

July 26, 1955

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2,713,902

STEEL CUTTING RULE

Filed Dec. 7, 1950

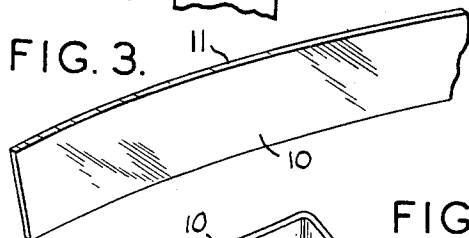
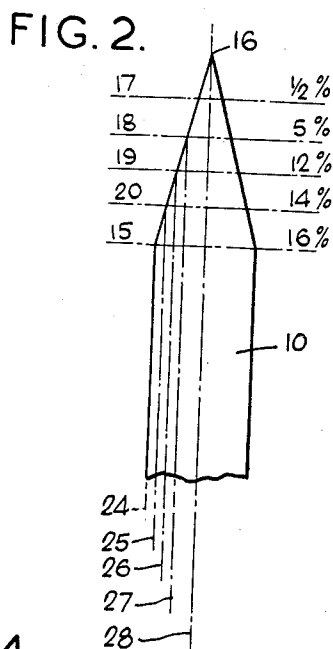
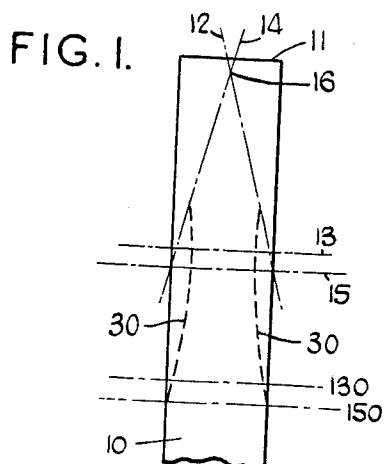
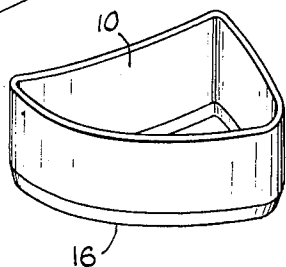


FIG. 4.



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STEEL CUTTING RULE

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Application December 7, 1950, Serial No. 199,663

Claims priority, application Great Britain April 18, 1950

3 Claims. (Cl. 164—29)

This invention relates to the manufacture of knives in the form of endless bands or long strips, having a thickness of 20 to 160 thousandths of an inch such as band knives or steel cutting rule, which serves bent into various shapes, e. g., into "formes," to cut out blanks, such as jig-saw puzzles and others. If the knives are to be bent around small radii or sharp corners without cracking, the metal of the blade must have a sufficiently high elongation with consequent reduced hardness and the cutting edge then has but a comparatively short life. It is therefore common practice to supply steel cutting rule in varying degrees of hardness, in order that the hardest strip may be used where possible, the softer strip being used for bending round smaller radii.

The main object of the present invention is to provide a knife blade such as printers' rule which can have its cutting edge fully hardened and will not crack even when the blade is bent to quite small radii.

The invention will be further described by way of example with reference to the accompanying diagrammatic drawings wherein:

Figure 1 is an end view of a strip;

Figure 2 is a similar end view after grinding the bevels;

Figure 3 is a perspective view of a strip curved in its own plane for a purpose to be described; and

Figure 4 is a perspective view of a forme made from the steel.

The steel strip 10 shown in Figure 1 has a thickness of 20 to 160 thousandths of an inch and is hardened from the edge 11 with diminishing hardness and increasing elongation towards a plane 13 where the hardness becomes the same as that of the body of the strip as shown by micrographic examination of its crystalline structure, for example, the structure adjacent to the extreme edge 11 may be that of fine martensite changing gradually through osmondite to a sorbitic structure of the same type as the body 10. Thus the body of the strip 10 up to the plane 13 will have a Rockwell C hardness not exceeding 38 whilst from the plane 13 to the edge 11 the hardness may increase from Rc=38 to about Rc=48 or 60. The bevels are then ground down to the planes 12, 14, so that the plane 15 of the juncture of the body with the bevels is below the plane 13, and consequently the crystalline structure as it varies from the cutting edge 16 becomes the same type as that of the body before passing the plane 15. The crystalline structure at the extreme cutting edge of the bevelled part as determined by microscopic examination may be of the same type as that of a piece of steel of the same composition hardened to between 42 and 63 Rockwell C degrees while the body of the blade and part of the bevelled portion of the blade may have a hardness between 60 Rockwell B and 38 Rockwell C degrees.

The blade may be hardened from its extreme cutting edge towards the said plane over a width not exceeding four times the thickness of the blade. The blade may be hardened to a width greater than four times the thick-

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ness of the strip but in such a case sufficient grinding may be effected to decrease the width of the strip until the fully hardened zone does not exceed four times the thickness of the strip. The body of the blade may have a constant thickness of 20 to 160 thousandths of an inch and may be made of steel containing 0.5 to 1.4 per cent carbon. It will be appreciated that if after hardening the strip the plane 13 is found to be more remote from the edge 11 than the plane 15, a greater amount of the steel must be removed when grinding, in order to bring the plane 15 below the plane 13 in every case. If after hardening there is a layer of undiminishing hardness near the edge 11 e. g. down to the plane 15, this will be removed during grinding. The hardening is preferably controlled so that the depth of hardening from 11 to 13 does not exceed four times the thickness of the strip.

In Figure 2, the horizontal lines 17, 18, 19, 20 indicate planes of common hardness and elongation; for example, the steel in the plane 17 may have an elongation of half per cent and the steel in the plane 18 may have an elongation of 5 per cent. In the plane 19 the elongation may be 12 per cent and in the plane 20 the elongation may be 14 per cent. The elongation continues to rise until at the plane 15 it is equal to the elongation of the body of the knife, for example, 16 per cent. The vertical lines 24, 25, 26, 27, 28, indicate planes of minimum elongation required to avoid cracking on bending. Thus at the neutral fibre 28, theoretically, nil elongation can be permitted without cracking. In the plane 24 the maximum elongation is required. In the plane 27 a minimum elongation of 3 per cent may be necessary and at 26, 10 per cent, at 25, 12 per cent. It will be seen that along the whole of the plane 27 the elongation is above 3 per cent and therefore no cracking will occur. Similarly, along plane 26 the actual elongation is above the required minimum of 10 per cent and at the outer plane 24 the actual elongation is greater than the required minimum of 12 per cent. This hardening of the cutting edge tends to effect a shortening, with consequent curvature of the blade, and to avoid this, the original blade may be curved as shown in Figure 3 and hardened and bevelled at the edge 11, which results in a blade which is substantially straight, or curved in such a way that by stretching the other edge which is not hardened it can be straightened. The degree of curvature is emphasized in Figure 3 and the required curvature will be selected by making a few initial experiments.

Figure 4 shows an example of a forme made by bending the finished strip, knife, or steel cutting rule.

In order to keep the cutting edge well supported, the cutting bevel may be ground with a less acute angle than would be necessary to remove the material of insufficient elongation as far as required and the remaining removal is then left to a secondary bevel, i. e. a bevel of more acute angle. Thus, secondary bevels, curved or straight, may be provided as at 30 in Figure 1 to remove material of insufficient elongation, i. e. in a case where the position of the planes 13, 15, are transposed to 130, 150 respectively.

I claim:

1. A steel cutting rule of from 20 to 160 thousandths of an inch thickness having a bevelled cutting edge on a longitudinal edge thereof integral with the body of the rule and hardened at the bevelled part of the rule but having a hardness not exceeding 38 Rockwell C in the whole of the body of the rule up to the bevels, the body of the rule having such a degree of hardness and crystalline structure that it can be longitudinally shaped around small radii without cracking, the crystalline structure of the bevelled part in cross-section having a hardness varying from the extreme cutting edge where it is hardest towards the plane of junction of the body with

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the bevels, the crystalline structure becoming of the same type as that of the body before passing said plane.

2. A steel knife blade as claimed in claim 1, wherein the crystalline structure at the extreme cutting edge of the bevelled part is of the same type as that of a piece of steel of the same composition hardened to between 42 and 63 Rockwell C, while the body of the blade has a hardness between 60 Rockwell B and 38 Rockwell C.

3. A knife blade as claimed in claim 1 made of steel with a carbon content of between 0.5 and 1.4% carbon.

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