May 1, 1934. S. R. OLDHAM 1,957,351

METHOD OF REMOVING METAL FROM METAL ARTICLES

Filed July 10, 1931

Fig. 1.

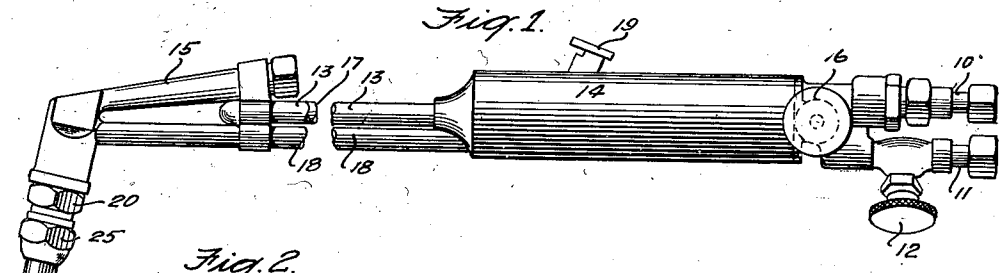


Fig. 2.

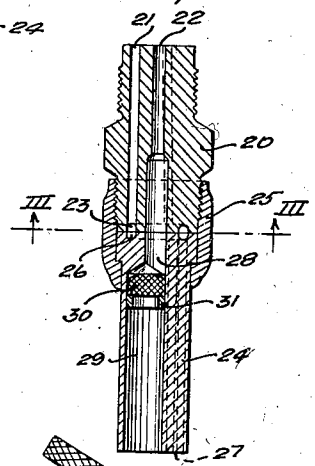


Fig. 3.

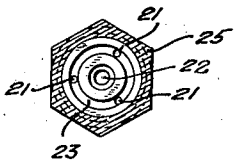


Fig. 4.

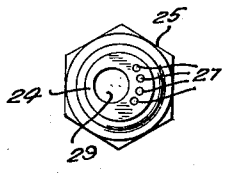


Fig. 6.

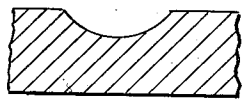


Fig. 5.

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METHOD OF REMOVING METAL FROM METAL ARTICLES

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Application July 10, 1931, Serial No. 550,000

3 Claims. (Cl. 148—9)

My invention relates to a method for removing defective and excess metal from metal articles, and particularly in reference to removing seams and other defective surface metal from steel billets prior to the subsequent hot working operations through which the billets pass.

An example of one application of my process is found in the manufacture of steel in which the surface of the billets is prepared for each rolling operation by removing irregular surfaces, surface cracks and other defective surface metal which may be badly oxidized or otherwise defective. Such surface portions are removed to prevent them from being rolled into the body of the metal and thereby produce concealed seams and unbonded, weak or poorly bonded metal within the body of the rolled metal.

As is well known in the art of rolling metals, the slopes of all elevations and depressions on the surface of the metal should be gradual and not so abrupt that the sides of the depression or elevation will be caused to be folded over under the pressure of the roll. Therefore, when metal is removed from the surface of billets to prepare them for the rolling operation it is necessary to leave the surface free from such abrupt slopes.

Heretofore the surfaces of billets have been prepared for the rolling operation by removing the defective surface portions by mechanical methods, such as chipping or milling. The removal of the surface portions in this manner requires much time and adds greatly to the cost of the rolled metal.

One of the objects of my invention is to provide an improved time and labor saving method for removing metal from metallic articles.

Another object of my invention is to provide an improved method for cutting channels or grooves in the surface of metals.

Another object of my invention is to provide a method of using an oxidizing gas stream to cut a relatively smooth channel with gradually sloping sides in a metal surface.

Another and more specific object of my invention is to consume and remove the defective surfaces of billets with an oxy-gas flame and a highly oxidizing stream of gas, and thereby put the surface of the billet in condition to be rolled.

The above objects are accomplished by the method described herein which may be practiced with the use of the apparatus described in the accompanying drawing, in which:

Fig. 1 is a side view of a blowpipe.

Fig. 2 is a longitudinal section of the nozzle and adapter of the blowpipe shown in Fig. 1.

Fig. 3 is a transverse section on line III—III in Fig. 2.

Fig. 4 is a view of the discharge end of the nozzle shown in Figs. 1 and 2.

Fig. 5 is an end view of the blowpipe disclosing the relative position of the blowpipe and the surface being operated upon, and a longitudinal section of a groove being cut.

Fig. 6 is a cross-section on line VI—VI in Fig. 5 of a groove cut in accordance with my method.

The apparatus shown in Fig. 1 comprises a cutting blowpipe of a well known type except for the adapter and nozzle which are shown in detail in Figs. 2, 3 and 4. The blowpipe is supplied with oxygen through a hose (not shown) attached to a nipple 10 and with a fuel gas such as acetylene through another hose (not shown) attached to a nipple 11. A valve 12 controls the supply of acetylene which flows in the acetylene conduit 13. The conduit 13 passes through the handle 14 and forms a communication between the nipple 11 and the head 15. A valve 16 controls the flow of oxygen in the branch oxygen conduit 17 which forms a communication between the main oxygen passage 18 and the head 15, where the oxygen in the branch oxygen passage is mixed with the acetylene to form the combustible mixture in the usual manner. A valve operated by button 19 on the handle 14 controls the flow of the oxygen in the main oxygen passage 18 which passage leads from the oxygen nipple 10 through the handle 14 to the blowpipe head 15.

The adapter 20 is attached to the blowpipe head 15 in the place of the usual blowpipe nozzle. The combustible mixture passages 21 in the adapter, as in the usual nozzle, are in communication with the combustible mixture passage in the head 15, and the central oxygen passage 22 in the adapter 20 is in communication with the oxygen passage 18 connected with the head 15. The lower end of the adapter 20 is provided with a circular groove 23 into which the combustible mixture passages 21 terminate.

A nozzle 24 is secured to the adapter 20 with a clamping nut 25. The nozzle is provided with a circular groove 26 in its upper end which coincides with the groove 23 in the lower end of the adapter 20. A group of passages 27, located in the outer wall of the nozzle, extend from the groove 26 in the coupling end of the nozzle through its discharge face. A short central passage 28 in the nozzle 24 coincides with the enlarged end of the central oxygen passage 22 in the adapter 20. An enlarged long eccentric passage 29 extends from the end of the short central

passage 28 to the discharge end of the nozzle. A screen 30 is placed in the upper end of the large oxygen passage 29 to reduce the turbulence of the oxygen in this passage. The screen 30 is held in place by a frictionally retained ferrule 31.

The adapter 20 and the nozzle 24 are designed to increase the volume and reduce the velocity of the oxygen discharged from the passages in the head 15 of the blowpipe so that a relatively large volume of oxygen at a reduced velocity will be discharged from the discharge orifice of the nozzle 24. Also, the adapter and the nozzle should be so designed as to deliver a sufficient quantity of combustible mixture to produce a relatively large quantity of heat at a high temperature. I have obtained good results with an adapter having passages without restrictions and a nozzle having an oxygen discharge orifice of .377 in. diameter, and four closely grouped combustible mixture orifices, each of .0465 in. diameter.

In the operation of the apparatus described for removing surface metal from billets, the combustible gas mixture is turned on and lighted as it issues from the passages 27 in the nozzle 24 in the usual manner. The nozzle 24 is held in reference to the surface to be operated on so that the flame will be underneath the oxygen stream and next to the surface, and so that the oxygen stream will be projected upon the surface at an acute angle thereto, preferably at an angle of about 30° to a tangent to the surface as shown in Fig. 5.

The gas flame quickly raises a spot on the surface of the metal to the temperature of ignition in a stream of oxygen. Having properly adjusted the oxygen pressure delivered to the torch, as will be explained hereafter, the oxygen is discharged from the passage 29 by pressing the oxygen valve button 19. The oxygen stream flows against the heated spot and gouges out a rounded depression having a cross-section of the character illustrated in Fig. 6. The removed metal is reduced to a nonadherent granular state and is blown out of the depression. A smooth groove having sloping sides of the characteristic shown in Fig. 6 is cut in the surface of the metal as the nozzle 24 is advanced relatively with respect to the metal along the surface of the metal in the direction of the oxygen stream as shown in Fig. 5.

The oxygen pressure delivered to the torch should be so adjusted that upon opening the main oxygen valve by pressing the button 19 the velocity of the oxygen discharged from the oxygen passage 29 is greater than 200 ft. per second, but not great enough to cause liquid metal to pile up in front of the stream and be blown from the path of the cut in that state or before such metal has become substantially oxidized to a state where it will not adhere to the body metal. Oxygen discharge velocities usually used for severing metal which are greater than 1000 ft. per second are too high. Oxidizing gas streams having higher velocities cause the metal to fuse more rapidly than it is oxidized. When the metal is fused and is not rapidly oxidized, the liquid metal is blown or pushed out of the cut by the high velocity oxygen stream onto the surface of metal and sometimes runs back again into the cut, and upon cooling it adheres tenaciously to the body metal. This action, of course, leaves the surface of the metal spotted with portions of firmly adhering, badly oxidized metal. Furthermore, an oxidizing stream of such high velocity produces a channel with steep side walls which also leaves the contour of the surface in an unsuitable condition to be rolled.

On the contrary, an oxygen stream which has a velocity greater than 200 ft. per second, but insufficient to produce a ball of liquid metal ahead of the stream will rapidly oxidize the metal and will blow the metal away in a crumbling and non-adherent condition, and a clean surface having a suitable contour for rolling will be obtained upon brushing off the non-adherent oxidized metal.

The discharge velocities of the oxidizing gas used herein are computed on the assumption that the oxidizing gas stream is at atmospheric pressure and at 70° F. when it issues from the nozzle discharge orifice.

It is to be understood that the method described herein for oxidizing and removing portions of metal from metal articles is not limited to the apparatus described herein. The method may be carried out with other apparatus capable of delivering a relatively low velocity oxidizing gas stream which is accompanied by sufficient high temperature heat to rapidly heat the metal to start the cut and to subsequently heat the metal and the oxidizing stream to produce a clean cut. In the specific example given herein about 35 cubic feet of acetylene per hour was used. The size of the combustible mixture holes may be varied and the quantity of combustible gas mixture may be changed to suit the type of the metal being operated upon, or the size of the oxidizing gas stream being used. An envelope of flame may also envelop the oxygen stream instead of being on the bottom side only, as shown.

Other variations may be made without departing from the scope of my method as defined in the appended claims.

I claim:

1. The method of removing metal from metal surfaces comprising heating a portion of said metal to be removed to a temperature at which it will ignite in a highly oxidizing gas stream; directing a highly oxidizing gas stream having a velocity between 200 and 1000 ft. per second upon said heated surface of metal at an acute angle thereto; and moving said oxidizing gas stream relatively with respect to said surface in the direction of said gas stream.

2. The method of removing metal from metal surfaces comprising preheating a portion of said metal to be removed with an oxy-gas flame; directing a highly oxidizing stream of gas upon said heated surface of metal at an acute angle thereto, said oxidizing stream of gas having a velocity greater than 200 ft. per second but less than 1000 ft. per second.

3. The method of removing metal from metal surfaces comprising preheating the metal to be removed with an oxy-gas flame; directing upon said metal a highly oxidizing stream of gas at an acute angle to the tangent to said surface at said heated point, said oxidizing gas stream having a sufficient velocity to oxidize said metal and having a velocity greater than 200 ft. per second but less than 1000 ft. per second, and moving said flame and oxidizing gas stream relatively with respect to said surface in the direction of said gas stream while maintaining the angular relation of the gas stream and the surface of the work.

SAMUEL R. OLDHAM.