June 25, 1957 J. M. BEYERSTEDT ET AL 2,796,898

HARD SURFACED ADZER BITS

Filed May 17, 1956 4 Sheets-Sheet 1

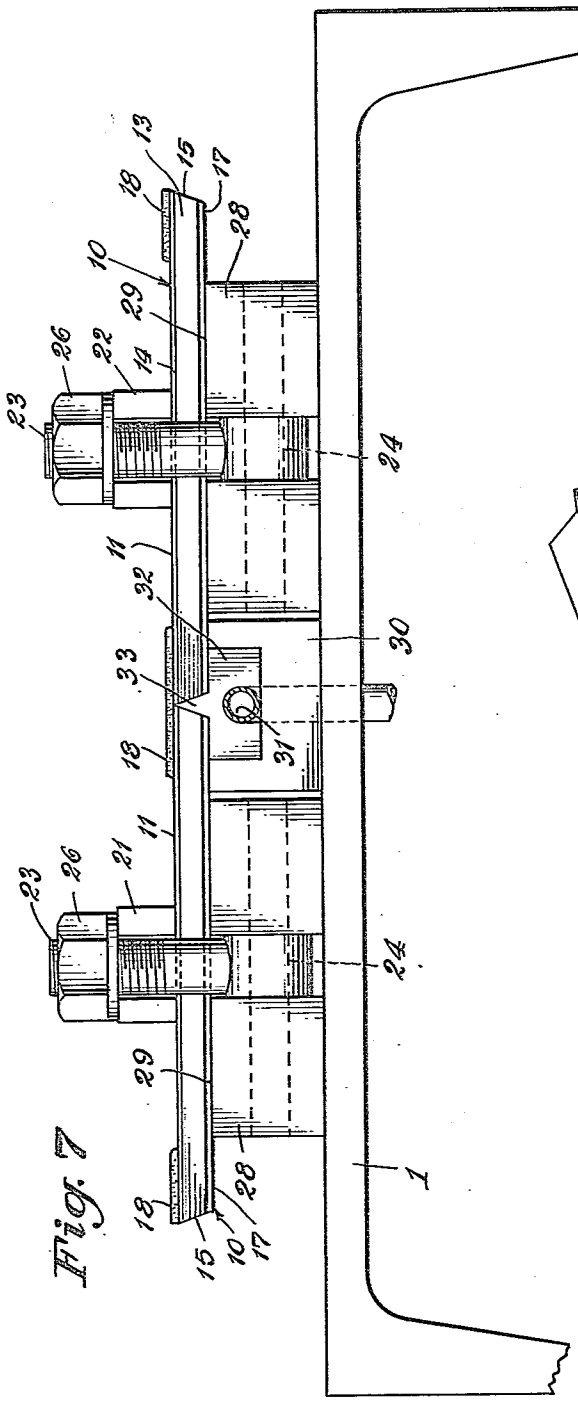



Fig. 1

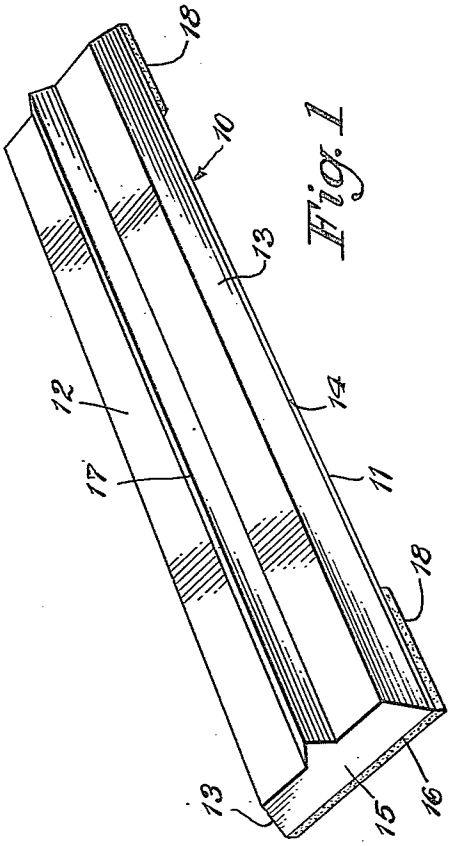



Fig. 2

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Filed May 17, 1956 4 Sheets-Sheet 2

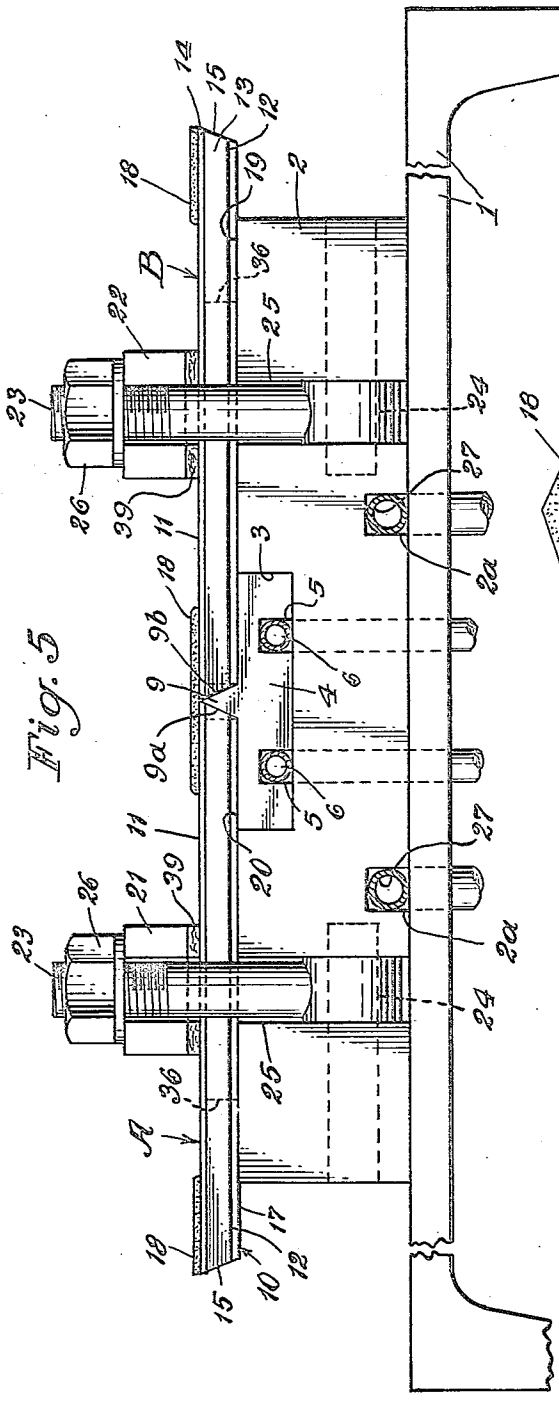


Fig. 5

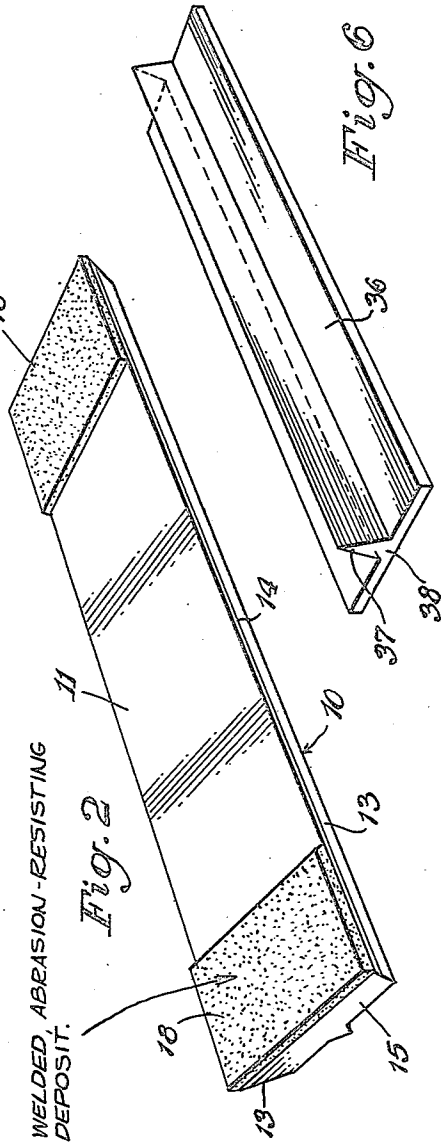


Fig. 6




Fig. 2

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HARD SURFACED ADZER BITS

Filed May 17, 1956 4 Sheets-Sheet 3

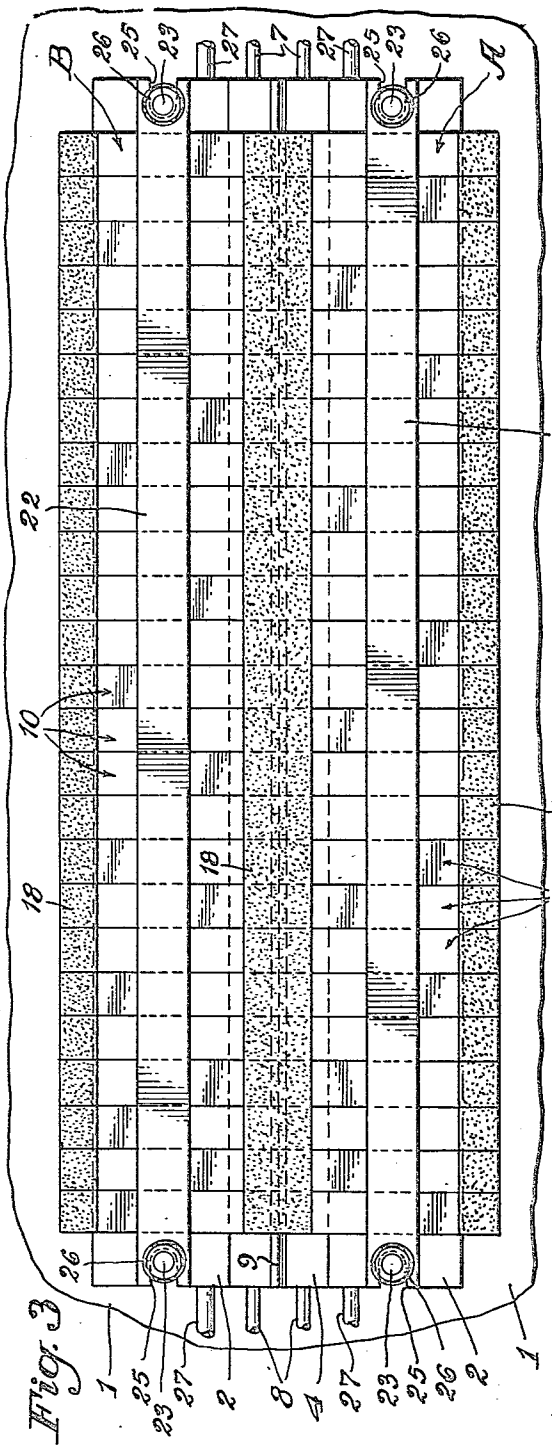


Fig. 3

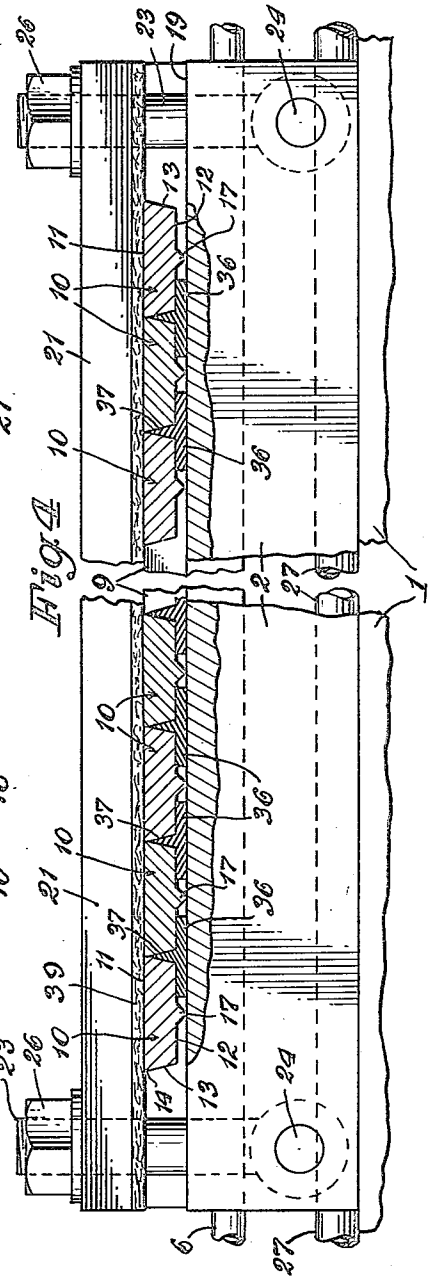


Fig. 4

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HARD SURFACED ADZER BITS

Filed May 17, 1956 4 Sheets-Sheet 4

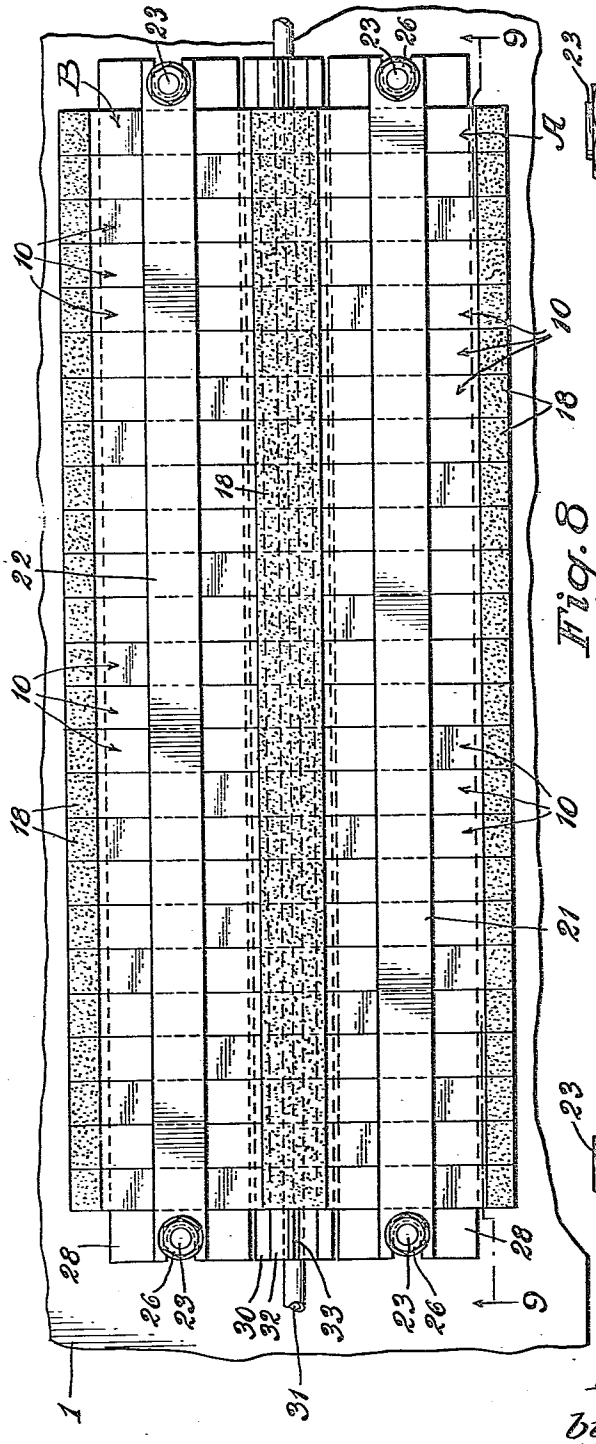


Fig. 8

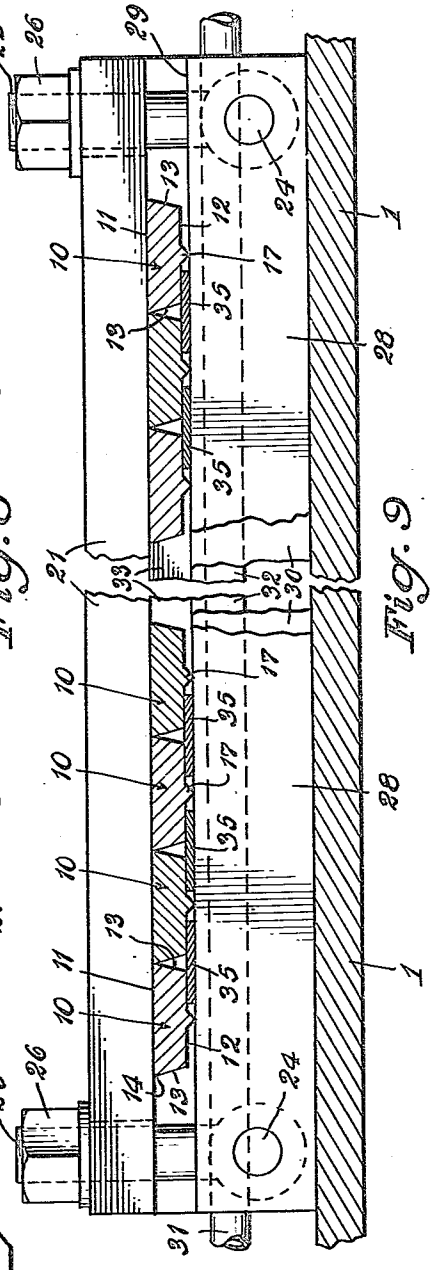


Fig. 9

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# HARD SURFACED ADZER BITS

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Application May 17, 1956, Serial No. 585,544

8 Claims. (Cl. 144—133)

Our invention relates to an improvement in adzer bits and methods of making them.

One object of the invention is an improved bit having high impact resistance and also high resistance to wear or abrasion.

Another object is such a bit in which a body of metal with high impact resistance carries a cutting surface or area or part with high abrasive resistance.

Another object is an improved mechanism or appliance useful in making such bits.

Another object is a method of making such a bit by the controlled application and withdrawal of heat.

Other objects will appear from time to time in the course of the specification and claims.

We illustrate our invention more or less diagrammatically in the accompanying drawings, wherein:

Figure 1 is a perspective view of a finished bit;

Figure 2 is a perspective view of the other side of the bit;

Figure 3 is a plan view of a mechanism or fixture for making our bits;

Figure 4 is a side view on an enlarged scale of Figure 3 partly in section;

Figure 5 is an end view of Figure 3;

Figure 6 is a perspective view of a spacer;

Figure 7 is a side view of a modified form;

Figure 8 is a plan view of Figure 7;

Figure 9 is a section taken along line 9—9 of Figure 8.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to the drawings, Figure 3 is a plan view which illustrates a base 1. Its upper surface may be provided with an elongated plate or support 2 having a central channel 3. The channel has an insert 4 with two or more grooves or slots 5, each of which hold a tube or duct 6, of copper or the like, through which a cooling fluid of any suitable type may be circulated by suitable connecting ducts, with an inlet at 7 and an outlet at 8 in Figure 3. Extending upwardly from the insert is a heat exchange blade, fin, or extension 9, possibly integral with the insert, both being formed of copper or other suitable high heat-transfer material, the blade or fin having upwardly convergent plane surfaces 9*a* and 9*b*.

The finished bit is illustrated in Figures 1 and 2. It should be understood that, before treatment, the bit body 10 has upper and lower surfaces 11 and 12 which are preferably parallel and connected by convergent longitudinal side faces 13, at an angle to the upper and lower surfaces. Whereas variations in the angle may be permitted, we find the angle of 14° practical for our purposes. These longitudinal side faces 13 are rolled or otherwise formed into flats 14, adjacent and at right angles to the upper surface 11. These edge portions or flats may be, for example, of the order of 1/16 to 3/32 of an inch in width. The ends of the body terminate in lateral inclined faces 15 which may advantageously be inclined at an angle on the order of 20° in relation to the upper and lower surfaces 11 and 12. The lateral end faces 15 may intersect the top surface at 16. It will be observed that the lower surface 12 is somewhat narrower than the upper surface 11.

Extending generally centrally along the lower surface 12 from end to end is a rib 17, shown as generally V-shaped or otherwise, the size and shape of which is unimportant for present purposes.

While we do not wish to be limited specifically to the bit form shown, we find it efficient for our purposes for use in the cutter heads of adzing machines employed, for example, in adzing upper surfaces or seats in railroad ties to receive the tie plates or the base of the rail being laid on the ties.

In use, such cutter bits are subjected to wear, abrasion, shock and severe impact. They may strike, for example, bits of metal, old spikes, and the like, embedded in old ties. In order to meet this problem, and to provide an adzing cutter bit which has both high impact resistance and high resistance to wear, we employ the above described cutter body, and treat it as below set out.

A number of the pre-formed bodies are arranged along the support 2. We find it very advantageous to weld a relatively thin layer of abrasion resisting deposit to each end of each bit used. For example, we may use tungsten carbide, boron carbide or any other suitable hard wear-resistant material of the nature of abrasion resisting carbide particles in a ferritic matrix. This thin layer, indicated at 18 in Figure 2, may be applied by any suitable welding torch or the like. The support 2 may be bolted or otherwise secured on the base 1 and may have a flat, relatively smooth upper surface 19 which is generally flush and co-parallel with the upper surface 20 of the insert. These upper surfaces are flat and generally smooth so that a virtually uninterrupted surface is provided for supporting the bits.

The bits are disposed in generally parallel aligned rows A and B and a clamping bar, one for each row of bits, at 21 and 22, is provided and pulls down on the bits by any suitable clamping mechanism. For example, we indicate bolts 23 pivoted at one end at 24 in the end of the support and adapted to pass through an open-sided slot 25 in the end of the support. A suitable nut 26 and washer or the like may be used on each bolt to pull the clamping bar firmly down on the flat upper surface of the bits.

The rows of bits A and B are brought together firmly against the opposite inclined faces of the cooling fin or heat transfer ridge and the end edges of the bits are brought together and held firmly to prevent run through.

Two rows of bits are brought together against the cooling tube, and a weld strip is run down on top of them. When the weld material solidifies, the two rows are separated by breaking along the contact line. Previously, the two rows of bits were reversed, but it was difficult to make full contact because the bits varied slightly in length from one to another. It is better to break the bits apart or separate them individually and grind the two sides of the welds, and possibly the end. Then the bits are reversed and any two bits can be matched up. The ends can then be brought together and slight variations in the length of the bits is not a problem.

The weld strip may be laid in the form of a thin band or layer, from end to end of the support, over the abutting edges of adjacent rows of bit bodies. We may employ, for example, a weld tube of steel, surrounding fine particles of either tungsten or boron carbides. The result in such case is a weld layer which may be of a thickness, for example, of 1/32 to 1/16 of an inch. This weld layer may be formed of tungsten carbide particles, as an example, embedded in a matrix steel. We may, for example, apply this layer in a band an inch or more in width. If we assume a width of the total band of 1¼ inches, there will be a layer deposited across the

end of the surface **11** of each body to a width of the order of 5/8 of an inch. This layer is limited to the surfaces **11** and does not penetrate to any substantial degree between adjacent bit bodies in each row, since the bit bodies are surrounded by abutting short plane surfaces or flats **14** and the end edges of **15** are brought together by bringing the rows together firmly which prevents weld material from running through. Thus the result of the welding operation is the depositing of this layer of tungsten or other abrasion resisting particles and steel, which is localized at the end portions of the broad surface **11** of each body. After each transverse passage of the welding means or tool the entire group of bits may be broken apart, first by breaking apart the rows, and then the individual bits within the rows.

We do not wish to be limited to any particular mechanism for carrying out the welding process, but traveling welding heads may advantageously be used.

In Figures 7, 8 and 9, we have shown a variation which has a pair of separate, generally aligned, parallel, supporting plates **28** suitably mounted thereon, each having a flat, smooth upper surface **29** with a supporting bar or strip **30** for a cooling tube **31**. The tube is surrounded by a copper insert **32** or other heat-transfer material which has a fin **33** projecting above the cooling tube. The support **2** in Figure 5 may have suitable channels or grooves **2***a* for additional cooling tubes **27** arranged in any suitable manner to cool the support or fixture either during welding runs or between runs. The clamping mechanism may be the same as in Figures 3, 4 and 5. The tube may have suitable inlet and outlet connections with valves and the like for regulating the rate of flow of any suitable cooling fluid, for example, water.

The procedure may be varied somewhat with either form. For example, the water in the cooling tube may only be turned on between welds to cool the bits and fixture after each weld, if the heat developed is needed for the welding operation. We might also pass cooling tubes through the plates **28** in Figures 7–9 next to the supporting bar **30** to further cool the fixture between welds. We might also use copper flat strips or the like between adjacent ribs under the bits, as at **35** in Figure 9. These strips may be narrower than the distance between ribs that the flats abut, and the strips may be easily pushed along the support. These prevent run through and additionally balance the bits more evenly on their ribs.

In Figure 6, we have shown a variation in which the flat strip **36** has an upstanding rib **37** which may extend between the inclined sides of adjacent bits, as shown in Figure 4. The flat portion or base of the strip may be narrower than the distance between adjacent ribs on the bits.

The length of either type of strip may be materially less than the length of the bits. The end surfaces at **38** may be vertical, and the inner end does not have to conform to the cooling rib **9** as do the ends of the bits.

It may be advisable to insert, at best, an asbestos strip **39** under the clamping bars to insulate the clamping mechanism to help it clamp uniformly. This will additionally prevent much needed heat from draining out of the bits during a weld run.

Depending upon the length of the fixture, C-clamps may be spaced to clamp the bars **21** firmly against the bits and fixture at various points. This will additionally prevent run through of the weld material.

While we have not described any specific welding torch or welding procedure, it has been found advantageous to weld in three steps using 3 welding heads; for example, first a preheating torch, followed by a sweating torch, and finally a welding torch, each being carried possibly by the same welding head, spaced from each other, and moving as a unit or separately, along the welding line over the ends of the bits.

By welding a plurality of bits in a row, as above, less



weld material is required. For example, if the weld material is applied to a single bit, the material would flow over and form a round edge. A sharp edge is needed so more weld material would have to be applied and then ground back to get a sharp cutting edge. We might add that bits made by our method have three to seven times the life of normal bits at only a small increase in cost. Additionally, our bits substantially reduce maintenance time required to replace worn out bits which involves disassembling parts of the machine and so forth, far fewer sharpenings, and cutter head changes.

It will be realized that whereas we have described and shown a practical adzing bit, properly coated at its point of wear with a hard surface, nevertheless, many changes may be made in size and shape of the bit, and in the mechanism and steps used for making or treating it. We wish our description and drawings to be taken, therefore, as in a broad sense illustrative or diagrammatic rather than as limiting us precisely to our showing herein.

The use and operation of our invention are as follows:

Adzing bits are subjected, as above mentioned, to severe wear and impact. We provide a bit which is admirably adapted both to resist wear and impact. Our preformed bit bodies may, for example, be of A. I. S. I. 6150, a steel well suited to austempering, in this section, for hardness as well as high impact resistance. However, a metal which has high resistance to impact may have poor resistance to wear or abrasion. Also, a metal which has optimum abrasion and wear resisting qualities usually does not have the high impact properties required for this type of service. We provide a bit body which has both high hardness and toughness. Our preformed bit bodies are prevailingly used in an adzing machine with the surface **11** moving against the work. It is to this broad surface **11**, therefore, that we apply the wear-resisting layers **18**. These layers are applied, as above described, at each end of each bit body. We find it important, in practice, to have the abrasion-resisting layers of wear resisting deposit of uniform thickness overlie the edges and corners which have defining walls perpendicular to the plane of the surface **11** upon which the weld is applied. We, therefore, preform the adzing bits with narrow flattened longitudinal edge portions or flats shown at **14**. Since the bit bodies abut on the side flats during welding, weld material does not run through. The wear resisting deposit is of uniform thickness and breaks with a relatively straight line along the edge.

We find in practice that the hard abrasion resisting deposit supported by the super tough cutter bit body prevents visible flaking or chipping of the carbide edges in operation. The weld deposits **18**, in effect, are abrasion resisting surfaces or faces which are bonded to cutter bit bodies having superior impact properties at high hardness. In use, when the cutter bit is moved, in an adzing machine, about a generally vertical axis, the faces or layers **18** engage the work and absorb the impact and provide the abrasion resisting cutting edge. Because the abrasion resisting deposit is bonded to and supported by a steel body or backing element, with high impact resistance, the bit will not be broken when it strikes against foreign material, metal, stone, or the like, in the course of the adzing operation. Thus, our adzing bits, though economical to manufacture, have a life upwards of three times as long as any adzing machine bits heretofore known to us. This results in less down time between sharpenings, a substantial increase in production, and lower operational cost.

The adzing bit material can be approximately .50 carbon alloy that responds to austempering. We employ a chrome vanadium grade identified as A. I. S. I. 6150, which responds ideally to the special austempering heat treatment we use. This treatment provides a microstructure consisting of 100% Bainite. Special control of the surface properties produce superior impact properties at the highest hardness range for this structure. These

properties in the bit adequately support the carbide layer when subjected to high impact loads. This heat treatment is applied after the welding process.

It will be understood, also, that it is within the field of our invention to apply tungsten carbide or other wear resistant material to the surface of roll stock by other means. However, we prefer to employ a welding process in which a steel tube may be filled with tungsten carbide grains.

It should be kept in mind that the use of a thin carbide weld deposit, which may be of the order of 1/16 of an inch in depth, provides a self sharpening effect during the adzing operation. The abrasion resistance or wear resisting properties of A. I. S. I. 6150 are much less than the carbide layer and therefore the A. I. S. I. 6150 wears away faster than the carbide layer and the cutting edge remains adequately sharp.

We claim:

1. An adzer bit having an elongated body of metal with high impact resistance with a cutting edge at each end and at least one generally plane front face, such bit having at each end on the front face a layer of a material having high abrasion resistance, such layer being substantially thinner than the thickness of the bit and extending for substantially the full lateral width of the bit and longitudinally from the cutting edge of the bit toward the center of the bit for a distance substantially less than half the length of the bit.

2. The structure of claim 1 characterized in that the metal of the bit body is steel having the general characteristics of A. I. S. I. 6150.

3. The structure of claim 1 characterized in that the layer of material having high abrasion resistance includes tungsten carbide.

4. The structure of claim 1 characterized in that the layer of material having high abrasion resistance is constituted by tungsten carbide particles embedded in a layer of steel.



5. The structure of claim 1 characterized in that the layer of material having high abrasion resistance is constituted by tungsten carbide, said layer having a thickness of the order of 1/32 to 1/16 of an inch.

6. The structure of claim 1, characterized in that the bit has a rear face narrower than the front face, the two faces being connected by rearwardly convergent side and end edges, and by flats on at least the side edges intersecting and generally perpendicular to the front face of the bit.

7. The structure of claim 6 characterized in that the flats have a front to rear width of the order of 1/16 to 3/32 of an inch.

8. An adzer bit having an elongated body of metal with high impact resistance with a cutting edge at least at one end and at least one generally plane front face, such bit having at the forward end on the front face a layer of a material having high abrasion resistance, such layer being substantially thinner than the thickness of the bit and extending for substantially the full lateral width of the bit and longitudinally from the cutting edge of the bit toward the center of the bit for a distance substantially less than half the length of the bit.


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