# United States Patent

[11] **3,576,098**


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[73] Assignee **FMC Corporation**
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[54] **FORGED CUTTER BLADE**
**2 Claims, 6 Drawing Figs.**


[52] **U.S. Cl.** ..... **56/295**
[51] **Int. Cl.** ..... **A01d 55/18**
[50] **Field of Search** ..... 56/295, 1 (M)



[56] **References Cited**
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|---|---|---|---|
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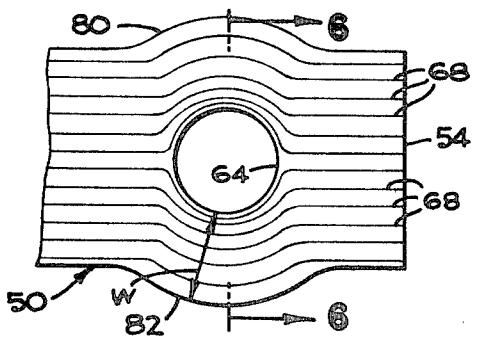
**ABSTRACT:** A machine is disclosed for making a blade for a rotary cutting machine having one end pivotally mounted to permit the blade to swing back upon striking an obstruction. The blade includes a mounting hole formed by displacement of the blade material so that the blade substantially retains its original strength in the vicinity of the mounting hole.

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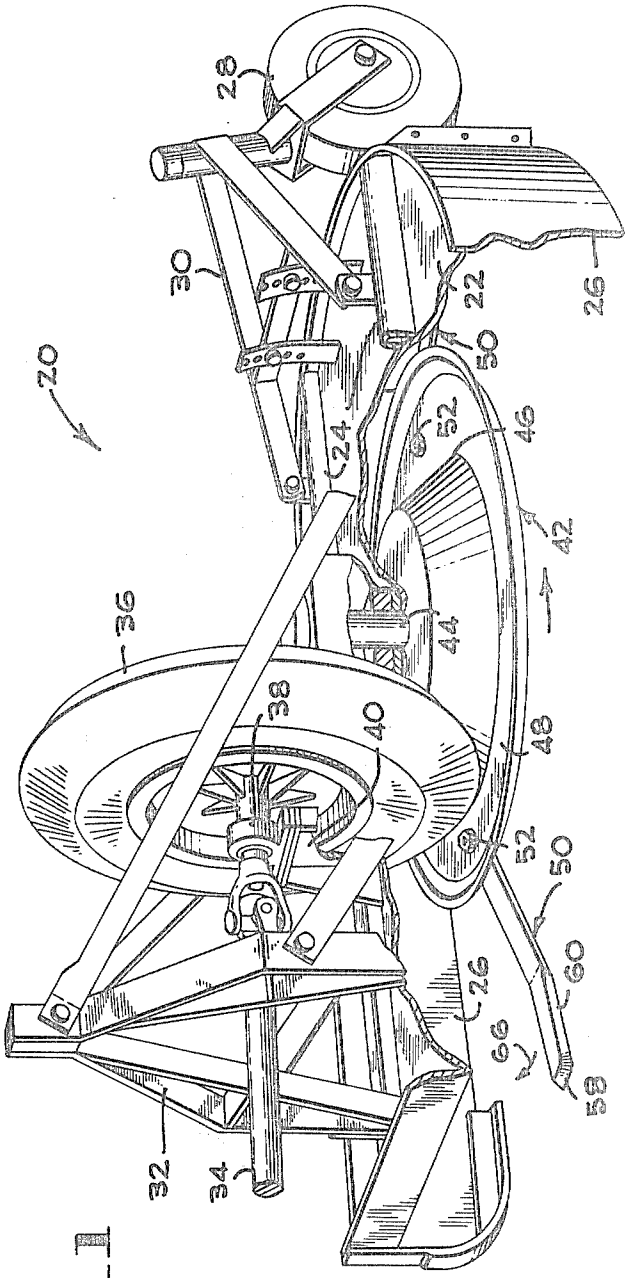


FIG. 1

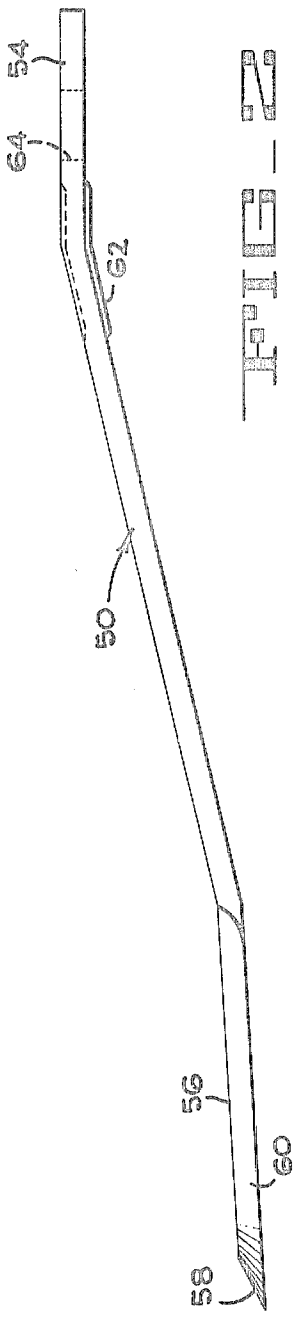


FIG. 2

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FIG_3

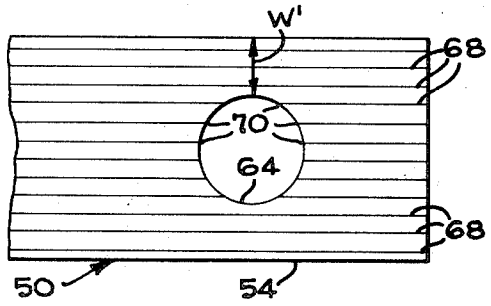
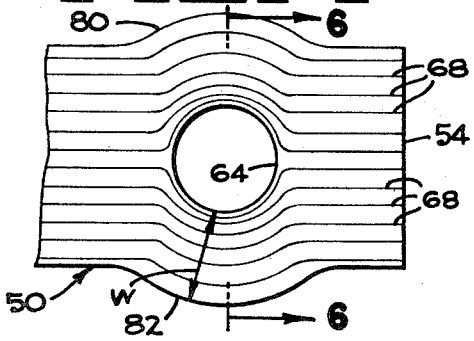



FIG_4



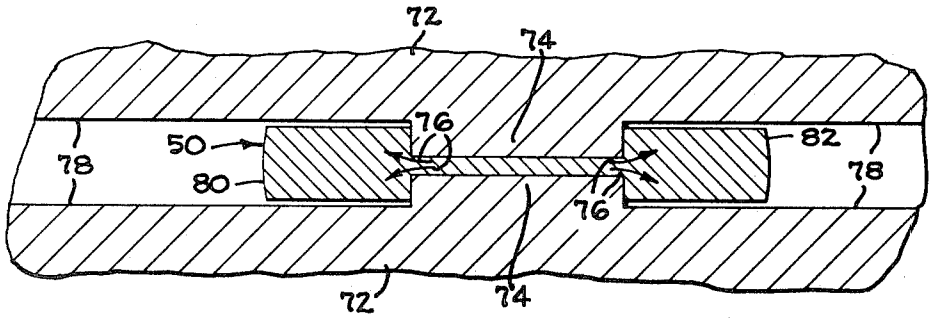




FIG_5

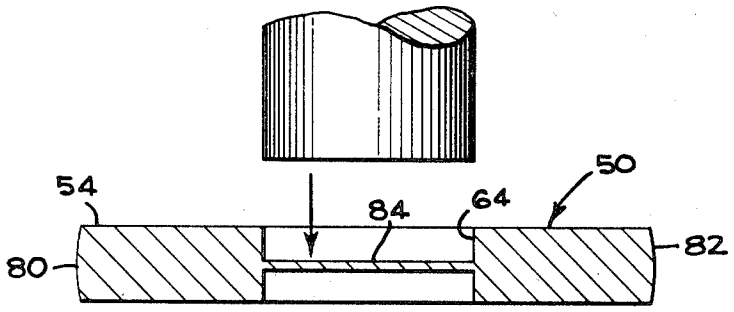



FIG_6

# FORGED CUTTER BLADE

## BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to heavy-duty rotary cutters employed in the cutting of brush, small trees and other dense growth, and in particular to an improved cutting blade construction and apparatus for making such blades.

2. Description of the Prior Art

Tyler, U.S. Pat. No. 1,296,235 describes a method for making a tool having portions offset in opposite directions.

Keller, U.S. Pat. No. 2,345,343 describes a sprocket gear and the method for making same. The gear blank is hammered so that a substantial portion of the flow lines of the metal, adjacent to the edges of each tooth, longitudinally conform to the shape of the edges.

## SUMMARY OF THE INVENTION

Heavy-duty rotary cutting machines often employ cutting blades which are pivotally mounted to swing back upon striking an obstruction. The cutting blades are generally fabricated from bar stock of uniform width and thickness and have a drilled hole at one end to receive the pivotal mounting. The pivot is relatively large to withstand the impact, necessitating a large mounting hole in the blade. Consequently, frequent failure of the blades is experienced at the mounting holes.

The object of the present invention is to provide an improved blade construction which is not subject to failure at the mounting hole and can be economically fabricated from bar stock without a significant increase in weight. This object is accomplished by a hot forging operation in which the material is displaced from the hole while the original blade thickness is retained so that the blade is locally widened and the original effective cross-sectional area is substantially retained. Other advantages obtained are the elimination of end grain at the hole and elongation of the grain structure adjacent to the hole, which further increase the strength of the blade.

## DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic perspective view having portions broken away, of a rotary cutting machine of the type with which the blade of the present invention is used.

FIG. 2 is a side view of a cutting blade.

FIG. 3 is a partial diagrammatic top view of a blade end having a conventional-drilled mounting hole, showing flow lines in the material.

FIG. 4 is a view similar to FIG. 3 but having a forged mounting hole.

FIG. 5 is a fragmentary transverse section of the cutting blade and forging dies in a partially compressed position.

FIG. 6 is an enlarged section of the blade showing the flashing web, taken on line 6–6 of FIG. 4.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

A rotary cutting machine 20 incorporating the blade of the present invention is illustrated in FIG. 1 and is of the type that is generally towed behind commonly known agricultural tractors. The cutter has a body that includes a bed plate 22, longitudinal reinforcing members 24, and a pair of curved protective side skirts 26. The body is supported in the rear by a caster wheel 28 mounted for swiveling motion on an A-frame 30 that is attached to reinforcing members 24; while the front is supported from a conventional three-point tractor hitch (not shown) by means of an A-frame 32 also attached to reinforcing members 24.

The cutter is driven by a shaft 34 that extends from a power takeoff, commonly found on tractors, to a rubber drive wheel 36. The drive wheel is supported between bearings 38 (only one being shown) mounted on brackets 40 extending upwardly from the bedplate 22.



A blade holder 42 is mounted in the bedplate on a rotating spindle 44 and has a conical surface 46 which engages the drive wheel 36 that projects downwardly through the bedplate 22. The blade holder further includes a flat annular section 48 to which multiple cutting blades 50 are pivotally connected. Details of the pivotal connection indicated at 52 are described in U.S. Pat. No. 3,112,599 to Brewer.

Referring to FIG. 2, the blade 50 is preferably constructed from high-strength steel bar stock and has an inner portion 54 that is vertically offset from an outer portion 56. Sharpened cutting surfaces 58 and 60 are formed on the end and leading edge of the outer portion 56 of the blade, and a stiffening web 62 is formed adjacent to the inner portion 54 to reduce vertical flexure of the blade. A hole 64 is provided on the inner portion 54 of the blade 50 to receive the pivotal connector 52 that attaches the blade to the blade holder 42.

When the rotary cutter is employed in land-clearing operations to cut heavy brush, small saplings and other dense growth, it is apparent that rocks, stumps and other obstructions will frequently be encountered. On striking such an obstruction, the cutter blade 50 is free to swing about its pivotal connection 52 as indicated by arrow 66. When the blade has passed the obstruction, it swings back to its normal position due to the centrifugal force created by the rotation of the blade holder 42.

If the blade-mounting hole 64, shown in FIG. 3 is produced by conventional drilling or punch operations and the top surface of the blade is subsequently polished and etched; flow lines 68 which indicate the orientation of the material grain structure become visible. In FIG. 3 it can be seen that the flow lines are cut producing end grains 70 at the hole 64. It is also apparent that the material removed substantially reduces the effective cross-sectional area of the blade, thereby further weakening the blade at its mounting point. In order to maintain the strength of the blade in the vicinity of the mounting hole without increasing its weight, in accordance with the present invention the hole is formed by a hot forging operation. The cutter blade 50 is heated and inserted in forging dies 72 that are mounted in a conventional forging machine such as a drop forge and include opposed cylindrical plugs 74 shown in FIG. 5. As the dies close during the forging operation, the blade material between the plugs 74 is forced outwardly as indicated by arrows 76 into expansion spaces disposed laterally of the plugs. The dies are compressed until the space between their internal opposed working surfaces 78 is equal to the original material thickness of the cutting blade and suitable controls, such as means for limiting the stroke of the drop hammer, are provided to assure that the dies are not closed past the desired spacing. Since the top and bottom surfaces of the blade are confined by the die, the material forced outwardly by the plugs 74 cause the exterior edges of the blade adjacent to the hole 64 to bulge or flow outwardly, as indicated at 80 and 82 in FIG. 4. Upon completion of the forging operation, a thin web of flashing 84 (FIG. 6) remains in the forged hole 64 and may be blanked or punched out while the blade is still hot.

In comparing FIGS. 3 and 4, it will be apparent that the width $W$ of material between the hole 64 and the edges 80 and 82 is greater in the forged blade end of FIG. 4, than the width $W'$ in FIG. 3. Since the blades have the same thickness, the forged blade of FIG. 4 has a greater cross-sectional area and consequently a greater strength. The flow lines 68 in FIG. 4 are continuous and pass around the hole 64, thereby showing that end grain has been eliminated. Furthermore, it can be seen that the flow lines adjacent the hole 64 are closer together, thereby indicating that the grains in this area have become elongated in the direction of the flow lines 68. Since the fracture of metals occurs along the grain boundaries, the elongation of the grains normal to the direction of the applied load increased the resistance of the material to fracture in the area adjacent to the hole 64.

Although the best mode contemplated for carrying out the present invention has been herein shown and described, it will

be apparent that modification and variation may be made without departing from what is regarded to be the subject matter of the invention.

I claim:

1. In a rotary cutter blade comprising a substantially rectangular metal bar of uniform thickness having a mounting hole formed at the axis of rotation and a cutting edge adjacent one end; the improvement wherein said bar has lateral bulges at each side of the hole, said bulges being of the same thickness as the remainder of the bar, the grains of the metal of the bar in the vicinity of the hole being elongated generally in the direction of the length of the bar but lying along continuous lines which pass along the length of the bar and around each side of the hole to form said bulges.

2. The cutter blade of claim 1, wherein said grains adjacent the hole are more elongated than those further spaced from the hole.