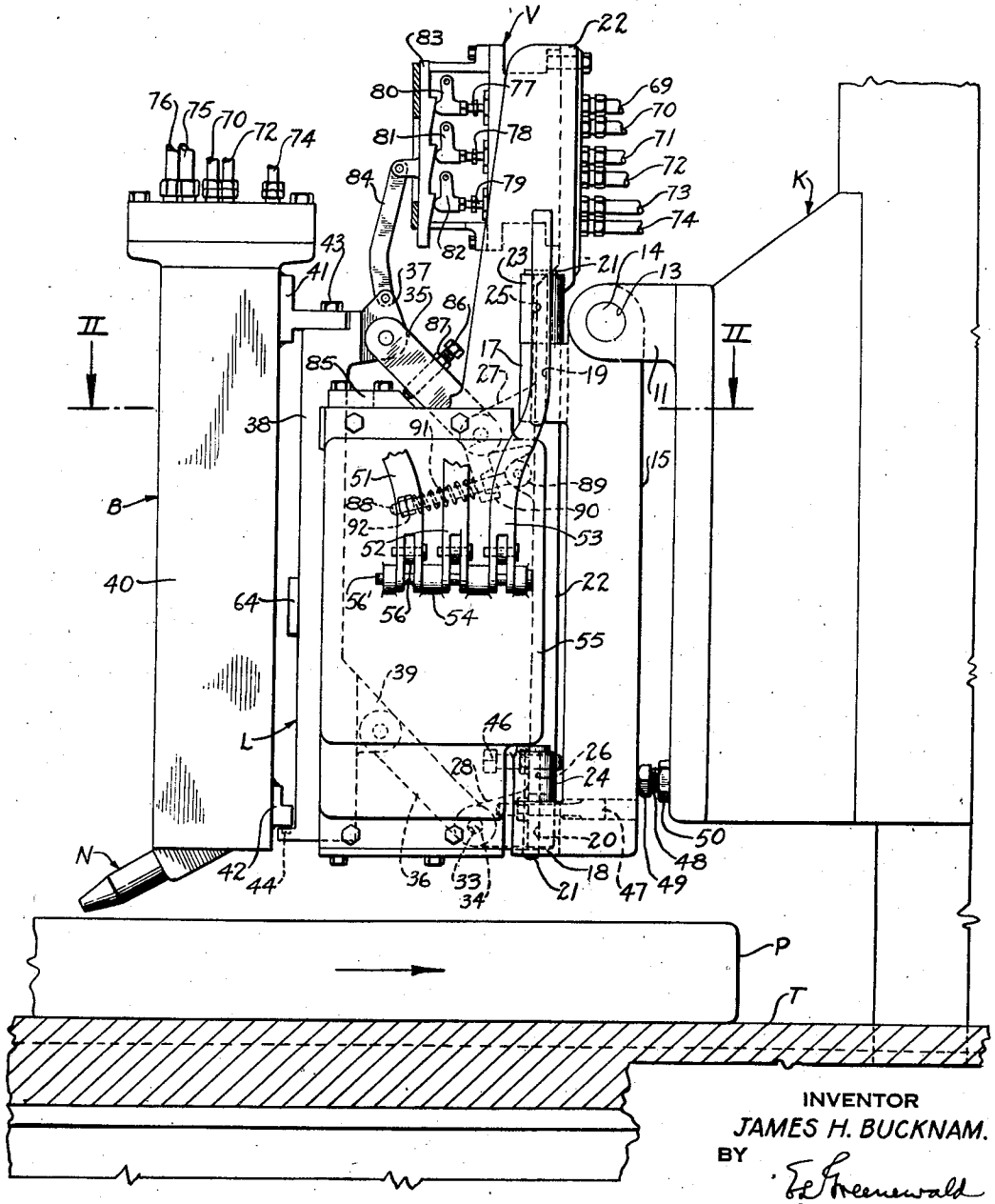
Jan. 9, 1940. J. H. BUCKNAM 2,186,096

METAL SURFACING APPARATUS

Filed July 16, 1936 2 Sheets-Sheet 1

Fig 1



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METAL SURFACING APPARATUS

Filed July 16, 1936 2 Sheets-Sheet 2

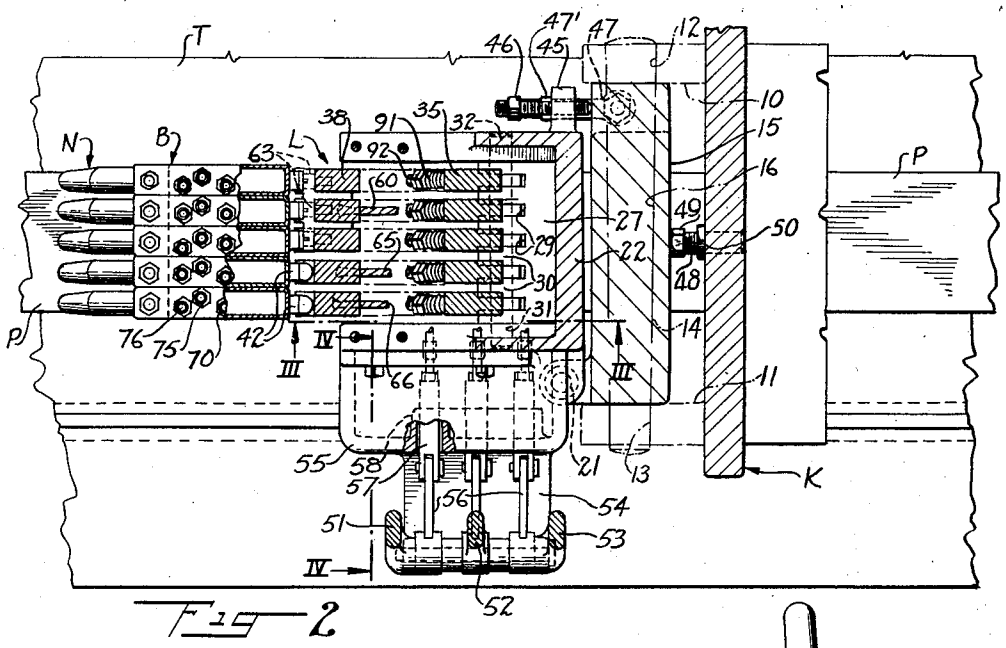


Fig 2

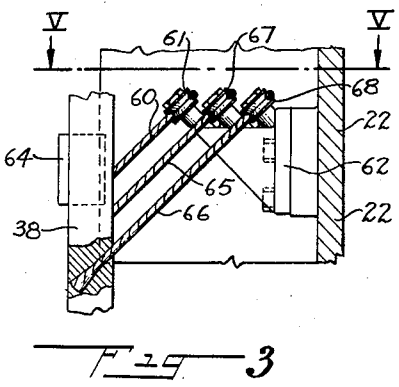


Fig 3

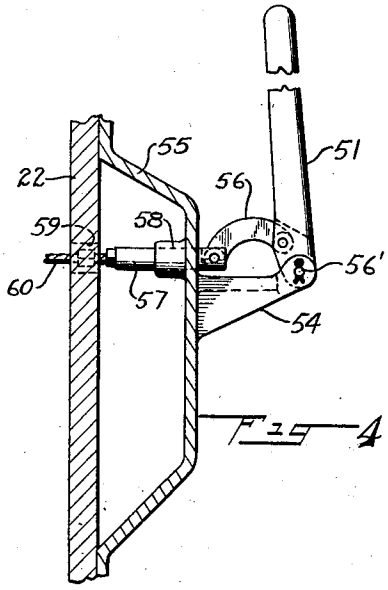


Fig 4

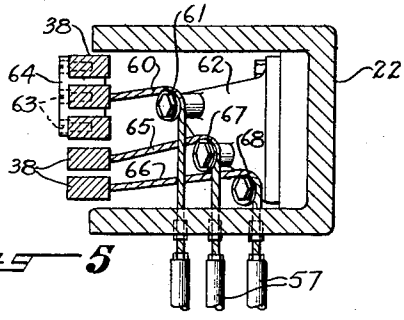


Fig 5

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Patented Jan. 9, 1940 2,186,096

UNITED STATES PATENT OFFICE

2,186,096

METAL SURFACING APPARATUS

James H. Bucknam, Cranford, N. J., assignor to The Linde Air Products Company, a corporation of Ohio

Application July 16, 1936, Serial No. 90,913

26 Claims. (Cl. 266—23)

This invention relates to the art of conditioning or surfacing metal bodies by means of a stream of oxiding gas, and more particularly to a blowpipe assembly for projecting heating and oxidizing jets obliquely against the surface of a metal body to surface condition or remove surface metal therefrom.

Surface metal is removed from semi-finished shapes, such as steel billets, blooms, slabs, and the like, to eliminate defects in and otherwise improve such surfaces. This metal-removing operation may be performed thermo-chemically by progressively applying a stream of oxidizing gas obliquely against and along the surface to be desurfaced while the surface metal is at an ignition temperature, heat for the latter purpose being conveniently applied by a high temperature heating flame associated with the oxidizing stream. One or more blowpipes are utilized to appropriately apply such stream and flame. In order to perform the operation economically and efficiently, it is important that the blowpipe shall be so constructed and mounted that it may be quickly and accurately set into and removed from its operating position; that the width of the desurfacing stream and flame shall conform to the width of the surface to be treated; and that the gases used shall be promptly turned on when the operation is to begin and promptly shut off when the operation is finished or the service of a blowpipe is not needed.

The principal objects of the invention are: to provide a blowpipe apparatus capable of economically and efficiently performing a surface conditioning operation; to provide blowpipe apparatus in which an individual unit of a group of blowpipes may be easily, quickly and accurately set into and out of operating position; to provide automatic means for turning on and shutting off the supply of metal-removing fluid to a blowpipe unit when the unit is set into either operating or non-operating position; to provide mechanism whereby a blowpipe unit may be adjusted laterally and vertically relatively to the surface undergoing treatment and may move out of the path of an obstruction which is encountered by its nozzle; and to provide blowpipe apparatus which is readily adjustable to efficiently surface condition any one of a number of widths of metal surfaces.

The above and other objects and the novel feature of this invention will become apparent from the following description taken with the accompanying drawings. In the drawings:

Fig. 1 is a side elevation, partly in section, of a blowpipe assembly embodying this invention;

Fig. 2 is a horizontal cross section of the assembly, taken on the line II—II of Fig. 1;

Fig. 3 is a vertical cross section of a part of the blowpipe support taken on the line III—III of Fig. 2;

Fig. 4 is a vertical section taken on the line IV—IV of Fig. 2, showing part of the mechanism whereby a unit of the assembly may be moved out of operating position; and

Fig. 5 is a horizontal cross section of part of the apparatus taken on the line V—V of Fig. 3.

Generally speaking, the invention comprises means, such as a plurality of blowpipe nozzles, for applying a stream of oxygen or oxygen-containing gas, with or without a fuel gas, obliquely against and lengthwise of a surface of a ferrous metal body, such as a steel billet, to remove defective portions from said surface. Each nozzle is preferably carried by a separate blowpipe unit which is independently supported from a common supporting member, so that any unit may be removed and replaced independently of the others and so that the position of the entire assembly may be varied relatively to the work. The nozzles and the blowpipe units carrying them are supported side by side and sufficiently close together to produce a substantially continuous stream of gas of the same width as the billet or other shape to be desurfaced. Means is provided for supplying to the units, oxygen and other fluids used by them; and automatic means is provided for either turning on or shutting off the supply of all of these fluids when the units are in either an operating or a non-operating position. Means is also provided whereby the effective width of the surface conditioning stream and flame may be varied; and other means are provided so that any unit may move out of the way of an obstruction which is encountered by its nozzle.

The improved blowpipe assembly, as illustrated in the drawings, comprises a row of blowpipe units B individually mounted on a suitable support, such as the frame K, and individually connected to a valve box V through which acetylene, preheating oxygen, desurfacing oxygen, and cooling water, respectively, are supplied to each unit. Each unit is desirably secured to the frame K by a linkage system L, whereby each unit is so suspended that it may be adjusted vertically and whereby all of the units may be adjusted angularly in a lateral sense. Suitable mechanism (not shown) may be provided to raise or lower

the frame K or to move it laterally relatively to the work, such as a steel billet P, which is carried on a conveyor or table T beneath the apparatus. Clearly the number of units used will depend upon the width of the surface layer to be removed. Suitable mechanism (not shown) may be provided to propel the table or conveyor T and with it one or more billets past the stationary blowpipe assembly; or conversely, the frame K carrying the blowpipe units and associated parts may be propelled lengthwise of the billet.

The blowpipe units B are supported from the frame K through the linkage system L by means of a pair of ears 10 and 11 which extend forwardly from the upper part of the frame K and which have therein horizontally aligned holes 12 and 13 respectively. Thus the frame K may accommodate a pin 14 extending horizontally through the holes 12 and 13. A clapper 15 having a width substantially equal to the distance between the ears 10 and 11 and having a transverse hole 16 therethrough is suspended from the ears 10 and 11 by positioning the pin 14 so that it extends through the hole 12, the transverse hole 16 and the hole 13. The clapper will then depend in front of the frame K as illustrated in Figs. 1 and 2. A pair of aligned projections 17 and 18 having therein coaxial holes 19 and 20, respectively, are formed at one vertical edge of the clapper 15. Pins 21, 21 are disposed in the holes 19 and 20 and extend above the projections 17 and 18 respectively.

A U-shaped main supporting member or blowpipe carrier 22 is provided for carrying all of the blowpipe units, and extending from one vertical corner thereof are a pair of spaced lugs 23 and 24 having coaxial vertically aligned holes 25 and 26 therethrough. The lugs 23 and 24 are spaced apart by a distance which permits their lower faces to contact the upper faces of the projections 17 and 18, respectively, on the clapper 15 with the pins 21 extending through the holes 25 and 26. The carrier 22 is thus pivoted to the clapper 15 and may be swung horizontally about the axis of the pins 21.

The blowpipe carrier 22 is provided with two spaced unitary cross pieces 27 and 28 extending, one above the other, completely across the bottom of the U. As shown in Fig. 2, the cross piece 27 has a series of inwardly extending vertical slots 29 at its front edge and a series of forwardly projecting fins 30 between these slots. Coaxial holes 31 extend through all of the fins 30 to accommodate a substantially horizontal pin 32. Similar slots in the lower cross piece 28 provide a similar set of fins through which coaxial holes 33 extend substantially horizontally to accommodate a horizontal pin 34. A series of links 35, each having one end disposed in a slot between two adjoining fins, are pivoted to the pin 32 in the upper cross piece 27 and a series of links 36 are similarly pivoted to the pin 34 in the lower cross piece 28.

The forward ends of the links 35 are pivoted to ears 37 formed on the upper part of vertically disposed bars 38, and the forward ends of the links 36 are similarly pivoted to ears 39 formed on the lower part of the bars 38, an upper link 35 and a lower link 36 immediately therebeneath being connected to the same bar. Thus a series of bars 38 are individually connected to the carrier 22, each by an upper and a lower link. Since the links 35 and 36 of each pair are parallel and of equal length, the bar 38 to which they are connected will remain vertical and parallel to the carrier 22, regardless of the angular position of the links.

The nozzles N are preferably carried individually at a desired acute angle to the surface of the billet by separate vertical blowpipe heads 40 through which they are supplied with oxygen and with a mixture of acetylene and preheating oxygen for heating the surface of the billet P. The blowpipe heads are made very narrow which permits the nozzles to be disposed close together so that the several desurfacing jets will merge to provide a single wide desurfacing stream and heating flame, as will be clear from Fig. 2. Each blowpipe head 40 is separately attached to a bar 38 by brackets 41 and 42, respectively secured to the upper and lower rear side of the head 40. A bolt 43 passes through a vertical hole in the bracket 41 and is threaded into the top of the bar 38, while a downwardly projecting stud 44 on the bracket 42 fits into a hole in a forward projection at the lower end of the bar 38. Each blowpipe is thus firmly mounted on its bar 38 in such manner that the blowpipe may be easily and quickly removed from the bar simply by unscrewing the bolt 43 and lifting the whole blowpipe unit vertically. By loosening the bolt 43, a blowpipe may be set at an angle to an adjoining blowpipe.

The carrier 22 is so mounted and adjustable on the clapper 15 that the group of blowpipes B may be positioned to apply their heating and oxidizing jets obliquely against a surface of the billet and also lengthwise of said surface, either exactly parallel to a vertical plane through the longitudinal axis of the billet or at an angle to said plane and transversely of said surface.

In order to set the carrier 22 so as to apply the blowpipe jets obliquely against the billet surface and either parallel to or at an angle to a vertical plane through the longitudinal axis of the billet, a lug 45 is formed on the carrier 22 on the opposite side to that on which the ears 23 and 24 are disposed. Two separate horizontal holes, one above the other, are formed in the lug 45; one of them being threaded and the other being unthreaded and open to the vertical edge of the lug 45. A bolt 46 is screwed into the threaded hole in the lug 45 and is turned until its end bears against the clapper 15, thereby limiting the clockwise angular turning of the carrier about the pivot 21, as viewed in Fig. 2. A second bolt 47, pivoted in the clapper 15, extends loosely through the unthreaded hole and a nut 47' screwed thereon at the forward side of the lug 45 limits counterclockwise turning of the carrier 22 about the pivot 21, as viewed in Fig. 2. By adjusting the bolt 46 and the nut 47', the carrier 22 may be fixed in the desired angular position relatively to the clapper 15, thereby fixing the angular position of the blowpipe jets with respect to the axis of the billet P. Thus, by setting the carrier 22 at an angle to the clapper 15, the heating and oxidizing jets will sweep diagonally across the billet surface.

In order to vary the vertical angle between the nozzles N and the billet surface, the clapper 15 may be adjusted by varying the distance between its lower end and the adjacent part of the frame K. Thus, a bolt 48 is screwed horizontally into the frame K at a point considerably below the pivot 14, and the head 49 of this bolt bears against the lower part of the clapper 15 in a manner to prevent counterclockwise swinging about the pivot 14. A lock nut 50 secures

the bolt 48 in any of its adjusted positions with respect to the frame K.

For economy in gas consumption, the number of blowpipes and nozzles used in desurfacing the face of any shape preferably is only that sufficient to apply a gas stream wide enough to cover the entire width of the surface to be treated. Five nozzles are here shown as an example of a plurality of nozzles used for this purpose, but a greater or smaller number of nozzles may be employed. When a narrower surface or width of billet is to be surfaced, nozzles which are not required to apply useful jets are moved into non-operating position, and means is provided in the apparatus for so moving the superfluous nozzles.

As best shown in Figs. 2 and 4, this means comprises three levers 51, 52, and 53, all pivoted to a bracket 54 which is carried on a cover plate 55 secured to the carrier 22. Each lever is connected by a curved locking link 56 to the end of a plunger 57 reciprocable in a bushing 58 in the cover plate 55. The other end of each plunger 57 is connected to the end of a cable which passes through an opening 59 in a wall of the carrier 22. As shown in Figs. 3 and 5, the cable 60 which is operated by the lever 51 passes over a pulley 61 mounted on a bracket 62 which is fastened to the carrier 22. The cable 60 passes downwardly from the pulley 61 and is fastened to the central blowpipe-supporting bar 38 of the group of three adjoining bars 38 at one end of the row of the five bars. These three supporting bars are connected by bolts 63 to a bracket 64 so that they will move together. Accordingly, when the lever 51 is pulled backwardly, it will elevate all three of the blowpipes carried by these bars and will elevate them into non-operating position.

The levers 52 and 53 are similarly connected individually to the remaining bars 38, 38 through cables 65 and 66 passing over pulleys 67 and 68, respectively, both mounted on the bracket 62. The blowpipes will be locked in their elevated positions by the several curved links 56 which extend around the pivots 56' and prevent unintentional swinging of the levers. The links 56 also limit the upward movement of the blowpipes. From the foregoing, it will be clear that by proper manipulation of the levers 51, 52, and 53 the number of blowpipes in use may be varied as desired between one and five; and two or more blowpipes in service will be equally near one another. The widths of the heating flame and the desurfacing stream may thus be readily varied to conform to the width of the surface to be treated.

Suitable mechanism is provided to control the supply of desurfacing oxygen as well as the supply of a preheating mixture of oxygen and acetylene to the several blowpipe nozzles N. Suitable means may also be provided to control the circulation of a cooling fluid, such as water, to the blowpipe heads 40 to dissipate the heat absorbed by the heads. As shown in Fig. 1, a valve box V may be secured to the top of the carrier 22 and contains separate valves through which desurfacing oxygen, acetylene, and combustion-supporting oxygen pass on their way to the blowpipe heads. One set of valves is provided for each blowpipe head 40 and but one set of valves and its connections will be here described by way of example.

In the embodiment illustrated, separate hose connections 69, 71 and 73 respectively deliver desurfacing oxygen, acetylene, and combustion-supporting oxygen to the separate valves in the valve box V; and separate hose connections 70, 72, and 74 respectively deliver such desurfacing oxygen, acetylene and combustion-supporting oxygen from the same valves in the box V individually to a blowpipe head B, wherein these gases are conveyed to and discharged by the nozzle N in a manner fully disclosed in application Serial No. 78,832, filed May 9, 1936 by James H. Bucknam and Homer W. Jones. Cooling water may be separately conveyed to and from the blowpipe head through hose connections 75 and 76, and may be circulated through said head in the manner disclosed in said Bucknam and Jones application. Since it is usually of little importance whether the cooling water be conserved or not, it may or may not be desirable to provide an automatically operated control valve for cooling water in the valve box V.

Three suitable valves in the valve box V control the passage of desurfacing oxygen, combustion-supporting oxygen, and acetylene, respectively, through the hose connections described to the blowpipe head; and the respective valve stems 77, 78, and 79 of such valves project from the several valve chambers for regulating the positions of the respective valves. Pivoted levers 80, 81, and 82 bear against the respective stems in order to open the valves and permit passage of the respective fluids therethrough. A slide 83 having a series of cam surfaces thereon is positioned to move back and forth adjacent the levers 80, 81, and 82 in such a manner that the cam surfaces will engage and operate the levers to open the valves when the slide moves downwardly, and will release the levers and permit the valves to close when the slide moves upwardly. Springs within the box V may cause the released valves to close in well known manner.

The gas control valves for each blowpipe unit are operated concurrently with the lowering or raising of the unit by means of a connecting rod 84 which has one end pivoted to the slide 83 and the other end pivoted to the ear 37 on the bar 38. Thus when the blowpipe is lowered into operating position, it pulls the slide 83 downwardly and thereby opens the three valves. When the blowpipe is moved upwardly into non-operating position, however, it moves the slide 83 upwardly and releases the valves, whereupon they are closed by their internal springs. Each blowpipe unit is, therefore, provided with automatic mechanism for shutting off the supply of fluid when the unit is in non-operating position, and for turning on such supply when the unit is in operating position.

If any nozzle N encounters an obstruction, the blowpipe unit which supports it will rise and the nozzle will pass over the obstruction. This is so because the links 35 and 36 incline upwardly toward the blowpipe head. When the obstruction is passed, the weight of the blowpipe and the bar 38 alone, or with the assistance of resilient means, will automatically restore the unit to its original position. Downward movement of each unit is limited by an abutment 85 which is bolted to the carrier 22 crosswise of the latter beneath the upper ears 37 on the bars 38. A bolt 86 threaded through each upper link 35 and maintained in position by a lock nut 87 bears upon the abutment 85, thereby limiting the downward movement of each unit and providing means for slight adjustment of its vertical position.

The cables 60, 65 and 66 can move the blowpipe units only in an upward direction. In order to assist gravity to restore and hold each unit in its operating position and to yieldingly press each unit in the downward direction or toward the operating position, a swivel bolt 88 is associated with each unit and is pivoted to the carrier 22, as at 89, and passes through a hole in a downwardly extending lug 90 on the upper link 35. A helical spring 91 surrounds the bolt 88 and is compressed between nuts 92 on the end of the bolt 88 and a surface of the lug 90. The spring 91, therefore, acts to turn the link 35 downwardly about its pivot 31 and thereby assists gravity in moving the unit downwardly and in seating the end of the bolt 86 upon the abutment 85. The spring 91 also urges the unit toward the surface of the work when the unit is held in such position that the force of gravity is not sufficiently effective, such as when the surface of the billet being treated is not horizontal.

From the foregoing, it will be apparent that the present invention provides simple, rugged, and easily maintained surfacing apparatus wherein the individual units of the assembly may be easily, quickly and accurately moved into and out of operating position; wherein automatic means turns on and shuts off the supply of gases to each unit immediately upon movement of that unit into either operating or non-operating position; whereby the effective width of the assembly may be varied; and whereby any unit is automatically moved upwardly out of the path of an obstruction which is encountered by its nozzle.

The embodiment here illustrated and described is presented merely to indicate how the invention may be applied. Certain novel features may be used without others; and other forms of blowpipes and mechanisms, differing in detail but not in principle from those herein disclosed, are included within the scope of this invention.

What is claimed is:

1. Apparatus for removing metal from the surface of a metal body such as a steel billet, comprising means supporting said body for maintaining such surface in a position to be operated upon; a blowpipe having a nozzle constantly inclined at an acute angle relatively to the plane of said surface for applying a stream of oxidizing gas obliquely against and lengthwise of said surface; a carrier for said blowpipe; means connecting said blowpipe and said carrier providing a desired degree of relative movement therebetween and freely to and from said surface in a direction other than that of the inclination of said nozzle to the plane of said surface while maintaining said acute angle substantially constant; a supporting frame for said carrier, said carrier being pivotally connected to said frame; means for moving said blowpipe relatively to said carrier and in said other direction; and adjustable means for limiting said movement toward said surface.

2. Apparatus for removing metal from the surface of a metal body such as a steel billet, comprising means supporting said body for maintaining such surface in a position to be operated upon; a blowpipe having a nozzle constantly inclined at an acute angle relatively to the plane of said surface for applying a stream of oxidizing gas obliquely against and lengthwise of said surface; a carrier for said blowpipe; means connecting said blowpipe to said carrier providing a desired degree of relative movement therebetween and freely in a direction to and from said surface while maintaining said acute angle substantially constant; a supporting frame for said carrier, said carrier being adjustable relatively to said frame about an axis substantially perpendicular to said surface; means for moving said blowpipe relatively to said carrier and in said direction; and adjustable means for limiting said movement toward said surface.

3. Apparatus for removing metal from the surface of a metal body such as a steel billet, comprising a blowpipe having a nozzle constantly inclined at an acute angle relatively to the plane of said surface for applying a stream of oxidizing gas obliquely against and lengthwise of said surface; a carrier for said blowpipe; means connecting said blowpipe to said carrier providing a desired degree of relative movement therebetween and freely in a direction to and from said surface while maintaining said acute angle substantially constant; a supporting frame for said carrier, said carrier being adjustable relatively to said frame about axes disposed in planes perpendicular to one another, one of said axes being substantially normal to said surface; means for moving said blowpipe relatively to said carrier and in said direction; and adjustable means for limiting said movement toward said surface.

4. Apparatus for removing metal from the surface of a metal body such as a steel billet, comprising a blowpipe having a nozzle constantly inclined at an acute angle relatively to the plane of said surface for applying a stream of oxidizing gas obliquely against and lengthwise of said surface; a carrier for said blowpipe; means connecting said blowpipe to said carrier providing a desired degree of relative movement therebetween and freely in a direction to and from said surface while maintaining said acute angle substantially constant; said connecting means also being arranged to provide for the angular adjustment of said blowpipe relatively to said carrier about an axis substantially perpendicular to said surface; and a supporting frame for supporting said carrier adjacent said surface.

5. The combination of a blowpipe; a carrier; parallel linkage means connecting said blowpipe to said carrier arranged to provide relative movement therebetween in a direction having a component lengthwise of said carrier; a supporting frame for said carrier, said carrier being adjustable relatively to said frame about an axis substantially parallel to said lengthwise component of movement.

6. Apparatus for removing metal from the surface of a metal body such as a steel billet, comprising a row of closely adjacent separate blowpipes having nozzles constantly inclined at acute angles relatively to the plane of said surface for applying oxidizing gas streams obliquely against and lengthwise of said surface; a carrier for said blowpipes; mechanism for connecting said blowpipes to said carrier providing limited free movement of said blowpipes with respect to said carrier in a direction toward and away from said surface while maintaining substantially constant the angle of inclination of said nozzles; adjustable means for limiting the movement of said blowpipes toward said surface; and a frame for supporting said carrier, said carrier being adjustable relatively to said frame about an axis parallel to said surface and to said row to adjust the acute angles between said nozzles and said surface.

7. Apparatus for removing metal from the sur-

face of a metal body such as a steel billet, comprising a blowpipe having a nozzle constantly inclined at an acute angle relatively to the plane of said surface for applying a stream of oxidizing gas obliquely against and lengthwise of said surface; a carrier for said blowpipe; means connecting said blowpipe to said carrier providing a desired degree of relative movement therebetween and freely to and from said surface in a direction other than that of the inclination of said nozzle while maintaining said acute angle substantially constant; means including a valve for delivering fluid to said blowpipe; and mechanism connected to said blowpipe and operable by the movement thereof for closing said valve when said blowpipe is moved to substantially the limit of its movement in one direction and for holding said valve means open when said blowpipe is moved away from such position.

8. Apparatus for removing metal from the surface of a metal body such as a steel billet, comprising a carrier; a blowpipe secured to and movable lengthwise of said carrier; and means operable to move said blowpipe lengthwise of said carrier, said means comprising a lever pivotally mounted on said carrier, and a cable secured to said blowpipe and to said lever.

9. Apparatus for removing metal from the surface of a metal body such as a steel billet, comprising a carrier; a blowpipe secured to and movable lengthwise of said carrier; and means operable to move said blowpipe lengthwise of said carrier, said means comprising a lever connected to move the blowpipe in one direction, and spring means tending to move the blowpipe in the opposite direction.

10. Apparatus for removing metal from the top surface of a metal body such as a steel billet, comprising a vertically-disposed blowpipe having a forwardly inclined nozzle adapted to direct a stream of oxidizing gas obliquely against and lengthwise of said surface; a vertically disposed carrier behind said blowpipe; parallel links pivotally connected to said carrier and extending forwardly and upwardly, and having forward ends pivotally connected to said blowpipe; and means limiting the downward movement of said blowpipe toward said surface, the construction and arrangement being such that said blowpipe and its nozzle are free to rise when said nozzle engages an obstruction.

11. Apparatus for conditioning the surface of a metal body such as a steel billet, comprising a blowpipe; a carrier therefor; and parallel link means pivotally connected both to said blowpipe and to said carrier, the pivotal connection to said carrier being nearer said surface than the pivotal connection to said blowpipe and all of said pivotal connections being directly above said surface.

12. In apparatus for conditioning the surface of a metal body such as a steel billet, the combination comprising blowpipe means adapted to project gas against such surface; a carrier therefor; a pair of parallel links pivotally connecting said blowpipe to said carrier for providing movement of said blowpipe means relative to said carrier toward and away from said surface; and spring means tending to press said blowpipe means toward said surface.

13. Apparatus for conditioning the surface of a metal body such as a steel billet, comprising a blowpipe carrier; a blowpipe adjustably mounted thereon for movement to and from an operating position with respect to said surface; means, including a valve mounted on said carrier, for supplying an oxidizing agent to said blowpipe; means operable to open said valve automatically when said blowpipe is in operating position to remove metal from said surface; and means connected to said blowpipe and operable by the movement thereof to close said valve automatically when said blowpipe is out of operative relation with respect to said surface.

14. Apparatus for conditioning the surfaces of metal bodies such as steel billets, comprising means for applying a wide stream of oxidizing gas obliquely against and lengthwise of said surfaces on a zone extending completely across such surface; and selectively operable mechanism whereby the width of said stream may be varied rapidly by the movement of parts of said apparatus in accordance with the width of said surfaces.

15. Apparatus for conditioning the surfaces of metal bodies such as steel billets, comprising a row of blowpipes disposed side-by-side to deliver a wide stream of oxidizing gas obliquely against and lengthwise of a metal surface; and selectively operable mechanism whereby the number of operating blowpipes in said row may be varied rapidly by movement of one or more of said blowpipes to change the width of the stream of oxidizing gas that is applied to the metal surface.

16. Apparatus for removing metal from the surfaces of metal bodies such as steel billets, comprising a series of separate blowpipes, each adapted to deliver a jet of oxidizing gas obliquely against and lengthwise of the surface of a metal body; means for moving said blowpipes to or away from their operating positions adjacent said surface; valves severally controlling the supply of oxidizing gas to said blowpipes; and mechanism for causing the movement of each blowpipe to actuate the valve controlling its oxidizing gas supply so as to deliver such gas to the blowpipe when it is in its operating position and to shut off such gas when the blowpipe is away from its operating position.

17. Apparatus for removing metal from the surfaces of metal bodies such as steel billets, comprising a series of separate blowpipes disposed side by side, each blowpipe adapted to apply a jet of oxidizing gas obliquely against and lengthwise of the surface of a metal body; a carrier for said blowpipes, said blowpipes being supported on said carrier for individual movement relatively therealong; and selectively operable mechanism for moving one or more of said blowpipes relatively to said carrier and to and from their operating positions adjacent said surface, the construction and arrangement being such that the width of the oxidizing stream applied by said apparatus may be increased in equal increments from the width of the oxidizing jet delivered by a single blowpipe to the width of the oxidizing stream adapted to be delivered by all the blowpipes in the series.

18. Apparatus for removing metal from the surfaces of metal bodies such as steel billets, comprising a series of separate blowpipes disposed side by side, each blowpipe adapted to apply a jet of oxidizing gas obliquely against and lengthwise of the surface of a metal body; a carrier for said blowpipes, said blowpipes being supported on said carrier for individual movement relatively therealong; and selectively operable mechanism for moving one or more of said blowpipes relatively to said carrier and to and from

their operating positions adjacent to said surface, the construction and arrangement being such that the width of the oxidizing stream applied by said apparatus may be increased in equal increments from the width of the oxidizing jet delivered by a single blowpipe to the width of the oxidizing stream adapted to be delivered by all the blowpipes in the series, said mechanism comprising a group of manually-operable levers, the number of blowpipes exceeding the number of levers.

19. Apparatus for removing metal from the surfaces of metal bodies such as steel billets, comprising a series of separate blowpipes disposed side by side, each blowpipe adapted to apply a jet of oxidizing gas obliquely against and lengthwise of the surface of a metal body; a carrier for said blowpipes, said blowpipes being supported on said carrier for individual movement relatively therealong; and selectively operable mechanism for moving one or more of said blowpipes relatively to said carrier and to and from their operating positions adjacent said surface, the construction and arrangement being such that the width of the oxidizing stream applied by said apparatus may be increased in equal increments from the width of the oxidizing jet delivered by a single blowpipe to the width of the oxidizing stream adapted to be delivered by all the blowpipes in the series, said mechanism comprising three manually-operable levers, said series of blowpipes comprising five blowpipes, two cables connecting two of said levers individually to two of said blowpipes, and a third cable connecting the remaining lever to all three of the remaining blowpipes of the series.

20. Apparatus for removing metal from a surface of a metal body such as a steel billet, comprising the combination of a plurality of blowpipes arranged side by side, each blowpipe being adapted to apply an oxidizing stream obliquely against and lengthwise of said surface; means for moving each of said blowpipes away from said surface and into non-operating position and releasably retaining them in such position; and means for independently restoring one or more of said blowpipes to their operating position.

21. Apparatus for removing metal from a surface of a metal body such as a steel billet, comprising the combination of blowpipe means for applying a stream of oxidizing gas obliquely against and lengthwise of said surface; a carrier for said blowpipe means, said blowpipe means being connected to move relatively along said carrier; lever means for moving said blowpipe means relatively to said carrier and away from said surface, said lever means being connected to said blowpipe means and pivotally mounted on said carrier; and releasable means operable by said lever means for retaining said lever means in a position to hold said blowpipe means in a position away from said surface.

22. Apparatus for removing metal from a surface of a metal body such as a steel billet, comprising the combination of a row of blowpipes disposed side by side for applying touching streams of oxidizing gas obliquely against and lengthwise of said surface; a carrier for said blowpipes; adjustable means connecting said blowpipes to said carrier including parallel links pivotally connected individually to each blowpipe for movement thereof relatively to said carrier and toward and away from said surface; and means on said carrier limiting the movement of each of said blowpipes toward said surface.

23. Apparatus for removing metal from a surface of a metal body such as a steel billet, comprising the combination of a row of blowpipes disposed side by side for applying touching streams of oxidizing gas obliquely against and lengthwise of said surface; a carrier for said blowpipes; parallel link means pivotally connected to said carrier and pivotally connected individually to each blowpipe for movement thereof relatively to said carrier and toward and away from said surface; and means for limiting the movement of each of said blowpipes toward said surface comprising a bar mounted on said carrier transversely of said links, and adjustable stops between said links and said bar independently to vary the limits of movement of the several blowpipes toward said surface.

24. Apparatus for removing metal from a surface of a metal body comprising the combination of a row of blowpipes disposed side by side for applying adjoining streams of oxidizing gas obliquely against and lengthwise of said surface; a carrier for said blowpipes; adjustable means connecting said blowpipes to said carrier providing individual movement of each blowpipe along said carrier and toward and away from said surface; means for supplying fluid to said blowpipes including valves mounted on said carrier severally controlling the supply of fluid to each of said blowpipes; and mechanism interconnecting each blowpipe and the corresponding valve supplying fluid thereto for causing the movement of each blowpipe to actuate its control valve so as to close such valve when the blowpipe is moved away from an operating position and from said surface and to open such valve when the blowpipe is moved toward its operating position adjacent said surface.

25. Apparatus for removing metal from the surface of a metal body such as a steel billet, comprising means supporting said body for maintaining such surface in a position to be operated upon; a carrier; a blowpipe having a nozzle constantly acutely inclined relatively to the plane of said surface and secured to and movable lengthwise of said carrier, the inclination of said nozzle to said surface being maintained constant during said movement; means connected to said blowpipe and mounted on said carrier operable to move said blowpipe lengthwise of said carrier; and spring means tending to urge said blowpipe toward said surface.

26. Apparatus for removing metal from the surfaces of metal bodies such as steel billets, comprising a series of separate blowpipes disposed side by side, each blowpipe adapted to deliver a jet of oxidizing gas, the distance between the blowpipes being such that the jets of all of such blowpipes merge to form essentially a single wide stream adapted to impinge obliquely against and lengthwise of a surface of a metal body; a corresponding series of supporting bars to which said blowpipes are individually secured for relative adjustment thereon; a frame; a carrier adjustably supported by said frame for adjustment about an axis parallel to and transversely of said surface and also adjustable relatively to said frame about an axis perpendicular to said surface; inclined parallel links pivotally connected to said carrier and also pivotally connected to said bars for providing movement of said bars and the blowpipes thereon toward and from said surface; springs pressing against said links and urging said bars and said blowpipes toward said

surface; means limiting the extent of the movement of said blowpipe toward said surface; selectively operable mechanism for moving one or more of said blowpipes away from said surface; means, including a valve individual to each blowpipe, for supplying oxidizing gas independently to the several blowpipes; and means operable by the movement of said blowpipes for controlling such valves independently to supply such gas to the blowpipes when they are in operating position adjacent said surface and to shut off such gas supply to any blowpipe or blowpipes not in such operating position.

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