United States Patent

Robinson

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[54] CUTTING AND/OR CREASING OF SHEET MATERIAL

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **83/663,** 76/107 C, 83/698

[51] **Int. Cl.** **B26d 1/32,** B26d 1/36, B21k 5/12

[58] **Field of Search** ..... 83/663, 665, 698; 76/107 C

[56] **References Cited**

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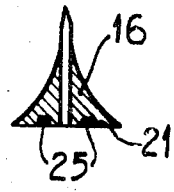
[57] **ABSTRACT**

A forme member for a cutting and/or creasing machine comprise a rule and a base of ductile metal, the base engaging the marginal inner edge portions of the rule and at least partly filling notches or other openings in the rule.

12 Claims, 10 Drawing Figures



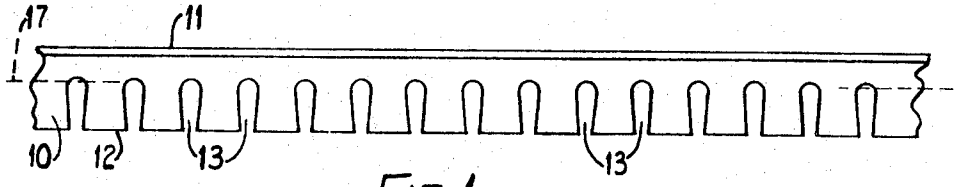


FIG. 1.

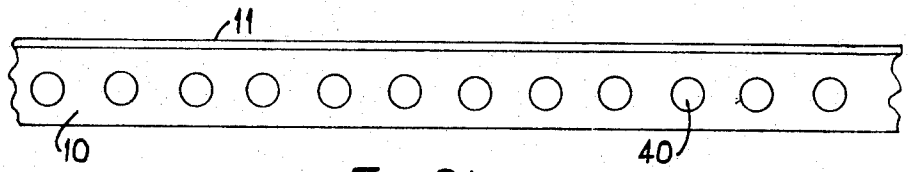


FIG. 2A.

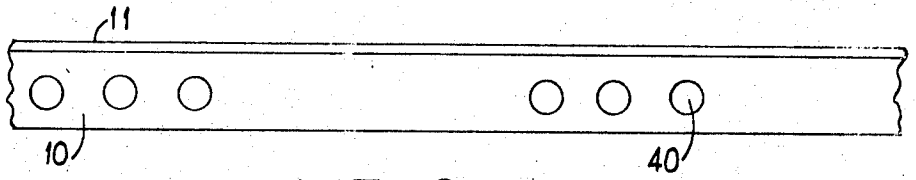
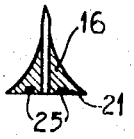


FIG. 2B.

FIG. 3.



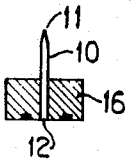


FIG. 4.

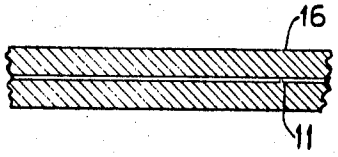


FIG. 5.

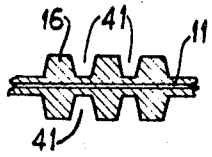


FIG. 6.

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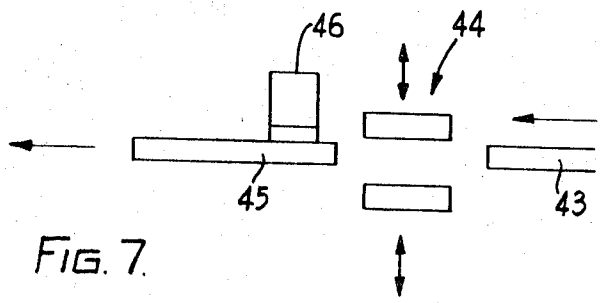

FIG. 7.

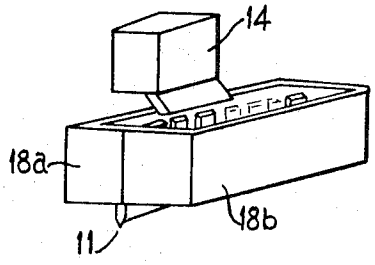

FIG. 8.

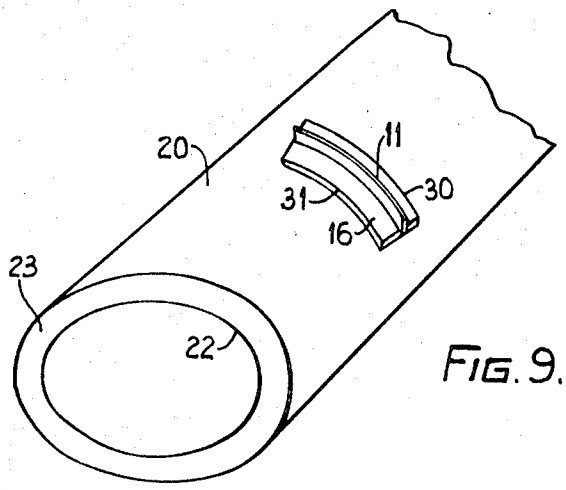

FIG. 9.

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CUTTING AND/OR CREASING OF SHEET MATERIAL

This invention relates to the cutting and/or creasing of sheet material by the method in which such material is pressed against a supporting surface by means of a form or forms mounted upon the cylindrical periphery of a coacting rotary carrier member.

The invention is applicable particularly, though not exclusively, to the cutting and/or creasing machine which forms the subject of U.S. Pat. application Ser. No. 776,911 now U.S. Pat. No. 3,566,734 and in which the form-carrier is a replaceable sleeve whose wall is drivably engaged between the supporting surface aforesaid and the periphery of a roller of smaller diameter than said sleeve, the sheet material under treatment being fed between the sleeve and the supporting surface which travels at the same linear speed as the material.

The forms used with the above and other known kinds of rotary cutting and/or creasing machine are fabricated from thin steel strips known as 'rules,' which are fixed edge-on upon the carrier surface at such positions and in such configuration as to outline the desired blank to be cut from, or the desired creases to be made in, the sheet material under treatment and, if desired, to additionally cut or crease such blank along predetermined lines.

It will be appreciated that such a rule, when extending otherwise than longitudinally of the cylindrical carrier surface parallel to the axis of the carrier member, requires to be bent in its own plane with a degree of curvature which, at any part of the rule, depends upon the orientation of that part with reference to the axis about which the carrier surface is to rotate, the radius of curvature of the inner edge of the rule being equal to that of the carrier surface only at those parts of the rule as are truly at right angles to the axis aforesaid.

Thus, for any complicated shape of form, it has hitherto been a tedious and expensive operation, not only to effect the requisite edge-bending of the rule in its own plane, but also to secure all parts of the latter rigidly to the surface of the carrier at their appropriate positions.

Numerous proposals for simplifying and cheapening the production of such forms have been made, but all of these have drawbacks in practice, particularly those in which the rule, after edge-bending by mechanical means, is provided at close intervals with separately formed attachment blocks or brackets which are screwed or rivetted individually to the carrier. This latter procedure also produces undesirable holes or apertures in the carrier wall.

According to one aspect of this invention, a form member for use in the cutting and/or creasing of sheet material comprises at least one length of rule whose inner edge is embedded in a base of ductile metal which metal is capable of being soldered to a carrier surface and engage the marginal inner edge portions of the rule, the embedded part of said rule having notches and/or other openings at least partly filled by the metal.

According to another aspect of the invention a method of making a form member for a cutting and/or creasing machine comprises forming openings in a rule spaced from the operative edge thereof, and applying a ductile metal base to the marginal inner edge portions of the rule with the metal extending through at least part of the openings, the metal being capable of being soldered to a carrier surface.

Preferably the inner edge surface of the rule remains free of contact with the metal, the inner edge surface of the base being substantially flush with the inner edge surface of the rule.

The invention may be performed in various ways and some specific embodiments will now be described by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a side elevation of part of a rule;

FIG. 2A is a side elevation of part of another rule;

FIG. 2B is a side elevation of part of a further rule somewhat similar to the rule of FIG. 2A;

FIG. 3 is a transverse section through one form of rule and base;

FIG. 4 is a transverse section through another form of rule and base;

FIG. 5 is a plan view of part of the rule of the form of FIG. 4;

FIG. 6 is a plan view of a form with a waisted base;

FIG. 7 is a diagrammatic view of a continuous casting method;

FIG. 8 is a perspective view of a moulding operation; and

FIG. 9 is a perspective view of part of a cylindrical carrier member with forms mounted on its outer surface.

Referring to the FIG. 1 of the drawings, in one example, a rule aforesaid comprises a strip **10** of alloy steel or other metal capable of being tempered to allow of one longitudinal edge **11** being sharpened as shown for cutting purposes, or rounded or left blunt when creasing only is to be effected.

This rule, which may be formed from about 16 SWG sheet, and conveniently measures ½ or 9/16 inch wide, has its other edge **12** formed with notches **13** (say) 0.4 inch deep by 0.2 inch wide at their maximum at a pitch of 0.4 inch.

In applying a cast base, the rule is mounted with its cutting or creasing edge **11** downwards in a mould formed from two dies **18*a***, **18*b*** and a suitable lead-base alloy, such as the ductile material known as white metal, is poured molten from an electrically heated melting pot **14** (FIG. **8**) around the whole notched portion thereof, the resultant cast base **16** having the operative edge **11** of the rule projecting medially thereof and being of either rectangular section (FIG. **4**) or triangular section (FIG. **3**). The upper level **17** FIG. **1** of the base may be slightly below the upper end of the notches **13** or it could be above the upper end of the notches. The notches are preferably wider at their closed end than their open end to provide a mechanical lock resisting separation of the rule and the base, but in some circumstances the notches would be rectangular, e.g., square. The notches could be rounded at their closed ends, as shown.

Referring to FIG. **9**, the cylindrical carrier surface **20** having been previously prepared by painting it over at the relevant places with a flux containing powdered solder, the flat underside **21** of the rule base can readily be united thereto by localized heating of the inner surface **22** of the carrier sleeve **23** with a curved electric element, or alternatively by running a low-temperature flame along the edges of the rule base.

The attachment of the form member or composite rule and base to the carrier surface may be facilitated by forming the base **16** with at least one underside channel containing a thread of solder **25**, see FIGS. **3** and **4**.

The advantages of such a form member are particularly apparent in a case where it is desired to cut a circular blank from the sheet material under treatment.

The conventionally attached form requires very careful and accurate edge-bending of the rule to its developed profile in order that it may conform exactly to the cylindrical carrier surface after it ends have been brought together.

In the production of such a form as described herein however, the ductility of the cast base, and the flexibility imparted to the rule by the notches therein, enables the composite article readily to be bent both edgewise and transversely with little or no tendency to revert to its original shape. The composite rule and base may require a slight initial overbending beyond the desired final shape but it retains any shape to which it may be bent in its own plane and/or transversely thereto when the bending forces are removed.

Thus it is merely necessary to solder one end to the carrier at the appropriate position, and then progressively bending and soldering such ring so that it conforms at all points to the underlying cylindrical surface. When secured the rule projects. Thus as shown for a noncircular rule, the base may be initially secured to the carrier at one end by localized soldering at **30**, and then the form similarly secured at a spaced location **31**, the intervening portion then being easily adjusted, for example by using a wood hammer, to gently bring the form to the desired position.

Further spaced soldering may be effected and the process continued until the whole form is in place. The base may then

be soldered to the carrier along the full length of the base but this is not essential.

At any parts of the required form which extend generally parallel to the rotational axis of the carrier, so that little or no edgewise bending is required, the slots formed in the inner edge of the rule may be replaced by a series of holes **40**, FIG. **2**, not necessarily so closely spaced, which allow effective keying of the cast base to the rule whilst giving the article a greater overall strength, particularly when a harder alloy is used for the base.

Whilst the cast base will usually be of uniform cross section, it may be found desirable in some cases, particularly when very sharp transverse bends are to be produced, to 'waist' such base at regular intervals as shown at **41**, FIG. **6**, by casting it with opposed indentations in both sides.

FIG. **7** shows a continuous process in which the unnotched rule **43** is fed step by step to a reciprocating mechanism **44** which cuts the notches in the rule, the notched rule being fed to a mould arrangement **45** receiving molten metal from a pot **46**, so as to cast the base, the rule and cast base moving step by step from the mould.

In some circumstances it may be possible to move the rule continuously through a suitable notching mechanism and then progressively through the mould.

In some cases the rule may have both holes and notches, and it may be desirable to space clusters of the notches or holes, so that portions of the rule are free of notches or holes.

Rubber members (not shown) may be secured to the surface of the carrier sleeve at suitable locations to assist in feeding the cut and/or creased material forwards.

It will be appreciated that the composite rule and base can be readily removed from the carrier by heat without damaging the carrier, leaving the carrier ready to receive further forms. No holes need be formed in the carrier, and additional means such as studs or rivets are not needed to secure the form to the carrier sleeve.

Small adjustments in the position of the cutting or creasing edge can be made after localized soldering, the ductile metal being readily cold-formed both during initial coarse bending before the base is locally soldered to the carrier, and after the base has been locally soldered.

The carrier sleeve may carry rules arranged for cutting and/or rules arranged for creasing.

In some cases more than one rule may be embedded in a single base.

It is possible that the base may be extruded around the rule.

In the preferred arrangement, the inner edge surface **12** of the rule is free of contact with the metal of the base which engages the marginal inner edge portions of the rule and has an inner surface substantially flush with the inner surface **12** of the rule. It may in some circumstances be possible for the base also to contact the surface **12** so that the inner surface of the base **13** is spaced slightly inwardly from the surface **12**.

I claim:

1. An elongated striplike form member for use in the cutting and/or creasing of sheet material comprising; an elongated striplike base of ductile metal capable of being soldered to a carrier surface, an elongated rule having an outer forming edge and an inner edge embedded in said base with the rule extending in a plane generally parallel to said base, said base engaging marginal inner edge portions on opposite sides of said rule, said rule having a plurality of openings longitudinally spaced therealong and being at least partly filled by said base.

2. A form member as claimed in claim **1**, in which the inner edge surface is free of contact with the metal, the inner edge surface of the base is formed substantially flush with the inner edge surface of the rule.

3. A form member as claimed in claim **1**, in which the base is of white metal.

4. A form member as claimed in claim **1**, in which the base is of triangular section.

5. A form member as claimed in claim **1**, in which the base is of rectangular section.

6. A form member as claimed in claim **1**, in which at least one channel is formed in the underside surface of the base, and a thread of solder is located in each channel.

7. The form member as claimed in claim **1** in which said openings and said rule are notches opening into said inner edge of said rule, the closed end of said notches being curved and wider than the open ends of said notches.

8. A method of making a form member for a cutting and/or creasing machine comprising the steps of forming openings in an elongated rule spaced from the working edge thereof and applying elongated striplike ductile metallic base portions to opposite sides of said rule along the marginal inner edge portions of the rule with the base portions extending through at least part of said openings, said metallic base portions being capable of being soldered to a carrier surface.

9. A method as claimed in claim **8**, in which said base portions are applied by casting.

10. The method defined in claim **8** wherein said base portions are applied to said rule such that the inner edge surface of the rule remains free of contact with said base portions and is substantially flush with the inner edge surface of said base portions.

11. The method defined in claim **9** wherein the base portions are cast in a hollow die means containing said rule with said openings and the inner edge portions facing upwardly in the die means and with the working edge of said rule projecting below the bottom of the die means and wherein molten metal is poured into said die means on opposite sides of said rule to the level of the upwardly facing inner edge portions of said rule.

12. A method of forming an arrangement of forming members for use in cutting and/or creasing sheet material comprising the steps of forming a plurality of forming members, each forming member being formed by applying elongated strips of ductile metallic material to opposite sides of an elongated rule having an outer work forming edge and an opposite inner edge with said elongated strips of ductile material engaging opposite sides of said inner edge portions of said rule, deforming each of said forming members into an arcuate shape conforming to the shape of a carrier support surface, and individually attaching said forming members to said carrier support surface in a desired pattern.

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