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METHOD OF FACILITATING THE REMOVAL OF BEADS THAT ADHERE TO FERROUS METAL CUT THERMOCHEMICALLY

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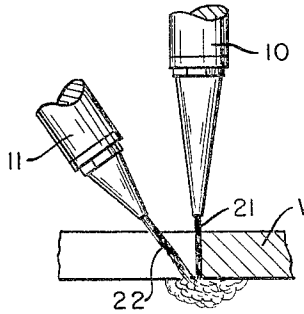


FIG. 2

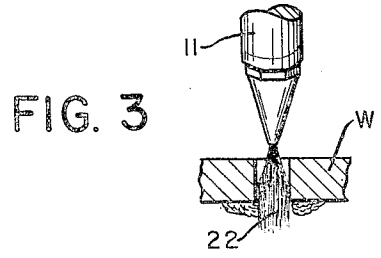


FIG. 3

FIG. 1

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METHOD OF FACILITATING THE REMOVAL OF BEADS THAT ADHERE TO FERROUS METAL CUT THERMOCHEMICALLY

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2 Claims. (Cl. 148—9)

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This invention relates to improvements in the thermochemical cutting of ferrous metal by means of an oxygen jet and more particularly to a method of facilitating the removal of beads that adhere to ferrous metal when cut thermochemically.

When cutting ferrous metal work-pieces thermochemically by means of an oxygen cutting torch some of the molten slag and molten metal produced by the cutting operation clings to the work along the bottom edges of the kerf, and when solidified, forms undesirable dense beads. This is particularly true when cutting hot metal at rolling or forging temperatures. Sometimes the beads are difficult to remove when they form on work that is cold-cut and can be removed only by using abrading or cutting methods such as grinding or chipping them off, but they are nearly always difficult to remove when they form on work that has been cut while hot because they actually become welded to the hot base metal.

The object of this invention is to convert the dense adhering beads into porous lightly adhering beads that can be very easily removed, leaving sharp bead-free corners on the work.

This result is achieved by projecting water against the molten products resulting from the cutting operation and which cling to the work along the bottom edges of the kerf. The water instantly forms steam pockets in the molten material clinging to the work and accelerates its solidification, creating spongy porous masses in place of the usual dense beads. The porous beads do not adhere tenaciously to the base metal but can be easily cracked off or readily removed by a slight blow or by reheating as is done in a descaling operation, leaving sharp bead-free edges on the work. A simple tumbling operation is one easy way of removing the beads.

In the preferred form of the method the water is projected in the form of a stream into the kerf closely behind the cutting-oxygen jet and from that side of the work-piece at which the cutting-oxygen jet is directed against it, the stream of water being divergent so that it strikes the side walls of the kerf preferably near the bottom of the kerf and so that it contacts with the molten products clinging to the work along the bottom edges of the kerf.

Apparatus suitable for carrying out the method is illustrated in the accompanying drawings, in which:

Figure 1 is a perspective view of the apparatus and a work-piece being cut by it;

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Fig. 2 is a vertical section of the work-piece taken along the line of the cut and showing the tip-ends of the cutting torch and the water-projecting nozzle in side elevation;

Fig. 3 is a transverse section of the work-piece showing the tip-end of the water nozzle in front elevation and illustrating the divergent or expanding nature of the water stream.

Referring to the drawings, the cutting torch is shown at 10 and the water nozzle at 11. These may be held in proper relation to each other and moved along a ferrous metal work-piece W in any suitable way. In the particular apparatus illustrated in the drawing they are mounted on a torch carriage 12 running on track rails 13. The carriage is electrically driven at a constant speed determined by the setting of a governor 14 associated with the carriage motor. An arm 15 supports a torch holder 16 in which the cutting torch is mounted. The cutting torch may be a machine type torch of standard design and need not be described in detail. It is adapted to project heating flames against the work to raise the metal to kindling temperature and to direct a jet of cutting-oxygen against the work to cut it thermochemically as is well understood in the art. An auxiliary arm 17 extending from the torch arm 15 carries an auxiliary holder 18 in which the water nozzle 11 is mounted. Water is supplied to the nozzle from an external source through a supply hose 19 and is controlled by a valve 20. The water nozzle is preferably adapted to produce a divergent or expanding stream of water. The water nozzle is mounted so that its tip is close to the tip of the cutting torch whereby the expanding or divergent water stream can enter the kerf close behind the oxygen cutting jet.

The torch carriage 12 and the work-piece W are properly positioned relative to each other and then the metal of the work-piece, where the cut is to be started, is preheated to kindling temperature by the heating flames of the cutting torch unless this preheating can be dispensed with in case the entire work-piece is sufficiently hot when cut. The jet of cutting-oxygen represented at 21 is then turned on and the torch carriage started. The water supply is then turned on to produce the water stream represented at 22. As the carriage 12 progresses, the oxygen jet 21 cuts a kerf 23 in the work-piece W by the thermochemical action of the oxygen jet on the ferrous metal of the work-piece. The cutting action produces molten metal and molten oxides which are largely blown out of the kerf by the force of the oxygen cutting jet, but some of it runs down under the

bottom edges of the kerf and clings to the work-piece. The water stream 22 is so directed and has such an angle of divergence that it strikes the side walls of the kerf (Fig. 3) near the bottom of the kerf immediately following the oxygen cutting jet 21 (Fig. 2). The water stream preferably does not lag behind the oxygen cutting jet at the bottom of the kerf by more than ⅛ of an inch and, of course, must not chill the metal to be cut by being directed against the uncut section of the work-piece. The original setting of the water stream must take into account the cutting speed to allow for drag, especially on thick work-pieces.

The divergent or expanding water stream directed into the kerf as above described comes in contact with the molten material clinging to the work-piece along the bottom edges of the kerf and forms steam pockets in it and accelerates its solidification, thus converting the otherwise dense beads that adhere to the work along the bottom edges of the kerf into spongy porous beads which can be readily removed as above stated.

I claim:

1. The method of thermochemically cutting through ferrous metal work-pieces and preventing beads of solidified molten material from becoming so welded to the work along the bottom edges of the kerf that it is difficult to remove, which comprises directing a jet of cutting-oxygen downwardly toward the work-piece and advancing it across the work-piece while the metal is at kindling temperature, and producing steam pockets in the molten material that is not blown away from the kerf and that clings to the work along the bottom edges of the kerf by projecting a stream of water downwardly into the kerf so that all parts of the water stream contact with the work-piece below the upper surface thereof and contact with the molten material only after the molten material has substantially reached the bottom edges of the kerf and while it is still clinging to the work and before it has solidified, whereby the beads into which such molten material solidifies are porous and can later be readily removed from the work, the stream of water being projected into the kerf angularly with respect to both the work-piece and the cutting-oxygen jet.

2. In the method of thermochemically cutting through ferrous metal work-pieces by directing a jet of cutting-oxygen downwardly toward the work-piece and advancing it across the work-piece while the metal is at kindling temperature, the improvement which comprises projecting a stream of water downwardly and angularly into the kerf from that side of the work-piece at which the cutting-oxygen jet is projected against it and closely behind the cutting-oxygen jet and so that it intersects the line of the cutting-oxygen jet at a region at least as low as the bottom of the kerf and so that the water contacts with the molten material that clings to the work at the bottom edges of the kerf only after the molten material has substantially reached the bottom of the kerf to form steam pockets in such molten material whereby the beads into which such molten material solidifies are porous and can later be readily removed from the work.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,585,893	Coberly	May 25, 1926
1,835,378	Coberly	Dec. 8, 1931
2,187,731	Davis	Jan. 23, 1940
2,208,121	Davis	July 16, 1940
2,218,141	Adams et al.	Oct. 15, 1940
2,465,297	Thompson et al.	Mar. 22, 1949

FOREIGN PATENTS

Number	Country	Date
26,337	Sweden	Oct. 8, 1907
563,934	Germany	Jan. 26, 1933
580,877	Great Britain	Sept. 23, 1946