

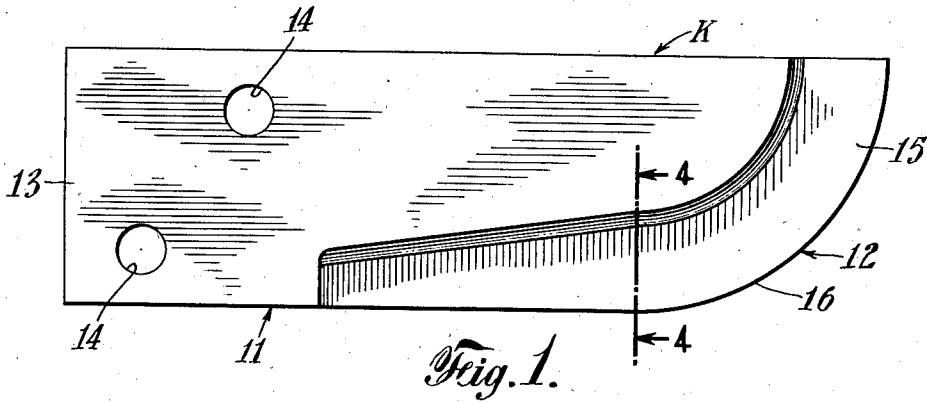
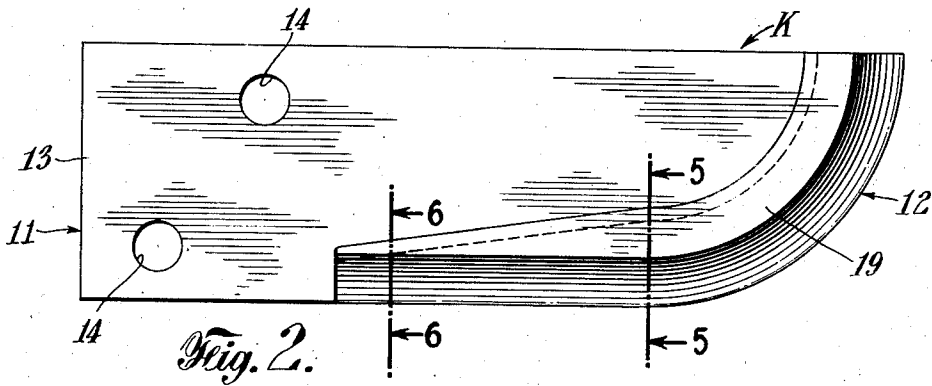
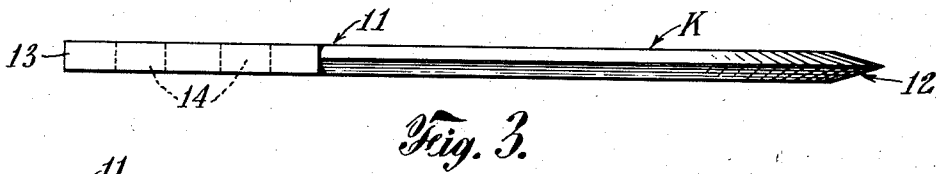
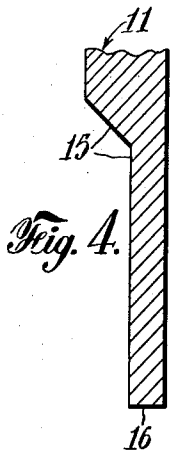
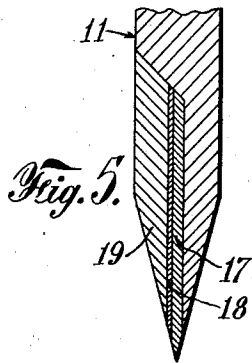
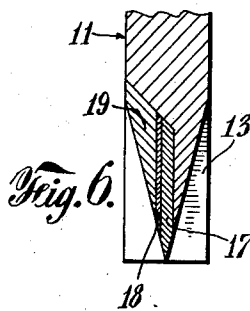
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2,335,249

KNIFE AND METHOD OF MAKING SAME

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KNIFE AND METHOD OF MAKING SAME

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Continuation of application Serial No. 426,954,
January 16, 1942. This application February
6, 1942, Serial No. 429,786

8 Claims. (Cl. 76—101)

The present invention relates to tools, and more especially to large sharp edged tools, such as plowshares and power-driven knives, whose cutting edge comprises a hard-faced material that has been fusion-deposited to a base of tough but more readily abrasible metal, to provide a hard, wear-resisting core within a tough supporting shell. This application is a continuation of my application Serial No. 426,954, filed January 16, 1942.

The invention herein has been described with special reference to a sugar-cane knife adapted to be mounted on a rotating shaft or drum, so that the cutting action occurs with considerable force or impact. It will be apparent, however, that the principles of the invention may be applied to tools generally and especially to knives or similar bladed implements whether of a machine or hand-operated type.

In the handling of sugar cane, the stalks are usually fed upon a moving belt to the crushing mills. To obtain the most efficient crushing action, the stalks must be cut, split, and shredded, in such manner that they make a bed of substantially uniform thickness on the belt. A knife of the present design is especially useful in thus preparing the sugar-cane stalks for the crushing operation.

Various attempts have been made to produce a satisfactory knife for this purpose by uniting hard wear-resisting metal and a shank or base of tough metal to form a composite blade especially designed for long useful life. The paramount objective in producing a sugar-cane knife is to prepare a blade that will remain sharp throughout the entire sugar-cane cutting period, consisting of three to five months immediately following the harvesting of a cane crop. Heretofore such knives have proven unsuitable for one or more reasons. In many cases the hard-metal insert has been silver-soldered or brazed to one face of the base metal which has proven unsatisfactory since the blade has a tendency to "peel apart" at the joint. Other efforts to produce a satisfactory knife have resulted in chipping off of the hard-metal insert during continued use, or wearing away of the blade at such a rapid rate that frequent shut-down was required in order to permit redressing the tools.

Accordingly, the principal objects of the present invention are: to provide an improved cutting tool that will remain sharp throughout a longer period than heretofore has been possible; to provide an improved sugar-cane knife and method of producing the same; to provide in such

a knife a better bond between the hard-metal insert and the tough base material; to provide a knife possessing improved self-sharpening characteristics; and to provide a knife, or the like, having uniform wearing qualities. These and other objects of the present invention will become more apparent from the following description and the accompanying drawing illustrating the invention as applied to a sugar-cane knife.

In the drawing,

Fig. 1 is a side elevational view of a knife blank, recessed to receive a hard-metal deposit;

Fig. 2 is a side elevational view of the completed knife blade, ground and in condition for use;

Fig. 3 is a bottom view of the knife shown in Fig. 2;

Fig. 4 is a sectional view through the blade blank on the line 4—4 of Fig. 1;

Fig. 5 is a sectional view through the completed blade taken on the line 5—5 of Fig. 2; and

Fig. 6 is a cross-sectional view through the completed blade taken on the line 6—6 of Fig. 2.

Generally speaking, the invention comprises a knife formed of a blank of tough abrasible metal such as mild steel, one edge of which is milled or otherwise recessed to provide an undercut portion adapted to receive a hard-metal core. The recessed portion is filled by successively applying a hard metal core, a thin bonding layer of dense, tough metal, and a substantially deep layer of metal having the same general composition as the blank.

More specifically the invention comprises an improved knife K formed from a blank 11 of tough abrasible metal. The blank 11 may be flame cut from a steel plate to the shape indicated in Fig. 1 to provide a blade portion 12 and a tang portion 13. The tang portion may be provided with apertures 14 or other similar means by which the knife may be firmly secured to a suitable holder, for example, to a rotatable disc or drum. The blank may be recessed along at least one side and adjoining end edge 16 thereof to provide an undercut portion 15 adapted to receive hard metal. The undercut portion 15 extends inwardly from the edge 16 a greater distance at a region adjacent to the end of the knife than it does at the region adjacent to the tang; as indicated in Fig. 1, the undercut portion widens toward the end of the blade. By this arrangement the hard-metal insert extends to a greater depth within the blade at the points of greatest wear, thereby compensating for non-uniform wear of the blade.

The blank 11 preferably comprises tough abrasible steel, the composition of which may vary widely to suit individual requirements. The blank 11 provides a substantial support for the hard-metal core to protect the latter against chipping and cracking under the strain of shock resulting from impact and at the same time provides a strong and durable mounting means by which the blade may be secured to a holder. Typical of such steels are the low and medium plain carbon steels of the types known as hot-rolled steel, machinery steel and the softer grades of tool steel. These steels, while relatively soft with regard to wearing qualities, nevertheless are tough and resistant to shock, and in these respects form a very suitable backing for the more brittle hard-facing material inserted within the undercut portion 15. Harder steels may be used for the blank where the impact is less severe, or the abrasion action greater.

A relatively thin layer or lamina of hard-facing material 17 is fusion-deposited on the base or bottom of the undercut portion 15. Although the composition of the hard-facing material may vary widely, satisfactory results have been obtained by employing a non-ferrous alloy including as its principal ingredients tungsten, cobalt, and chromium, and generally known as Haynes "Stellite" alloy. Typical examples of "Stellite" compositions may be found in patents to Elwood Haynes Nos. 873,745; 1,057,423; 1,057,828; and 1,150,113. As another example, use may be made of an alloy containing chiefly iron, chromium, and manganese, in the general proportions set forth in patent to F. M. Becket 1,333,151, a composition known in the trade as Haynes "Hascrome" alloy. It will be apparent, however, that other ferrous and non-ferrous hard-facing materials may be used as well. The hard-facing metal may be fusion-deposited in position as by melting hard-facing rod with an oxy-acetylene flame onto the portion 15, which portion preferably has been preheated. The portion 15 extends to a substantial depth into the plate or blank 11, preferably to a depth slightly in excess of half the plate thickness, so that the hard-facing material when applied forms a layer substantially aligned with the central or median plane of the plate.

A relatively thin protecting and bonding layer 18 is then applied to the hard-facing material preferably by means of the oxy-acetylene flame, which flames allows the material to be spread on evenly and with no appreciable dilution of the layer 17. The undercut portion 15 then may be completely filled to the original level of the plate with filler metal 19 preferably having a composition of the same general type as that of the blank 11. For example, the layer 18 may comprise a plain low carbon steel of relatively high fluidity such as standard coated plain steel rod which may be deposited by the arc-welding process.

It thus will be observed that the knife K comprises an extremely hard lamination 17 at the core which is highly resistant to wear. The hard layer is protected against chipping and cracking resulting from excessive impact by the adjoining protective layers of tough steel. Since the base material of the blank 11 and the layers 18 and 19 are relatively soft as compared to the hard layer 17, they will erode during use at a faster rate, and the hard core will continue to project slightly to provide a self-sharpening tool that retains a good cutting edge at all times.

The function of the intermediate layer 18 is two-fold. In the first place it provides an initial protective covering of dense, tough steel for the hard-facing material 17 which reinforces the hard material and in effect, insulates the hard material from the drastic thermal action that occurs during the fusion-deposition of the thick layer 19 by the arc-welding process. In this respect it has been found that a thin layer 18 may be applied by the oxy-acetylene process with less effect on the hard material than either a heavy or arc-welded layer. Insulating the hard layer in this fashion also results in less dilution of the hard layer when the heavy layer 19 is applied.

In the second place the layer 18 serves as a sort of tinning layer to provide a better bond between the hard layer 17 and the filler metal 19. This is important because the improved bond has been found to overcome the peeling action between the elements which was common in earlier designs.

The composition of the layer 18 may vary somewhat over a wide range but preferably consists of a ferrous metal with good toughness and clean welding characteristics. I have found that a low alloy steel containing about ¼% chromium, about 1% manganese, and about ¼% silicon is satisfactory for this purpose. This particular metal has been found to provide excellent bonding characteristics for the layer 19. That is, by employing the layer 18, a better bond is provided than would be attained by depositing the layer 19 directly upon the hard-facing material. At the same time the layer 17 is better protected against the formation of surface checks and cracks which might otherwise serve as the starting point for subsequent chipping of the hard layer if the layer 18 were omitted.

Layers 18 and 19 should be similar enough in hardness and abrasion resistance that they will wear away at approximately the same rate as the metal 11 comprising the body of the knife so that the beveled edges will wear substantially uniformly on opposite sides of the layer 17.

As a typical example, a knife has been produced according to the present invention from a ½" steel plate approximately 6" x 20" in size. The end of the blade was first flame-cut about a 6" radius and the undercut portion 15 milled out as shown in Figs. 1 and 4. The layer of hard-facing material then was deposited to a depth of not exceeding ¼" after which the successive layers 18 and 19 were applied as previously indicated. The cutting edge was roughly beveled at a 15° angle by the flame-cutting process after which the edge was hand ground to the final shape. Holes 14 of approximately 1" in diameter then were drilled to provide means for connecting the knife to a handle or rotating holder.

The invention is susceptible of various changes without departing from the spirit of the invention or sacrificing its advantages.

I claim:

1. A severing knife comprising an abrasible metal plate having a tang and a thin, wide, substantially flat blade portion, the edge of said blade portion being recessed to about one-half of the thickness of said plate and for a substantial part of its width inwardly; a thin substantially imperforate layer of hard-facing material fused to and distributed over the bottom of such recessed portion in substantial alignment with the medium plane of said portion; a thin bonding layer of metal fused on top of said hard-facing material; and tough but relatively abrasible filler metal

fused to said bonding layer and filling said recessed portion to the original surface level of said plate, both sides of the finished plate adjacent to the formerly recessed edge being adapted to be abraded off, to bevel the same, and thereby to expose said layer of hard-facing material as the cutting edge of the blade of said knife.

2. A severing knife blade comprising an elongated thin, wide, substantially flat plate of tough abrasible steel, said plate being recessed in one face to a substantial depth and for a substantial part of its width inwardly along the edge of one side and the adjoining end of said plate; a thin substantially imperforate layer of hard-facing material fused to and distributed over the bottom of such recessed portion in substantial alignment with the median plane of said blade; and tough but relatively abrasible filler metal fused to said layer of hard-facing material and substantially filling said recessed portion, both sides of the finished plate adjacent to the formerly recessed edge being adapted to be abraded off, to bevel the same and thereby to expose said layer of hard-facing material as the cutting edge of the blade of said knife.

3. A severing knife comprising a tough abrasible metal plate of elongated, thin, wide and substantially flat shape, said plate being recessed inwardly for a substantial part of its width along at least one edge to form an undercut portion extending to a substantial depth in said plate, said undercut portion extending inwardly from said edge a greater distance at a zone near the end of said blade than at a zone remote from said end; a substantially imperforate lamina of hard-facing material fusion-deposited on said undercut portion in substantial alignment with the central plane of said plate; and a tough abrasible metal layer fusion-deposited on said lamina and filling said undercut portion to the original level of the surface of said plate, both sides of said finished plate adjacent to the formerly recessed edge being flame cut off to bevel the same and expose said lamina, and both sides of said lamina being abraded off at substantially the same angle to bevel and sharpen the exposed edge of said lamina to form the severing edge of the knife.

4. In a method of making a knife, the steps comprising forming a shallow zone or groove in a ferrous metal plate along at least one edge of said plate to form a recessed zone extending about halfway through the thickness of said plate; depositing hard-facing material in a thin even layer along said recessed zone; protecting said material against dilution by depositing a thin layer of ferrous metal thereon of a composition adapted to provide a good bond with said hard-facing material and building up said zone to substantially the original thickness of said plate by fusion depositing additional ferrous metal on such protective layer.

5. In a method of making a knife from a fer-

rous metal plate, the steps comprising undercutting said plate along at least one edge of said plate to form a recessed zone extending about half-way through the thickness of said plate; depositing molten hard-facing material in a thin even layer along said recessed zone; fusion depositing on said material a thin protective layer of steel of a composition adapted to provide a good bond with said hard-facing material; and substantially completely filling said zone to the original thickness of said plate by fusion-depositing ferrous metal on said protective layer.

6. In a method of making a knife having a tang and an elongated blade, the steps comprising milling the edge of said blade along a zone extending from the end thereof to a region adjacent to said tang, thereby to form an undercut portion along the edge of said blade, said undercut portion extending inwardly from said edge a lesser distance at said region adjacent to said tang than at the region adjacent to said end; fusion-depositing a layer of hard-facing material along and within said undercut portion in a thin even layer; fusion depositing on said material a thin protective layer of steel of a composition adapted to provide a good bond with said hard-facing material; and substantially completely filling said zone to the original thickness of said plate by fusion-depositing ferrous metal on said protective layer.

7. A method of preparing a knife-blade blank comprising undercutting a tough abrasible plate of comparatively mild steel along one edge thereof; preheating said plate and fusion-depositing a lamina of hard-facing material onto such undercut portion; protecting said lamina by applying thereto with an oxy-acetylene flame a thin layer of tough, dense steel such as carbon or low-alloy steel; and arc-welding a relatively thick layer of comparatively mild steel to said thin layer, to build up said undercut portion to the original plate thickness.

8. In a method of making a knife, the steps comprising forming a shallow zone or groove in a ferrous metal plate along at least one edge of said plate to form a recessed zone extending about halfway through the thickness of said plate; depositing hard-facing material in a thin even layer along said shallow zone; protecting said material against dilution by depositing a thin layer of ferrous metal thereon of a composition adapted to provide a good bond with said hard-facing material; building up said zone to substantially the original thickness of said plate by fusion-depositing additional ferrous metal on such protective layer, flame cutting off both sides of said body adjacent to the hard-facing material to expose the same, and abrading off both sides of said hard-facing material at substantially the same angle to bevel and sharpen said exposed edge to form the severing edge of said tool.

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