

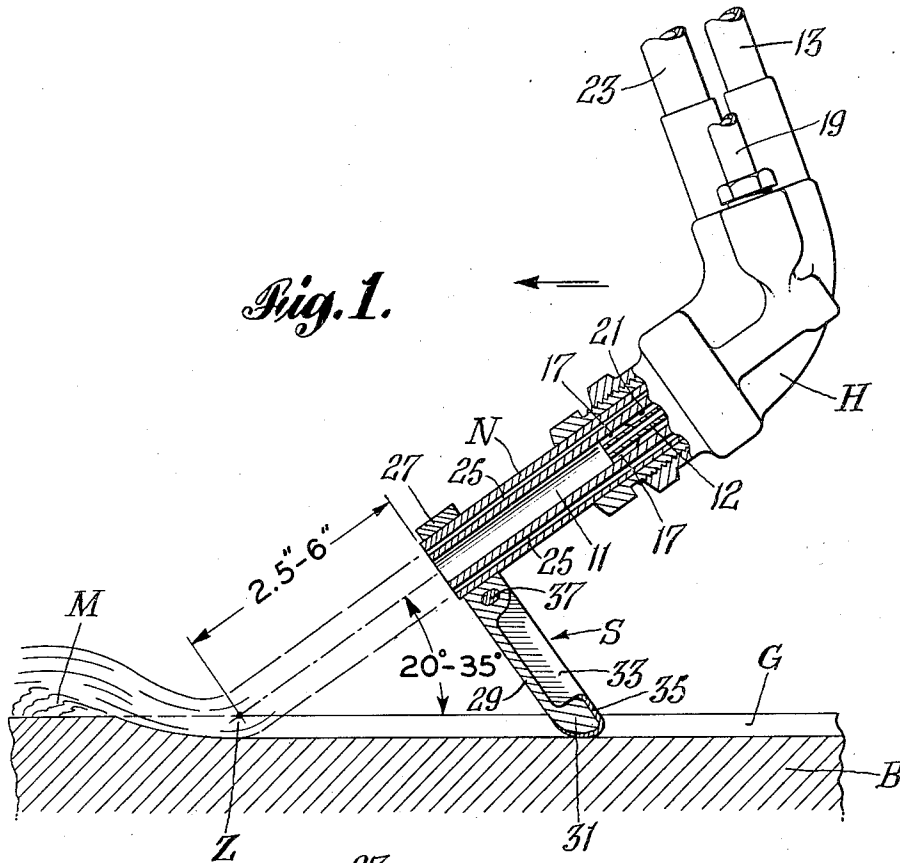
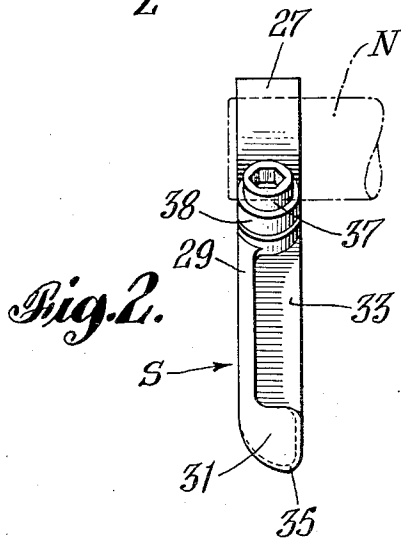
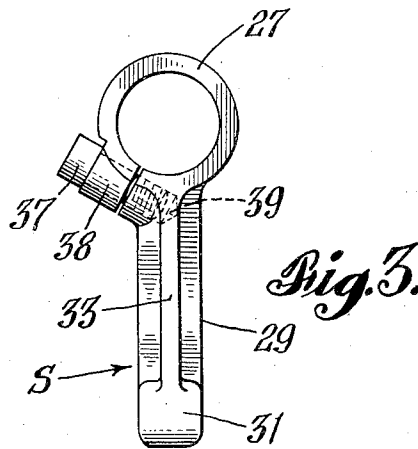
March 29, 1949.

E. MEINCKE

2,465,978

THERMOCHEMICAL POWDER-SCARFING METHOD

Filed Jan. 31, 1946



INVENTOR
EDWARD MEINCKE
BY *Ed. Greenwald*
ATTORNEY

UNITED STATES PATENT OFFICE

2,465,978

THERMOCHEMICAL POWDER-SCARFING
METHODEdward Meincke, Summit, N. J., assignor to The
Linde Air Products Company, a corporation of
Ohio

Application January 31, 1946, Serial No. 644,550

4 Claims. (Cl. 148—9)

1

This invention relates to a method for thermochemically scarfing metals and alloys which resist progressive oxidation by the sole action of a jet of oxygen impinging on heated portions thereof.

There has recently been developed a process for thermochemically removing metal from such resistant metals and alloys as alloy steels containing over 5% of chromium (e. g. 18% Cr-8% Ni stainless steel), cast iron, and non-ferrous metals and alloys, such as those comprising copper, aluminum, and nickel. In the new process a flowing stream of powdered adjuvant material which promotes the metal removing reaction is applied against the resistant metal body concurrently with the usual oxygen jet and preheating medium, such as an oxyacetylene flame. Generally the powder comprises highly combustible material such as an exothermically oxidizable metal, for example, iron or ferromanganese powder.

When scarfing such a metal body to remove a surface layer of metal, an oxygen jet flowing at a velocity between 550 and 750 ft./sec. is directed at an acute angle to the heated surface in the direction of the path of metal removal, and the thermochemical reaction is advanced by effecting movement of the oxygen jet, preheating medium, and powder stream lengthwise of the path. The term "scarfing" as used herein to denote removal of a surface layer to a shallow depth embraces such diverse operations as desurfacing by a plurality of adjacent oxygen jets, deseaming, and flame machining.

Among the objects of the present invention are to improve the efficiency of the foregoing method for thermochemically scarfing resistant metals; and to improve the character of surface obtained on a resistant metal body scarfing by the foregoing method.

The above and other objects, and the novel features of the invention, will become apparent from the following description, having reference to the annexed drawing wherein:

Fig. 1 is a fragmentary longitudinal sectional view, parts being in elevation, of a scarfing blowpipe and supporting device therefor in position for scarfing a resistant metal body;

Fig. 2 is a side elevational view showing in detail the supporting device of Fig. 1; and

Fig. 3 is an elevational view of the supporting device as seen from the right in Fig. 2.

I have found that the efficiency and the character of the surface obtained when thermochemically scarfing a resistant metal body, such as a billet of stainless steel, are improved considerably by concurrently directing a preheating me-

2

dium, such as an oxy-acetylene heating flame, and a stream of finely-divided powder comprising particles of exothermically oxidizable metal through between 2.5 and 6 inches of free space before they enter the reaction zone on the metal body. Usually a jet of commercially pure oxygen is directed into the reaction zone through the same distance as the powder and flame, but effective results can be obtained even if the oxygen flows through a greater or smaller distance. If these limits are observed, the powder is fully preheated to its combustion temperature by the flame when it enters the reaction zone, thus providing a high rate of powder combustion in the reaction zone, and increasing the efficiency of the process. Less than 2.5 inches of travel retards the rate of powder combustion in the reaction zone, decreases efficiency, and causes the scarfed groove or furrow to have undesirably rough and stringy edges which are likely to reduce the quality of the products obtained upon further processing the scarfed body. If there is a greater travel than 6 inches it may not be possible to maintain the scarfing reaction at all, but even if the scarfing reaction can be maintained, there is a substantial reduction in efficiency.

By the distance traveled in free space is meant the distance traveled without restraint by a physical object, although during such travel in free space the powder, oxygen, and preheating flame gases may interfere with one another to some extent. By increasing efficiency is meant increasing the quantity of metal removed per cubic foot of oxygen, the quantity of metal removed per pound of powder, and the cubic feet of oxygen consumed per pound of powder.

The distance through which the powder travels for the best combination of high efficiency and good surface character also depends on powder size. If a relatively coarse powder is used, e. g. predominantly coarser than 100 mesh, the powder travel should be near the 6 inch upper limit; and if a relatively fine powder is used, e. g. 100% finer than 100 mesh and 50% finer than 325 mesh, the powder travel should be near the lower limit.

When scarfing, the heating flame, the jet of scarfing oxygen, and the powder stream (either separately or entrained by and mixed with the scarfing oxygen) are advantageously all inclined at an acute angle to the surface and are directed along the surface lengthwise of the selected path toward the successive reaction zones from which metal is to be removed. The axis of the scarfing oxygen jet advantageously is inclined at an angle

between 20° and 35° to the surface, and ordinarily the preheating flames and the stream of powder have the same inclination. However, for some operations the heating flames may be inclined more or less than the scarfing oxygen jet, and, if the powder stream is separate from the oxygen jet, the powder stream may be directed at a different angle than the jet. As in the scarfing of carbon steels, an oxygen jet of low velocity is used, generally being maintained below 980 ft./sec. (the acoustic velocity in oxygen).

Suitable apparatus for carrying out the method described above, as shown in Fig. 1, comprises a scarfing nozzle N secured in a blowpipe head H. Nozzle N has a large diameter central longitudinal oxygen passage 11 coaxially within which is a relatively small diameter tubular oxygen injector 12 spaced from the cylindrical wall of the passage 11 by radial fins 17, and supplied with scarfing oxygen from a conduit 13. Adjuvant powder suspended in a gas, such as compressed air, is supplied by a conduit 19 to the annular space 21 surrounding the injector 12 from which it is aspirated between the fins 17 into oxygen passage 11 and mixes intimately with the scarfing oxygen before leaving the nozzle. For heating the powder and the workpiece a combustible gas, such as an oxy-acetylene gas mixture, is supplied by a conduit 23 to a plurality of annularly arranged longitudinal passages 25 surrounding passage 11, and ignition of the resulting gas jets forms a preheating flame composed of a plurality of intensely hot flame jets surrounding the central powder-laden oxygen jet.

When scarfing a metal body B by the method of the invention, the nozzle N is held by the operator in such a position that the preheating flame jets, and the central oxygen jet carrying a stream of adjuvant powder are all directed toward the surface of the body at an angle between 20° and 35° to its surface, and the end of the nozzle N is held at least 2.5 but not more than 6 inches from the original surface of the body so that the required distance of travel is obtained before the powder enters the reaction zone Z and impinges against the body. A fluid slag containing both molten metal and oxides forms in the reaction zone Z and is blown ahead by the oxygen jet to preheat the surface of the metal in advance of the nozzle, as shown at M in Fig. 1. By moving nozzle N over the body B, metal is progressively removed from successive surface zones, leaving a shallow groove or furrow G.

To insure that the angle of impingement of the oxygen jet against the work and the spacing of the end of the nozzle N from the work are maintained substantially constant during traverse of the nozzle over the work, the nozzle is provided with a projecting support or skid S which rides in the groove G on the hot newly-exposed surface of the work behind the reaction zone Z. The support S is so constructed and so arranged with respect to the nozzle that when the operator holds the nozzle at an angle between 20° and 35° to the surface with the support in contact with the surface, the proper spacing of the discharge orifices of the nozzle from the reaction zone Z is obtained automatically.

The preferred form of supporting device or skid S comprises a split ring clamp 27 which fits over the nozzle N at an appropriate short distance behind its discharge orifices, and a leg 29 which is integral with an extends radially from the clamp and has a foot end 31 adapted to slide along or ride on the newly-exposed hot surface

of the body B. It is essential that such a nozzle skid be light in weight, so that the operator of the blowtorch will not become unduly fatigued, yet it must be sufficiently strong and rigid to insure that the correct operating conditions are obtained. Both of these requirements are met by making the skid of metal such as malleable iron and by providing the skid with a T-shaped cross-section between the clamp 27 and the foot end of the leg 29 so that there is a narrow central reinforcing rib 33 extending lengthwise of the leg of the skid.

The foot end 31 of the skid S is subject to severe abrasion by the hot newly-exposed surface of the groove G as the nozzle N traverses the metal body B. To reduce wear to a minimum the end 31 is provided with a rounded surface to reduce friction; and the relatively soft metal of the rounded surface is provided with a welded-on layer 35 of a suitable relatively hard and abrasion resistant material, such as a cobalt-chromium-tungsten alloy.

The nozzle skid S can be loosened from and tightened on the nozzle N simply by manipulating a bolt 37, the head of which bears against a lug 38 integral with the clamp 27 and the threaded end of which fits in a threaded recess 39 in the upper end of the leg 29 to connect together the adjacent ends of the split ring clamp 27. Turning in the bolt 37 draws the ends of the ring together and decreases the effective opening of the clamp to firmly secure the skid to the nozzle. Backing out the bolt 37 causes the ends of the ring to separate due to the resilience of the metal, and increases the effective opening of the clamp so that the skid can be removed from the nozzle.

Specific embodiments of my novel method have been described in detail solely to illustrate the principles of the invention. It is to be understood that changes in procedure can be made within the scope of the invention as defined in the appended claims.

I claim:

1. A method of thermochemically removing a layer of metal on a path extending along the surface of a body of metal or alloy which resists the progressive removal of metal by the sole action of a jet of oxygen upon heated portions thereof, such method comprising concurrently directing together through between 2.5 and 6 inches of free space a heating flame and finely divided adjuvant powder comprising particles of exothermically oxidizable metal into successive reaction zones along a selected path on said body, and concurrently directing into said successive reaction zones a jet of oxygen flowing obliquely toward and along the surface of said body lengthwise of said path in the direction of such successive reaction zones at a velocity between 550 and 750 ft./sec.

2. A method of thermochemically scarfing metal and alloy bodies which resist the progressive removal of metal by the sole action of a jet of oxygen upon heated portions thereof, such method comprising concurrently directing together through between 2.5 and 6 inches of free space a heating flame, a jet of oxygen flowing at a velocity between 550 and 750 ft./sec., and finely divided adjuvant powder comprising particles of exothermically oxidizable metal into successive reaction zones along a selected path on said body, while concurrently directing such flame, oxygen jet and powder obliquely toward and along the surface of said body lengthwise of said path toward such successive reaction zones.

5

3. A method of thermochemically scarfing metal and alloy bodies which resist the progressive removal of metal by the sole action of a jet of oxygen upon heated portions thereof, such method comprising concurrently directing together through between 2.5 and 6 inches of free space a heating flame, a jet of oxygen flowing at a velocity between 550 and 750 ft./sec., and finely divided adjuvant powder comprising particles of exothermically oxidizable metal into successive reaction zones along a selected path on said body, while concurrently directing such flame, oxygen jet, and powder obliquely toward and along the surface of said body lengthwise of said path toward such successive zones, at least said oxygen jet being inclined at an angle between 20° and 35° to said surface.

4. A method of thermochemically scarfing metal and alloy bodies which resist the progressive removal of metal by the sole action of a jet of oxygen upon heated portions thereof, such method comprising concurrently directing together through between 2.5 and 6 inches of free space a heating flame, a jet of oxygen flowing at a velocity between 550 and 750 ft./sec., and finely divided adjuvant powder comprising particles of exothermically oxidizable metal into successive reaction zones along a selected path on said body,

6

while concurrently directing such flame, oxygen jet, and powder obliquely toward and along the surface of said body lengthwise of said path toward such successive zones, said powder being intimately mixed with and carried by said oxygen jet.

EDWARD MEINCKE.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
936,438	Fitzgerald	Oct. 12, 1909
1,097,746	Benton	May 26, 1914
1,704,473	Greene	Mar. 5, 1929
1,714,329	Stevens	May 21, 1929
1,823,194	Gray	Sept. 15, 1931
1,944,125	Halbing	Jan. 16, 1934
1,957,351	Oldham	May 1, 1934
2,125,180	Serner	July 26, 1938
2,205,890	Nicholson et al.	June 25, 1940
2,280,151	Hughey	Apr. 21, 1942
2,286,191	Aitchison et al.	June 16, 1942
2,415,815	Deming	Feb. 18, 1947
2,444,900	Meincke et al.	July 6, 1948