made available in strips or rolls in which a plurality of such labels or the like are attached to an elongated continuous backing layer by a pressure sensitive adhesive. The pressure sensitive gum or adhesive is permanently adhered to the back of the label, while the backing layer is provided with a release coating. Hence, the label with pressure sensitive adhesive separates readily from the back strip, and the user merely has to peel the labels or markers from the backing strip and apply them as desired.

Such labels or markers are manufactured on a mass production basis whereby a strip comprising a label material, a layer of pressure sensitive adhesive and a backing layer are assembled and passed under a cutting die. The die, which may have any convenient arrangement or array of patterns thereon in accordance with the shapes desired for the labels, cuts through the layer comprising the material which will form the labels. The die also cuts through the material which will form the labels. The die also cuts through the adhesive layer but does not cut through the backing layer so that a continuous strip or sheet of labels is maintained.

Etched cutting dies of the type used in preparing label strips of the prior art have the undesirable characteristic of tending to crush the label paper into the backing or release layer, thereby weakening or destroying the latter. This occurs due to the fact that invariably the label material and backing layers are made of paper and the edges of the cutting dies have flat lands or faces. The flat faces result from the fact that the cutting edges must be of such a small size that mechanical techniques for forming them are not feasible, and the edges must therefore be prepared by well known photo-etching processes.

Accordingly, it would be desirable to have a method for cutting labels and the like in such a manner that the crushing effect and resultant weakening of the backing layer encountered with dies of the prior art would be avoided. Similarly, it would be desirable to produce a cutting die and method for making such a die which would avoid these disadvantages.

The above and other problems of the prior art are avoided by the present invention which comprises a die comprising a base, a raised cutting edge extending from the base, the lateral extent of the cutting edge defining a pattern for the labels or the like to be cut, and the profile of the cutting edge remote from the base being rounded so that the portions of the cut layer on either side of a cut made by the cutting edge are cammed away from each other and the uncut layer is not crushed. The present invention also comprises the method of cutting labels or the like with this cutting die.

Additionally, the invention is directed to an improved process for manufacturing dies of the type having a cutting edge for cutting at least one but less than all of the layers in a plurality of layers of paper in which the improvement comprises the step of rounding the

profile of the cutting edge so that the portions of the cut layer on either side of a cut made by the cutting edge are cammed away from each other and the uncut layer is not crushed.

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.

FIG. 1 is a perspective view of a die assembly employing a cutting die used to form labels in accordance with the present invention.

FIG. 2 is an enlarged and fragmented sectional view showing the manner in which the die of the present invention penetrates the layers of material in a label strip.

FIG. 3 is a plan view of a die sheet comprising a plurality of cutting patterns.

FIGS. 4-10 illustrate in sectional view the appearance of a cutting die in each of the steps of manufacture according to the present invention.

Referring now to the drawings for a detailed description of the invention wherein like numerals refer to like elements throughout the several views, FIG. 1 shows a die assembly generally indicated by numeral 10 for employing the present invention. The die assembly 10 is of a conventional type comprising a hard roll 12 and a die supporting roll or platen 14. The two rolls or platens 12 and 14 are mounted for rotation on shafts 16 and 18, respectively.

Support roll 14 carries a die plate 20 having a die pattern 22 thereon. The size of the cutting edge 32 of die pattern 22 has been greatly exaggerated for ease of illustration. Also, for purposes of illustration, only one die pattern 22 has been shown on die plate 20 in FIG. 1. However, it will be apparent that as many patterns of like or different configuration may be placed on die plate 20 as is convenient. For example, FIG. 3 illustrates a die plate 20 having seven die patterns 34, each having a different distinctive configuration.

A label strip generally indicated by numeral 24 is shown in FIGS. 1 and 2 as it passes through the nip between hard roll 12 and die support roll 14. As best shown in FIG. 2, the label strip assembly 24 comprises a facing layer 26 of label material, a backing layer or release sheet 28, and a layer of pressure sensitive adhesive 30 sandwiched between the facing and backing layers. The label strip assembly 24 shown in FIG. 1 is moving toward the upper left-hand corner as indicated by the arrows. Thus, die pattern 22 has already cut the label 31 (whose cut edges are also exaggerated in size) into facing layer 26 of label strip assembly 24 without cutting the backing layer 28.

FIG. 2 is an enlarged fragmented cross sectional view of a die assembly of the type shown in FIG. 1 illustrating the penetration of a cutting edge 32 of a die pattern into a label strip assembly 24. In accordance with the present invention, the profile of the cutting edge 32 is rounded and of such a height that it cuts through facing layer 26 of label material and pressure sensitive adhesive layer 30 without crushing or cutting into backing layer 28.

As shown in FIGS. 1 and 2, the die plate 20 comprises a thin metal plate or sheet which may be easily attached to die support roll 14 by the use of permanent magnets, adhesives or clamps. Although, according to the preferred embodiment illustrated, the die plate is

shown on a roller, it will be evident that the die plate can be attached to a support of any convenient shape and may be used in a so-called flatbed cutter.

As with cutting dies of the prior art, the cutting die of the present invention has a plurality of raised cutting edges extending from the thin metal base plate. The lateral extent of these cutting edges 32 define a pattern which is to be cut. However, whereas in the prior art the cutting edges 32 have had flat lands or faces, the cutting edges of the present invention are rounded. The details of the configuration of the cutting edges of the cutting die will now be described with reference to FIGS. 4-10 in connection with the process by which the die is manufactured.

Referring first to FIG. 4, a sheet of metal 36 is provided from which the aforementioned die plate 20 will be formed. The sheet of metal 36 may be any suitable metal from which cutting dies are conventionally made, such as hardened or soft steel, stainless steel, etc. Similarly, the metal sheet 36 may be of any convenient size. A plate having dimensions of about 18 by 24 inches and a thickness of about 17 mils has been found particularly suitable.

Due to the very small dimensions (on the order of several mils) of raised cutting edges of cutting dies of the prior art, mechanical forming techniques are not feasible and photographic etching processes are usually employed in the manufacture of such cutting dies. Since these photographic etching processes are old and well known in the art, the basic process upon which the improvement of the present invention is based will only be described very briefly, and it will be understood that any variations desired may be employed as will be obvious to one of ordinary skill in the art leading up to the steps of the present invention.

In preparation for coating the sheet of metal 36 with a suitable light sensitive resist 42, the sheet of metal 36 is first thoroughly cleaned with an alkaline wash or detergent. Many such washes or detergents are well known in the art and proprietary cleaners are commercially available.

After cleaning, a conversion coating is then applied to the sheet of metal 36. Conversion coatings are well known in the art and are desirable to promote adhesion of a light sensitive photoresist to the sheet of metal. A number of suitable conversion coating solutions are commercially available.

After application of a conversion coating, a light sensitive photoresist 42 is applied to the sheet of metal 36. Such light sensitive photoresists are well known in the art and typically comprise a synthetic polymer which will cross link or further polymerize when subjected to ultraviolet light. A number of suitable liquid or dry film light sensitive resists are readily commercially available. Preferably, both top face 38 and bottom face 40 of the sheet of metal 36 are coated with the light sensitive resist 42. The coating of the back face 40 will prevent any inadvertent etching of that face of the sheet of metal.

As is well known in the art, a negative 44 is next placed over the light sensitive resist 42 on the top face of the sheet of metal to be etched, as shown in FIG. 5. In this manner the desired die pattern is transferred to the light sensitive resist by projecting ultraviolet light onto the top of the negative 44.

The negative 44 may be prepared by first making a film of the clear celluloid type and blocking out opaque

areas surrounding the pattern. This may suitably be done using a cut and strip material which is commercially available and comprises a red film laminated over a clear sheet of Mylar (polyethylene terephthalate).

5 The desired patterns may be cut into the cut and strip material on the scale of 5 times or 10 times the final size of the desired label with a scribing knife or other sharp tool. Scribing is preferred as a means for drawing the pattern as it gives clear sharp lines.

10 The inscribed cut and strip material (not shown) forms a master negative which is then exposed onto photograph film with a reduction camera.

The developed film will have a clear background with the pattern appearing in black lines. This film (also not shown) is subsequently exposed onto another photographic film which is then developed to yield negative 44 having a black background with the pattern appearing in clear lines.

Where multiple patterns on a given cutting die are desired, the multiple patterns are formed on a negative by use of a step and repeat exposure technique wherein a portion of the negative is exposed, shifted, another portion exposed, shifted and so forth.

When negative 44 is placed over light sensitive resist 42, ultraviolet radiation passes through the clear portions of the negative, thereby causing the underlying portions of the photoresist to cross link or further polymerize. As a result, when the photoresist is subjected to the appropriate developing chemicals, the light sensitive resist will remain in those areas where the light has passed through the negative and will be dissolved away in all other areas, as shown in FIG. 6.

In this manner, the pattern from negative 44 which corresponds to the pattern of a cutting edge to be formed in the sheet of metal 36, and which has a width w, is transferred to the light sensitive resist 42 such that a pattern of photoresist also having a width w will remain on the top face 38 of the sheet of metal 36. The means and method for removing the remainder of the light sensitive resist by developing are well known in the photographic art and need not be described in detail herein.

After the developing of the light sensitive resist, the sheet of metal 36 is then etched in a conventional manner to form a die plate. The etching may be achieved by any of a number of old and well known chemical or electrolytic techniques, such as nitric acid, ferric chloride, aqua regia, and the like for chemical etching and sodium chloride, hydrochloric acid, sulphuric acid and the like for electrolytic etching. The resulting structure after etching is shown in FIG. 7.

Etching fluid of suitable composition such as ferric chloride of density 42° Baume, at a temperature of between 120° and 130° F is carried by manifold pipes having nozzles therein and is continuously sprayed upon the exposed metal area of the cutting die plate. The nozzles are continuously oscillated cross-wise of the direction of travel of the plate at high speed, i.e., 60 strokes per minute.

60 The light sensitive resist 42 is then removed from the tops of the unetched portions which define the cutting pattern, thus yielding the die plate shown in FIG. 8. To this point, the process for making cutting dies for the cutting of labels and the like is conventional and well known in the art. The sharp corners 48 of lands 46 shown in FIG. 8 are responsible for effecting the cutting of the labels with prior art cutting dies. It is these

sharp corners 48 which are responsible for the crushing and weakening of the backing layer during the normal cutting of labels. In many instances the conventional dies were undercut such as shown by the phantom lines in FIG. 8. Due to the undercut, the conventional dies had a tendency to flex or deform thereby diminishing the effectiveness of the dies.

According to the present invention, the die plate shown in FIG. 8 is subjected to the following additional steps. First of all, the entire exposed surface of the die plate is cleaned by a suitable alkaline cleaner in the same manner as described previously. The die plate is then further etched to form the structure shown in FIG. 9, and finally the photoresist 42 on the bottom face 40 of the plate is removed to yield the final die plate shown in FIG. 10, which corresponds to the die plates 20 shown in use in FIGS. 1 and 2.

In order to form the rounded cutting edges 32 shown in FIGS. 9 and 10, the additional etching step will comprise a chemical etching technique in which the die plate is placed on a conveyor which past spray nozzles which spray the chemical etchant crosswise to the direction of travel of the die plate onto the face of the die plate. Although the etchant will attack the entire exposed surface of the die plate and further reduce the various dimensions, it has been discovered that the etching will attack the previously covered lands 46 to the extent that the metal will be eaten away into a rounded configuration to yield a rounded cutting edge 32. As a result of the lateral movement of the nozzles and high speed plate movement, rapid and uniform etching of a rounded cutting edge is obtained. The rounded configuration is a natural phenomenon obtained from moving the die plate past the spray nozzles for the etchant.

The degree of etching will depend upon a number of factors including the particular material of the sheet of metal 36, the particular etchant or etching material, the speed at which the die plates move past the spray nozzles, the pressure at which the chemical etchant is sprayed, and the direction or orientation of the spray nozzles. The variation of these parameters for various materials will be readily determined by one of ordinary skill in the art.

In one particular example, where the sheet of metal 36 was cold rolled steel and the chemical etchant was ferric chloride having a density of 42° Baume, the desired configuration of the rounded cutting edges 32 was obtained by spraying the chemical etchant at a pressure of about 35 pounds per square inch approximately perpendicular to the die plate, as the die plate moved past the spray nozzles at a speed of between 40 and 120 inches per minute, and preferably about 80 inches per minute.

It will also be understood that the cutting edges 32 shown in FIGS. 9 and 10 may have various dimensions depending upon the type and size of cut to be made in forming the labels or other markers. However, a particularly preferred set of dimensions comprises a thickness of about 7-8 mils (0.007-0.008 inch) for the base

of the die plate, a cutting edge height  $T$  of about 7-8 mils, and a rounded cutting edge radius  $r$  of about 3 mils. In order to form a so dimensioned die plate according to the above process, a sheet of metal 36 having a thickness of about 17 mils should be used to start with and the width of the cutting land 46  $w$  should be about 6 mils, and the height of the originally etched cutting edges shown in FIGS. 7 and 8  $t$  should be about 8 mils, while the thickness of the base of the die plate shown in FIGS. 7 and 8 may be about 9 mils.

After the lands 46 have been etched to the desired roundness, as shown in FIG. 9, the light sensitive resist 42 is removed from the bottom face 40 of the die plate as shown in FIG. 10. The resulting die plate illustrated in FIG. 10 may be connected to a roller or flat plate as described above. Since the cutting edges are round, rather than flat, the cutting of labels will not result in a crushing of the backing paper but instead the rounded cutting edges will tend to cause the label material to be cammed away from the cut so that the backing layer will not be crushed. This phenomenon is clearly illustrated in FIG. 2 where it can be seen that the portions of labels strip 26 on either side of cutting face 32 are separated from each other. As a result, there is no material below the cutting edge 32 to bear against the backing layer 28 and crush it.

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.

I claim:

1. A method for cutting label sheets and the like of the type comprising a facing layer, a pressure sensitive adhesive on the back of said facing layer, and a protective backing layer underlying said pressure sensitive adhesive, the steps comprising providing a cutting die, said die comprising a base, a raised cutting edge extending from said base, the lateral extent of said cutting edge defining a pattern to be cut in said sheets and the profile of said cutting edge remote from said base being rounded, bringing said cutting die into cutting engagement with said facing layer, and forcing said cutting edge through said facing layer, whereby portions of said facing layer on either side of the cut made by said cutting edge are cammed away from each other but said backing layer is neither cut nor crushed by the cutting edge of said die.

2. A method according to claim 1 wherein said raised cutting edge is integral with said base.

3. A method according to claim 1 wherein said die is made of a shapeable metal and the base of said die is wrapped on a round platen.

4. A method according to claim 1 wherein said cutting edge is rounded to a radius of about 3 mils.

5. A method according to claim 1 wherein said cutting edge has a height above said base of about 7 to 8 mils.

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