

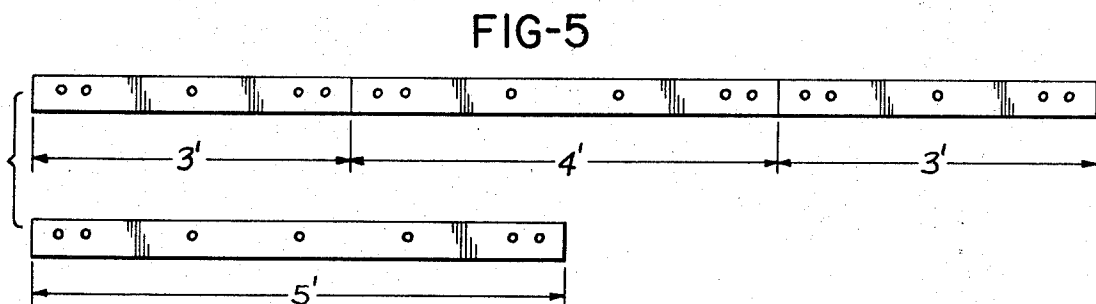
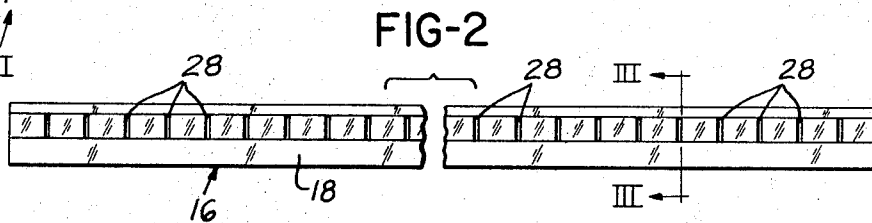
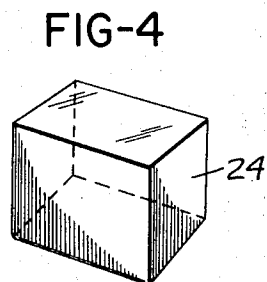
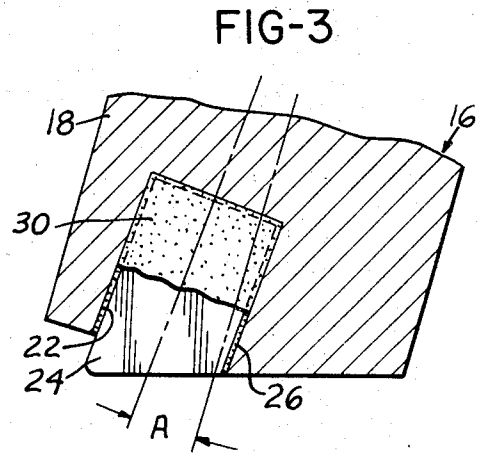
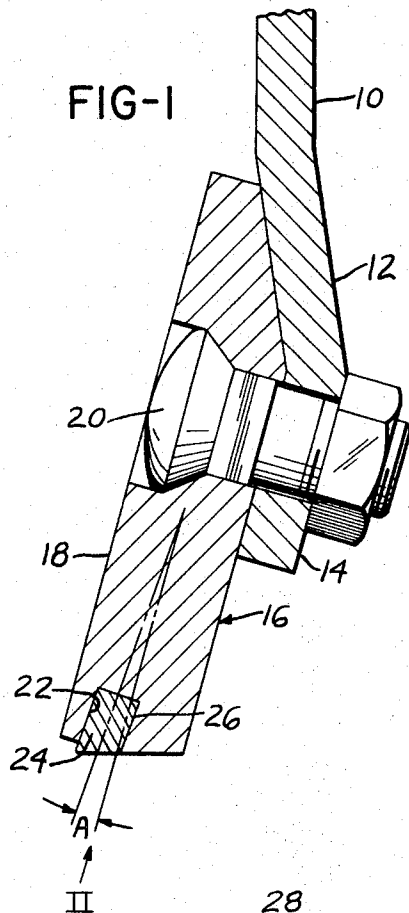
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GRADER BLADE

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## GRADER BLADE

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8 Claims

### ABSTRACT OF THE DISCLOSURE

A replaceable steel edge for the blade of a grader or the like is grooved along the working edge and has blocks of a cemented hard metal carbide mounted therein, preferably, by brazing. The blade edge is divided into sections shorter than the blade and the sections are mounted on the blade in end to end relation.

The high wear resistance of the carbide block permits the blade edge to be made thicker in the fore and aft direction and narrower in the top to bottom direction for greater stiffness of the sections.

The carbide blocks are set at an angle to the vertical axis of the sections to provide for improved wearing characteristics of the blade section.

This invention relates to cutting blade edges for the blades of graders and the like, and is particularly concerned with such blade edges which have hard edging applied thereto.

Grader blade structures are well known and comprise a fairly long support member of steel, usually concave on the forward side and adapted for mounting beneath or in front of a power device, such as a tractor. Means is provided for raising and lowering the support member and for tilting it in the lateral direction. The blade includes a detachable edge portion, thicker than the support member and attached to the lower edge of the support member and projecting downwardly therefrom. Such blade edges are made of good grade of steel and are bolted to the support member and withstand most of the abrasion and abuse to which the blade assembly is subjected in use.

The wear rate of a grader blade edge can be extremely high at times, particularly where the ground being worked is sandy or contains a great many stones and, when a blade wears down to beyond a predetermined point, it must be replaced with another. The replacing of the blade edge is, of course, time consuming and also represents downtime for the equipment.

Hard facing or the application of hard material to the lower working side of such a blade edge has been considered and attempted, but the application of such material as by spraying or the like has heretofore been unsuccessful because deposits applied in this manner are relatively thin and fragile, and, furthermore, tend to crack because a grader blade edge will naturally flex somewhat in use and may even be bent upon striking an obstruction such as a large stone.

The present invention is concerned with the forming of a grader blade edge by slotting the lower edge and inserting blocks of a hard metal carbide, such as tungsten carbide, in the slot and brazing the blocks in place. It has been found that, when blocks of this nature are placed in the lower edge of the grader blade edge in the proper manner, greatly increased life of the blade edge is obtained so that a considerable overall economy is realized even though blade edges edged in this manner are substantially more expensive than the best steel blade edges.

Having the foregoing in mind, the primary objectives

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of the present invention are to provide a greatly improved grader blade edge structure having extremely long life and improved operating characteristics and one which provides for a substantial economy to the users of such blade edges.

The objectives referred to above as well as still other objectives and advantages of the present invention will become more apparent upon reference to the following detailed specification taken in connection with the accompanying drawings in which:

FIG. 1 is a vertical sectional view of a grader blade constructed according to the present invention and showing a portion of the support member therefor and the detachable edge portion of the present invention;

FIG. 2 is a view looking in at the lower edge of the grader blade edge as indicated by arrow II on FIG. 1;

FIG. 3 is a fragmentary cross sectional view indicated by line III-III on FIG. 2 showing how braze material may be disposed between adjacent ones of the hard blocks in the lower edge of the blade edge;

FIG. 4 is a perspective view of a typical block of hard material for mounting in the slot of the lower edge of the blade edge; and

FIG. 5 shows how the blade edge of the present invention may be made in short sections and bolted to the support member in end to end relation.

Referring to FIG. 1, 10 indicates a grader blade comprising a support member and a blade edge. These support members may be up to 18 feet long and are supported on a power vehicle so that the length of the support member is, generally, parallel to the surface being worked and so the support member can be raised and lowered relative to the said surface and tilted relative to the surface in the fore and aft direction and also in the lateral direction.

The lower end of support member 10 usually has an inclined offset 12 and a straight terminal portion 14. The grader blade edge, generally indicated at 16, consists of a steel body 18 having its upper end shaped to conform to the contour of inclined portion 12 and terminal portion 14 of the support member in the forward side of the support member. Bolts 20 detachably secure the blade edge to the support member. These bolts are generally in the form of plow bolts so that the heads are substantially flush with the working side of the blade and thus offer substantially no obstruction to the sliding of material over the face of the blade edge.

The body 18 of the blade edge has a slot 22 milled therein along the lower edge and disposed in slot 22 are blocks 24 of hard material. A cemented metal carbide, such as tungsten carbide of a tough grade, has been found suitable for this purpose. A layer of brazing material 26 bonds the blocks 24 into the groove 22.

As will be seen in FIG. 2, there are a plurality of the blocks 26 arranged in end to end relation in the groove 22. When the blocks are placed in the groove, it has been found important to space them slightly from each other on the order of from about 0.010 to 0.020 inch. The spacing is indicated at 28 in FIG. 2 and is important for the reason that the coefficient of thermal expansion of steel differs from that of the carbide blocks and, if the space referred to at 28 is not provided between each adjacent pair of the blocks, the blade edge will bend as it cools down after the brazing operation. It has been found, however, by leaving the space referred to at 28 that it is possible to carry out the brazing operation and have the blade edges come out substantially straight along the lower working edge thereof.

As will be seen in FIG. 3, the brazing material flows upwardly between adjacent ones of the blocks to form shims, as indicated at 30, and may more or less com-

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pletely fill the space between adjacent blocks although this is not necessary because the unfilled open space will produce no disadvantageous results.

A particularly important aspect of the present invention is in the mounting of the blocks 24 in the lower edge of the blade edge as shown at FIG. 1 wherein it will be seen that the blocks are inclined so that the vertical central axis of each block makes an angle A with the central axis of the lower edge of the blade edge. This angle is such that the lower edge of each block 24 is nearer the front face of the blade edge than the upper edge thereof. It has been found that when angle A is about 5 degrees the most satisfactory results are obtained. If angle A is much less than 5 degrees the steel in front of the carbide blocks abrades away quite rapidly and leaves the blocks supported in the steel only by the brazing material at the upper ends of the blocks and along the back sides of the blocks. Blocks supported in this manner can be knocked out of the blade thereby detracting from its efficiency and exposing the blade so that it will wear rapidly where the block has been removed therefrom.

If, on the other hand, angle A exceeds 5 degrees by a substantial amount, the steel will commence to wear away at the lower forward edge of the blocks and the blocks will then have a sort of hook effect on the material being worked by the blade and increased power will be required to drive the blade and increased abrasion will occur where the steel meets the forward side of the blocks. Tests and experimentation have shown that angle A should be between about  $3\frac{1}{2}$  and  $6\frac{1}{2}$  degrees for the best results with 5 degrees appearing to be optimum angle.

Blade edges having the carbide blocks in the lower edge according to this invention may last from 15 to 20 times as long as conventional blade edges made of the best commercially available steel and throughout their useful life will remain substantially straight along their lower working edges so that superior results, particularly when fine grading is required, is obtainable throughout the life of a carbide edged blade edge over the best steel blades.

Due to the fact that the cutting edge remains relatively sharp, it has been found by test and experimentation that a grader blade having a carbide edged blade edge according to the present invention requires less downwardly direct pressure on the blade for a given work operation and less power to push the blade in the forward direction. This comes about because, whereas a steel blade will become quite blunt and rounded, a carbide edged blade edge retains a relatively sharp forward corner, and thus can operate under reduced power. In connection with the reduced power required, it has been found that the tilting of the carbide insert in the blade edge at the angle referred to is of merit because if this angle becomes too great, say, as much as ten degrees, the power requirements for operating the blade will increase.

Due to the extremely long life of the working edge of a blade edge having carbide inserts in accordance with the present invention, it is possible to make the blade edge narrower than ordinary steel blade edges, up to about 2 inches narrower, and this makes the blade edge according to the present invention somewhat stiffer than a conventional steel blade edge and, therefore, less subject to being damaged in use as by bending.

At the same time, even with less total amount of steel, blade edges according to the present invention can be, and usually are, made somewhat thicker in the front to back direction than conventional steel blade edges and this imparts increased stiffness and longer life to the blade edge and also provides the solid support necessary for the carbide blocks to permit them to be used to the best advantage.

With respect to the increased thickness of the blade edges which impart increased stiffness thereto, the entire blade edge is more rigid than usual steel edges and this rigidity is important for protecting the carbide inserts,

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The blade is less apt to bend when made thicker and, thus, disturbances of the brazed joints and of the carbide is prevented. Still further, there is less chance for a thick blade to chatter than a thin blade, and this is of importance because chattering or vibration of a blade will tend to chip or split the carbide blocks.

Long blade edges are made in shorter sections of different length which can be combined in different groupings to give several standard total blade edge lengths. Further, when the blade edges are made up of sections, the sections can be shifted around as the blade edge wears and thereby the maximum useful life obtained. FIG. 5 shows standard sections of 3, 4 and 5 foot lengths from which can be made blade edges of several standard lengths.

The sectioning of the blade edge is important because if the blade edge were to be made full length, flexing thereof in use would tend to break the carbide blocks loose. The short sections are more rigid and the long blade, instead of flexing along its full length, tends to flex bodily at the joints so the support member takes the bending instead of the carbide edged blade edge.

What is claimed is:

1. In combination, a grader including a blade, a cutting edge member for said blade comprising: an elongated steel bar having substantially parallel front and back sides and an upper edge and a lower working edge, said bar having means for connection thereof to said blade with said working edge of the bar located at a lower level than the lower edge of the said blade and thereby exposed, a straight groove formed in and extending along the exposed working edge of said bar and having a pair of opposed parallel planar side walls and a planar bottom wall, and blocks of a hard wear-resistant cemented metal carbide mounted in said groove in closely spaced side-by-side relation and bonded to the said side and bottom walls of said groove and to each other and projecting beyond the mouth of the groove to form a highly wear-resistant region in the said working edge of said bar, said blocks having planar bottom walls parallel to the said bottom wall of said groove and planar front and back walls parallel to the said side walls of said groove and planar side walls parallel to each other and perpendicular to said front and back walls.

2. A cutting edge member according to claim 1 in which said groove when viewed from the end of the bar is inclined to the longitudinal central plane of said bar adjacent said working edge in a direction such that the front walls of said blocks and the front side of said bar converge in a direction toward the working edge of said bar.

3. A cutting edge member according to claim 1 in which said blocks are connected to the walls of the groove and to each other by braze material.

4. A cutting edge member according to claim 3 in which adjacent side walls of adjacent blocks are spaced apart in the direction of the length of said groove a distance on the order of from about 0.010 to about 0.025 inch.

5. A cutting edge member according to claim 4 in which said cemented metal carbide is cemented tungsten carbide.

6. A cutting edge member according to claim 5 in which the spacing between said blocks is obtained by shims of braze material about as thick as the desired spacing and inserted therebetween prior to the brazing operation.

7. The grader of claim 1 in which there is a plurality of said cutting edge members connected to said blade near the said lower edge thereof in end-to-end relation and extending downwardly from said lower edge, said cutting edge members being formed to selected different basic lengths whereby cutting edges can be provided for a variety of lengths of blades from a few basic lengths of said cutting edge members.

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8. A cutting edge member according to claim 7 in which said blade is thinner and more easily flexed than said edge members whereby the junctures of said edge members form the principal region in which the combination of the blade and the plurality of edge members flexes when a working load is imposed thereon.

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