Dec. 3, 1940. H. W. JONES ET AL 2,223,452

BLOWPIPE APPARATUS FOR SURFACE CONDITIONING

Filed Sept. 16, 1936 3 Sheets-Sheet 1

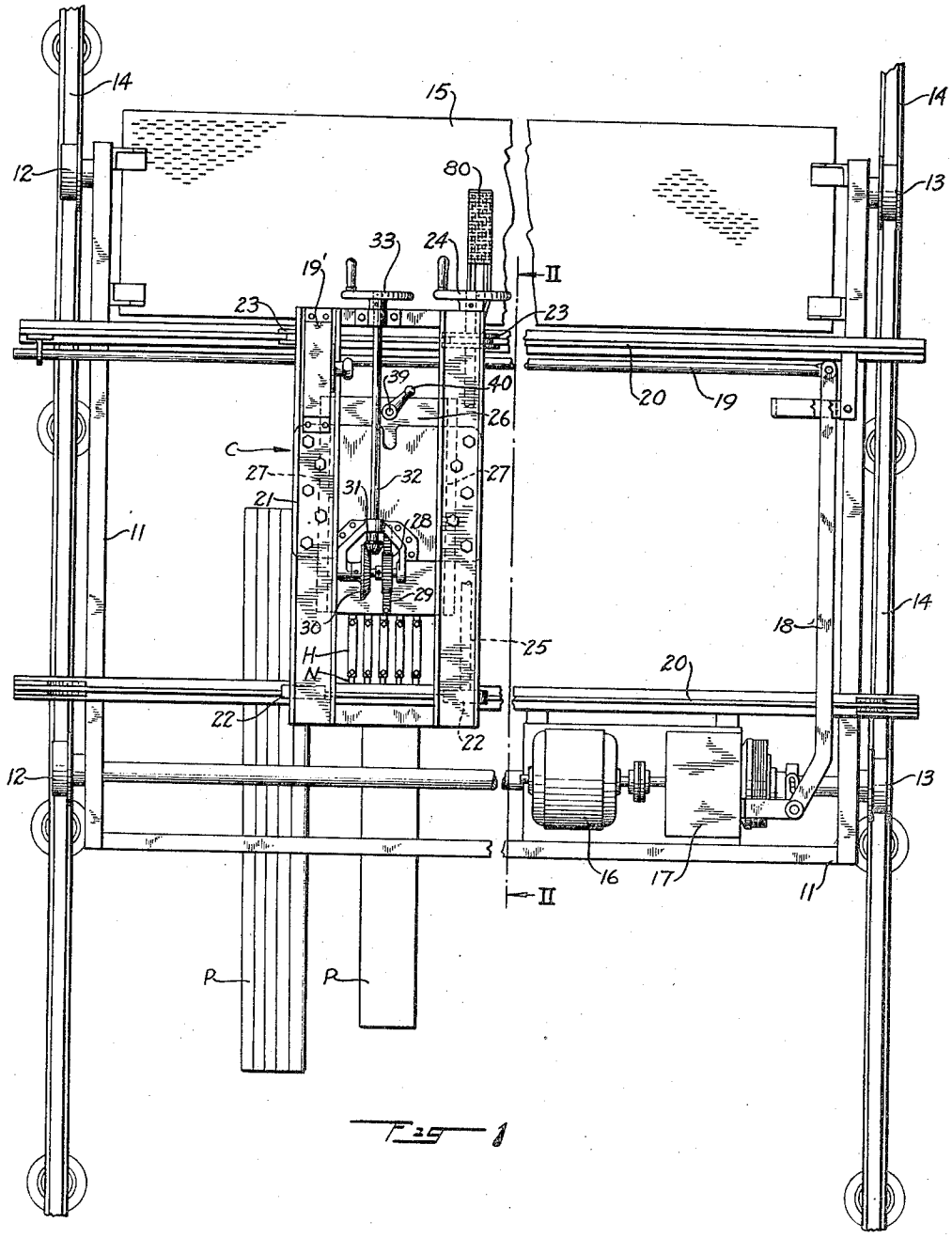


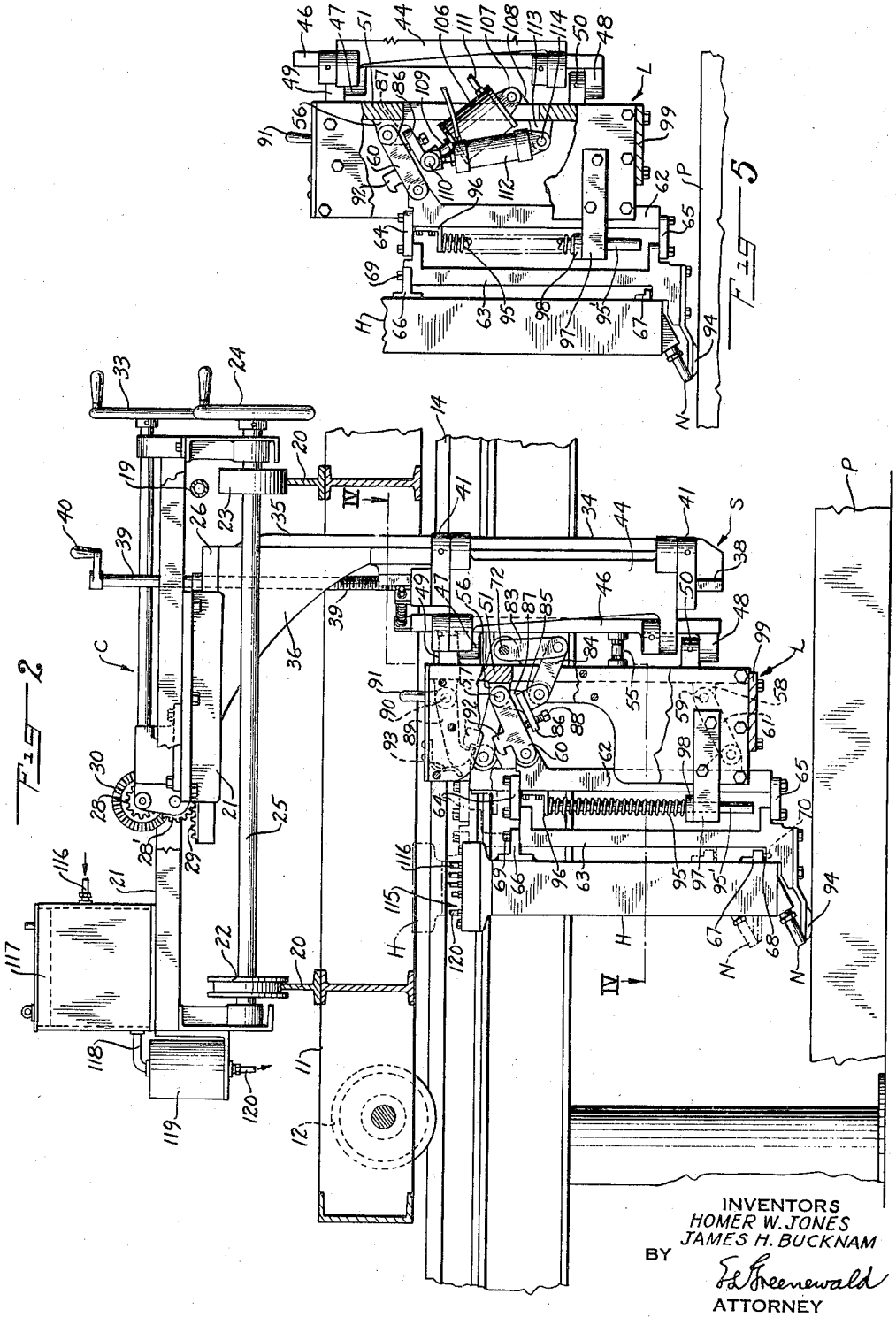
Fig. 1

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BLOWPIPE APPARATUS FOR SURFACE CONDITIONING

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BLOWPIPE APPARATUS FOR SURFACE CONDITIONING

Filed Sept. 16, 1936 3 Sheets-Sheet 3

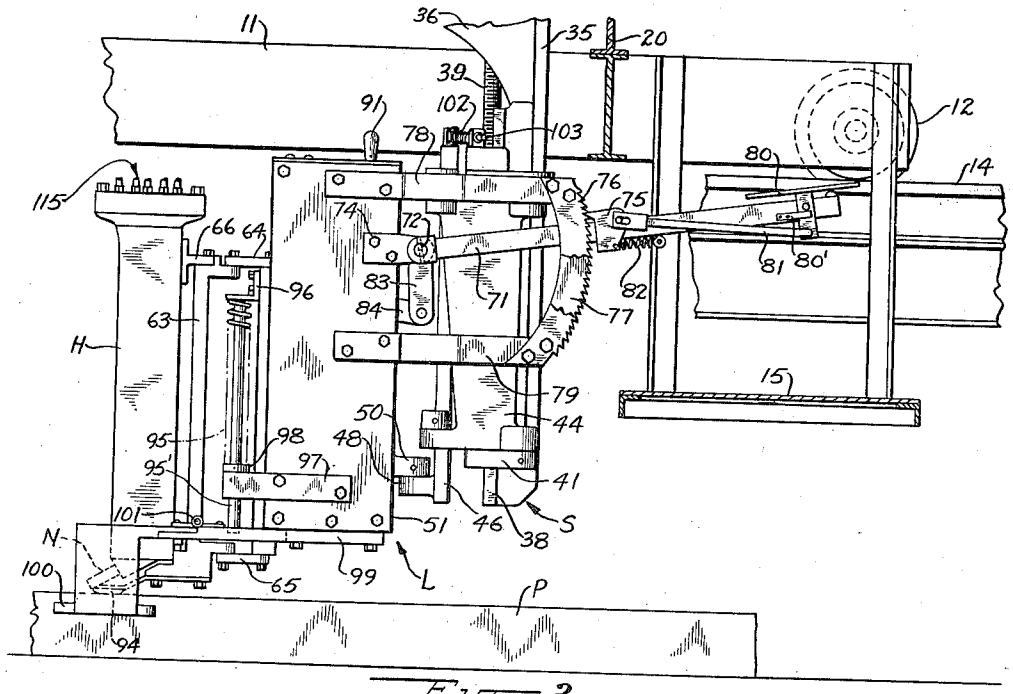


Fig 3

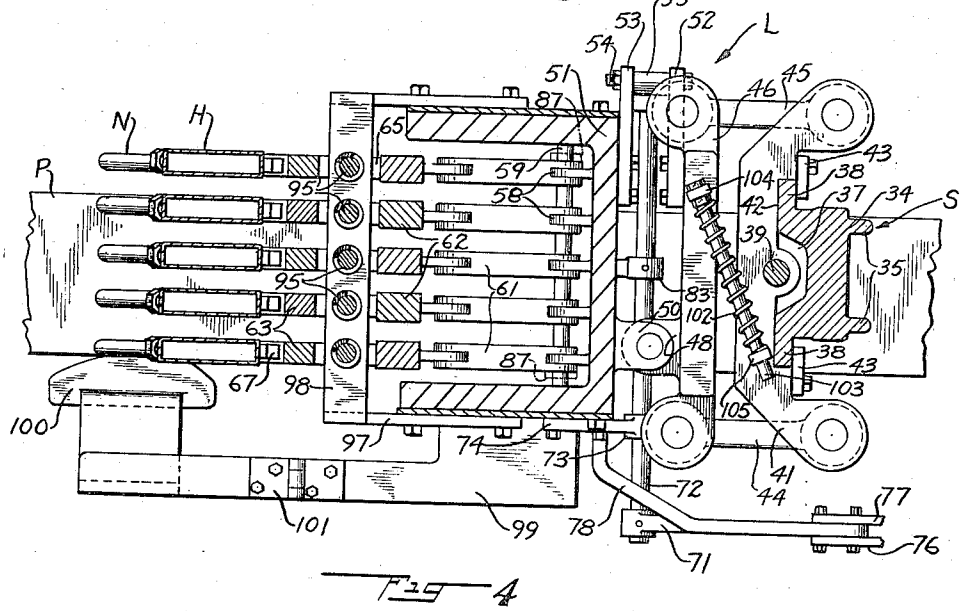


Fig 4

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UNITED STATES PATENT OFFICE

2,223,452

BLOWPIPE APPARATUS FOR SURFACE CONDITIONING

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Application September 16, 1936, Serial No. 101,038

13 Claims. (Cl. 266—23)

This invention relates to the art of conditioning or surfacing metal bodies by means of an oxidizing stream, and more particularly to an improved blowpipe apparatus for projecting gaseous heating and oxidizing jets obliquely against and lengthwise of a surface of a metal body, such as a steel billet, to thermo-chemically remove a surface layer of metal therefrom.

Billets, blooms, slabs and other semi-finished shapes are desurfaced to eliminate surface defects and to improve their surfaces for subsequent rolling. This metal-removing operation is accomplished by suitable apparatus for progressively applying an oxidizing stream obliquely against and lengthwise of the surface while the latter is at an ignition temperature. Heretofore, such apparatus has included a row of blowpipes, having nozzles adapted to deliver jets of heating and oxidizing gases, the several nozzles preferably being sufficiently close together to provide in effect a single wide high temperature heating flame and an associated single relatively wide oxidizing stream of substantially the same width as the surface to be conditioned. The width, as well as the contour or vertical and horizontal camber, of shapes requiring surfacing vary, and therefore the surface-removing apparatus should be sufficiently flexible to be capable of economically and uniformly performing the surfacing operation on metal bodies of different widths and forms.

The principal objects of the invention are: to provide improved mechanism for supporting, manipulating and adjusting such blowpipe apparatus to more effectively and economically perform the metal-removing operation; to provide convenient and quick-acting means for moving the blowpipe units into and out of operating position; to provide means for varying the effective width of the heating flame and the oxidizing stream; to provide means for locking one or more blowpipe units in inoperative position; to provide mechanism for setting and holding the oxidizing stream and heating flame in proper relation to the surface being treated; to provide means whereby the position of the heating flames and oxidizing streams may be adjusted relatively to said surface; to provide spring floating means for each blowpipe unit acting in a direction perpendicular to the surface undergoing treatment; to provide spring floating means for one or more units in a direction parallel to said surface; and to provide an improved cooling system for the blowpipes.

The above and other objects and the novel features of this invention will become apparent from the following description taken with the accompanying drawings, in which:

Fig. 1 is a plan view of a multiple unit blowpipe machine embodying this invention;

Fig. 2 is a vertical section of the machine taken on the line II—II of Fig. 1;

Fig. 3 is a broken elevation of the lower part of the machine shown in Fig. 2;

Fig. 4 is a horizontal section taken on the line IV—IV of Fig. 2; and

Fig. 5 is a fragmental elevation, partly in section, showing a variant form of the mechanism illustrated in the lower part of Fig. 2.

Broadly, the invention comprises means, such as an assembly of blowpipe units disposed side by side, to produce a wide and substantially continuous metal-removing stream, together with means for supporting the assembly in such position with respect to a billet surface from which defects are to be removed that the metal-removing stream will impinge obliquely against the surface across its entire width. The supporting means is adapted to move the assembly back and forth lengthwise of the surface, and also to permit a limited longitudinal, transverse and perpendicular adjustment of the assembly relatively to the surface. The supporting means also carries mechanism for temporarily and quickly moving the entire assembly of blowpipe units toward and away from the surface and for locking selected units in a position displaced from the surface during operation of the machine.

The improved blowpipe assembly and supporting means therefore, as shown, comprises a travelling crane structure C, a supporting frame or abutment S depending therefrom, a linkage system L carried by the abutment S, and a plurality of blowpipe units disposed side by side and separately carried by the linkage system adjacent a ferrous metal body or billet P. Each blowpipe unit comprises a blowpipe head H having a nozzle N thereon which delivers heating and oxidizing jets; and the several blowpipes and nozzles are sufficiently close together to provide a substantially continuous heating flame as wide as the surface and an associated oxidizing stream of the same width.

The travelling crane C comprises a frame 11 having wheels 12, 12 and 13, 13 thereon by means of which the frame 11 may move forward and backward along rails 14, 14. The frame 11 carries thereon a platform 15 upon which an operator may stand and ride with the frame. The frame also supports a motor 16 and a clutch 17, with the usual operating lever 18, clutch con-

trol rod 19 and rheostat 19' for propelling the frame along the rails 14, 14, all more fully disclosed in application Serial No. 732,668, filed June 27, 1934, by Homer W. Jones and Edmund A. Doyle.

Carried on the frame, and forming a part of the crane C, are a pair of tracks 20, 20 perpendicular to the rails 14, 14. A cross carriage 21, likewise forming a part of the crane C, has wheels 22, 22 and 23, 23 whereby it may move along the tracks 20, 20 on the frame 11 perpendicularly to the movement of the frame along the rails 14, 14. The carriage 21 is moved back and forth along the tracks 20, 20 by means of a handwheel 24 above the platform 15 and keyed to one end of the axle 25 of one pair of wheels 22—23.

The supporting abutment S is rigidly suspended from a horizontal slide 26 carried by longitudinal dovetail grooves 27, 27 in the carriage 21. The slide 26 is adjustable relatively to the carriage 21 by a pinion 28' journaled in the carriage and meshing with a rack 29 secured to the slide 26 and extending longitudinally thereof. Thus, turning the pinion 28' will move the slide 26 forwardly or rearwardly on the carriage 21, depending upon the direction of rotation of the pinion 28' by a gear 28 meshing therewith. The gear 28 and a bevel gear 30 are both mounted on an axle journaled in the carriage 21. The gear 30 meshes with a bevel pinion 31 secured to the end of a shaft 32 journaled in the carriage 21 and substantially perpendicular to the axes of the gears 28 and 30. By turning a handwheel 33 keyed to the shaft 32, the operator may turn the pinion 31, the gear 30, the gear 28, and the pinion 28', to move the rack 29, and with it the slide 26, forwardly or rearwardly of the carriage 21.

As best shown in Fig. 4, the abutment S comprises a vertical guide 34 rigidly depending from the slide 26 and having stiffening ribs 35—35 on the rear side thereof. The connection between the guide 34 and the slide 26 is braced by angle plates 36, 36, only one of which is shown in the drawings. (See Figs. 2 and 3.) The guide 34 has a groove 37 formed centrally lengthwise of the front side thereof; and unitary vertical flanges 38, 38 extend laterally of the guide 34 along opposite sides of the groove 37. A vertical shaft 39, held against axial movement, is journaled in the horizontal slide 26, and extends below the latter and along the groove 37. The lower end of the shaft 39 is threaded and engages threads in a vertical slide 41 having its rear face 42 in sliding contact with the front face of the vertical guide 34. Longitudinal flanges 43, 43 secured to the vertical slide 41, extend inwardly over and slidingly engage the rear surfaces of the flanges 38 on the guide 34. The shaft 39, being threaded into the slide 41, provides means for adjusting the height of the latter along the guide 34. Thus, the operator upon the platform 15 may turn the shaft 39 by means of a handle 40 to raise or lower the slide 41 with respect to the crane C and perpendicular to the metal surface to be treated.

The vertical slide 41 has pivoted thereto a pair of links 44 and 45, one at each side thereof. Each link is pivoted to the slide 41 at two points axially in line one above the other, so that the links 44 and 45 are free to swing horizontally or in planes parallel to the surface undergoing treatment. The forward ends of the links 44 and 45 are each pivoted at two points vertically in line to a vertical supporting plate 46. Since the links 44 and 45 are of the same length, they support and swing the plate 46 always in parallel relation to the slide 41. A pair of vertically alined lugs 47 and 48 are formed on the plate 46 adjacent one vertical edge of the front face of the latter; and pivoted coaxially to these lugs are two correspondingly alined lugs 49 and 50 formed on and adjacent one vertical edge of the rear face of a U-shaped main support member or blowpipe carrier 51.

Means is provided for varying the angular position of the blowpipe carrier 51 with respect to the supporting plate 46. A pair of parallel metal strips 52 and 53 are respectively secured to the opposed faces of the plate 46 and the carrier 51 and project laterally beyond the two vertical edges of the plate 46 and carrier 51 which are farthest from the pivotally connected lugs 48 and 50. Coaxial holes are provided adjacent the ends of both strips, and an adjustable bolt 54 passing through a bushing 55 of selected length between the strips 52 and 53 fixes the angular relation between the carrier 51 and the plate 46.

The blowpipe carrier 51 has a series of projections 56 extending forwardly from the upper part of its inside rear wall, and coaxial holes are provided in all of the projections 56 to receive a horizontal pin 57. A similar set of projections 58 are provided on the carrier 51 beneath the projections 56 and coaxial holes through the projections 58 receive a pin 59 which is disposed parallel to the pin 57. A series of upper supporting links 60 are pivoted to the pin 57 and each link is held against lateral displacement by a projection 56 which it straddles. A parallel series of lower supporting links 61 are similarly pivoted to the pin 59. All of the links 60 and 61 are of equal length. A series of vertical supporting bars 62 are severally pivoted at their upper ends to an upper link 60 and at their lower ends to a lower link 61. Each bar 62 may therefore swing upwardly or downwardly supported by an upper link 60 and a lower link 61, and each bar will remain always in vertical position.

A second vertical supporting bar or blowpipe support 63 is adjustably connected to each bar 62 by means of an upper horizontally adjustable link 64 and a lower horizontally adjustable link 65. The pairs of links 64 and 65 are of equal length, and therefore carry the bars 63 always in vertical position, while permitting horizontal angular displacement thereof when the bolts which secure these links to the bars are loosened.

The individual blowpipe heads H are made narrow in order that the several blowpipes will produce a substantially continuous metal-removing stream extending completely across the face of the billet or body to be desurfaced. Obviously, the number of blowpipes used will depend upon the width of the surface layer to be removed. The blowpipe units are separately carried by the linkage mechanism above the billet P in the following manner: Each blowpipe head H has a pair of brackets 66 and 67 secured, respectively, adjacent the upper and lower ends of its rear face. The bracket 66 has a vertical hole therethrough and the bracket 67 has a downwardly extending pin 68 formed thereon. A blowpipe head H is removably secured to each of the bars 63 by means of a bolt 69 passing through the hole in the bracket 66 and into a threaded hole in the top of the bar 63, and the pin 68 centers a hole or socket 70 in the lower part of the bar 63. Since the bolt 69 and the

pin 68 are not coaxial, the connection between the blowpipe head and the bar 63 will be rigid. Any blowpipe head H may be quickly removed from the apparatus by unscrewing the bolt 69 and lifting the head from the bar 63.

A single means is provided for raising all of the blowpipe units together into non-operating position, that is to say, into a position at an appreciable distance from the billet P. As best shown in Figs. 3 and 4, the means here disclosed comprises a lever 71 keyed to a transverse shaft 72 journaled in bearing 73 carried by brackets 74 bolted to the blowpipe carrier 51. One bearing only is illustrated in the drawings. Upward swinging of the lever 71 about the shaft 72 is prevented by a pawl 75 which is pivoted to the lever 71 and coacts with a pair of toothed racks 76 and 77 connected by brackets 78 and 79 to the carrier 51. A pedal 80 for depressing the lever 71 is pivoted adjacent the outer end of the latter; and means, such as a leaf spring 80' secured to the lever 71 and having a free end frictionally engaging the stem of the pedal 80, retains the pedal in any position to which it is adjusted. By turning the pedal 80 about its pivot, a rod 81 may be actuated to withdraw the pawl 75 from engagement with the teeth of racks 76 and 77. A spring 82 tends to press the pawl into engagement with the toothed racks. Carried by the shaft 72 and keyed thereto is a lever 83, here shown as extending downwardly from the shaft 72. Thus, when the pedal 80 is depressed, the lever 83 is turned forwardly about the axis of the shaft 72. As shown in Figs. 2 and 3, a link 84 is pivoted at one end to the lever 83 and is pivoted at its other end to a lever 85 which comprises a transverse bar 86 extending across all of the blowpipe units beneath the upper links 60. A pair of ears 87 at the ends of the transverse bar 86 are pivoted to the pin 57.

From the foregoing, it will be apparent that by depressing the pedal 80 the transverse bar 86 will be lifted and will in turn lift all of the upper links 60. As a result, all of the blowpipe units will be raised when the pedal 80 is depressed until they are in inoperative position. It is preferred not to have the bar 86 make direct contact with the underside of the links 60, but to provide individual adjustments governing the height of each unit. Accordingly, an adjustment screw 88 is provided in the bar 86 for making contact with each link 60, so that the operating distance of each blowpipe unit relatively to the billet surface may be adjusted independently of the other units.

Individual means is provided for locking each unit in inoperative position. As here shown, this means comprises a series of latch members 89 pivoted at 90 on the blowpipe carrier 51 and swingable vertically by handles 91 extending upwardly within reach of the operator. One latch member is provided for each blowpip unit. A hook 92 is secured to the top of each upper link 60 in a position to be engaged by the corresponding latch member 89 when the link is in its uppermost position and when the latch member is depressed by the handle 91. A retaining spring 93 is provided for releasably holding each latch member in its upper and disengaging position when not in use. Accordingly, the number of blowpipe units which is employed may be varied by latching in non-operating position those units which are not to be used, and by permitting the remaining blowpipe units to return by their own weight to their operating positions.

Cushioning means is also provided for supporting each unit resiliently when in operating position. A shoe 94, preferably comprising a wear resistant and high temperature resistant alloy, is bolted or otherwise rigidly attached to the lower part of each of the bars 63, and extends forwardly immediately beneath and in supporting contact with each nozzle N to provide a contact wearing surface upon which each unit may ride upon the surface of the billet. The shoe 94 also serves to position each nozzle N at the proper distance above the billet surface, but the entire weight of a blowpipe unit is not permitted to bear upon the shoe. Some of the weight of each unit is resiliently supported by means of a helical compression spring 95 which surrounds a vertically extending rod 95' fixed to an angle member 96 bolted adjacent the top of each bar 62. An arm 97 is secured to each side of the carrier 51 and extends forwardly thereof to a point adjacent the bar 63. A transverse bracket or shelf 98 rests on the arms 97 and extends across the front of the carrier 51, and has a row of vertical holes therein, one hole being provided for the passage of each rod 95'. The spring 95 surrounding each rod 95' is accordingly compressed between the angle member 96 and the top face of the shelf 98, and resists downward movement of the bar 62 with respect to the carrier 51. When the blowpipe units are lowered into operative position, a spring float for supporting each unit resiliently is thus provided.

Because each blowpipe unit has a separate vertical float, unevenness encountered by any unit will react upon the shoe 94 of that unit only to raise it independently of the other units. Furthermore, longitudinal waves and transverse undulations of the surface upon which the units act will be followed closely because of the separate vertical floats. This mounting compensates for irregularities and twists of the metal body or billet P, and the heating and oxidizing agents will be applied evenly to the billet surface to uniformly condition the same.

Means is also provided for giving the entire blowpipe assembly a lateral float or adjustment in order to compensate for camber in the billet P. As here shown, a bracket 99 secured to one side of the blowpipe carrier 51 and extending forwardly to one side thereof carries, substantially in line with the forward ends of the nozzles N, a shoe 100 in a position to engage the side of the billet. The bracket 99 may be hinged as at 101 so the shoe 100 may be lifted out of operating position. The shoe is caused to bear constantly upon one vertical face of the billet P by means of a spring 102 which encircles a rod 103 attached to a projection 104 on the plate 46. The rod 103 extends through a lug 105 on the guide 34. Thus, the spring 102 is compressed between the lug 105 and the projection 104 and tends to swing the plate 46, as well as the blowpipe carrier 51, transversely of the surface of the billet P, thus pressing the shoe 100 against a vertical side of the billet adjoining the surface to which the stream is applied. The perpendicular and lateral positions of the blowpipes relatively to the billet surface are thus controlled by the contour of the billet. Furthermore, it will be observed that the angular positions of the blowpipe units are not changed because the plate 46 moves always in parallel relation to the guide 34. However, by selecting a bushing 55 of suitable length, the carrier 51 may be set at an angle to the plate 46,

sufficient to cause the desurfacing stream to flow over a lateral edge of the billet surface ahead of the point of impingement of said stream against said surface.

The desurfacing gases and cooling fluid used by the blowpipe units are supplied individually to them through hose connections attached to the top of their heads H which are generally indicated in Figs. 2 and 3 at 115. A cooling medium such as water is circulated through each blowpipe head as more fully disclosed in application Serial No. 78,832, filed May 9, 1936 by James H. Bucknam and Homer W. Jones. In order to avoid wasting water and also to avoid long supply and discharge hose lines, the water is maintained in a closed system in which the heated water discharged from the blowpipes is cooled and then returned to the blowpipe units to cool the latter. As illustrated in Fig. 2, heated water is discharged from the blowpipe heads through a hose connection 116 to a vented tank 117 on the carriage 21 from which the water flows through a connection 118 to a coil or fin cooler 119. From the cooler 119, the cooling water flows back to each blowpipe unit through hose connections as 120. Such an arrangement is also of advantage during severely cold weather when cold water flowing through long pipes is apt to freeze.

In the variant form illustrated in Fig. 5, the pedal-actuated mechanism for raising all of the blowpipe units together into non-operating position is replaced by fluid-actuated mechanism comprising a pneumatic cylinder 106 pivoted at 107 to a bracket 108 on the blowpipe carrier 51. A piston within the cylinder 106 operates a piston rod 109 pivoted at 110 to the free end of the transverse bar 86. A hose connection 111 supplies fluid, preferably air under pressure, to the pressure side of the piston and elevates the bar 86 and with it all of the blowpipe units together. The unlatched blowpipe units may be lowered by releasing the air from the cylinder 106 through a hose connection 111. A dashpot 112 may be provided for steadying the action of the cylinder 106 and, as illustrated in Fig. 5, this dashpot is pivoted at 110 to the bar 86 and at 114 to a bracket 113 on the blowpipe carrier 51.

Briefly, the operation of the apparatus is as follows: The blowpipe units are assumed to be initially adjusted in line and so that their nozzles will together deliver continuous wide associated streams of heating and oxidizing agents obliquely against and lengthwise of the billet surface to be conditioned. Standing upon the platform 15 with the blowpipe heads, the nozzles and the billet end in view, the operator steps upon the pedal 80, thereby elevating all of the blowpipe units well above the billet surface where they are retained in position by the pawl 75. The operator next closes a starting switch (not shown) having three buttons ("forward," reverse," and "stop"), to start the motor 16, and then manipulates the rheostat box 19' to adjust the motor speed and pushes the control rod 19 to his right or left as required to throw in the clutch 17 to move the crane C in the proper direction until the nozzles N are horizontally in line with the starting end of the billet P. If fewer than the entire number of nozzles are required to apply a continuous wide oxidizing stream and high temperature heating flame across the entire width of the top surface of the billet, then the superfluous units (as the uppermost unit shown in Fig. 4) will be latched in non-operating position by pushing forward the required handles 91. The operator now steps upon the pedal 80 and depresses his toe, thereby disengaging the pawl 75 from the racks 76 and 77. By lifting the foot which he has upon the pedal 80, the operator permits all of the unlatched blowpipe units to descend until their respective shoes 94 bear against the billet surface. The handwheel 24 is next turned to move the blowpipe assembly laterally and centralize it relatively to the width of the billet surface. Further vertical and horizontal adjustments may be made by turning the handles 40, 24 and 33, until the nozzles N are located accurately relatively to the starting end of the billet surface and until the shoe 100 bears against the side of the billet. The preheating mixture is then turned on and ignited and, as soon as the end portion of the surface has been raised to an ignition temperature by the preheating flame, the oxidizing gas is turned on. Thereupon the line switch is closed to start the motor and the control rod 19 is moved to engage the clutch 17, to propel the assembly forwardly at the proper speed. The pawls 75 being disengaged, the blowpipe assembly will now follow the upper surface of the billet P, adjusting itself laterally and vertically for camber, twists, and irregularities, to uniformly remove a stratum of metal from the billet surface. Furthermore, only sufficient gas will be used to project a preheating flame and an oxidizing stream of about the same width as the billet surface, since any units not needed will have been shut off and latched in non-operating position. When the far end of the billet is reached, the operation which has just been described may be repeated, either with respect to another billet end to end therewith, or laterally parallel therewith, or with respect to the same billet turned so as to present a different face for desurfacing.

If the pneumatic cylinder 106 is employed instead of the elevating lever 71, a three-way air control valve (not shown) may be manipulated by the operator to elevate the units into inoperative position and to permit their return to operating position.

The embodiments described herein and illustrated in the drawings are disclosed to indicate how the invention may be applied. Certain features of the invention may be used independently of others, and numerous changes may be made in the details of the apparatus here disclosed without departing from the principles of the invention. For example, other types of propelling, supporting and adjusting mechanisms may be utilized; the blowpipe apparatus may be stationary and the billets may be propelled relatively thereto; other types of blowpipes may be employed to apply a stream of oxidizing gas obliquely against and lengthwise of the surface to be conditioned; and some or all features of the invention may be utilized in machines having surface-removing blowpipes disposed horizontally relatively to a vertical surface, instead of vertically relatively to a horizontal surface as here shown.

What is claimed is:

1. Apparatus for thermochemically 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 an oxidizing stream obliquely against and lengthwise of said surface; a carrier; means connecting said blowpipes individually to said carrier for independent movement relatively thereto toward and away from said surface; a

single means operable to move all of said blowpipes away from said surface and into a non-operating position; and means independent of said single means operable to retain each blowpipe separately in such non-operating position.

2. Apparatus for thermo-chemically 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 an oxidizing stream obliquely against and lengthwise of said surface; mechanism for simultaneously moving all of said blowpipes into a non-operating position relatively to said surface; and devices severally associated with each of said blowpipes for separately retaining one or more of said blowpipes in such non-operating position.

3. Apparatus for thermo-chemically 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 an oxidizing stream obliquely against and lengthwise of said surface; mechanism for simultaneously moving all of said blowpipes into a non-operating position relatively to said surface; and devices severally associated with each of said blowpipes for separately retaining one or more blowpipes in such non-operating position; said devices comprising a row of latches equal in number to the number of blowpipes in said row.

4. Apparatus for thermo-chemically removing metal from a surface of a metal body such as a steel billet, comprising the combination of a blowpipe for applying an oxidizing stream obliquely against and lengthwise of said surface; a supporting frame; means, including a link, for adjustably supporting said blowpipe on said frame for movement toward and away from said surface; mechanism for moving said blowpipe into a non-operating position away from said surface; and a latch cooperating with said link to retain said blowpipe in its non-operating position.

5. Blowpipe apparatus comprising the combination of a carriage; mechanism mounted on said carriage for propelling the same; a blowpipe supported by said carriage, said blowpipe having a portion exposed to the high temperature heat produced by the blowpipe and also having a chamber in heat exchanging relation to said portion; a combined heat dissipator and liquid receiver supported on said carriage remote from such blowpipe portion and heat; and conduit means supported by said carriage and connecting said chamber and said receiver so as to provide a closed circulating system for such liquid.

6. Blowpipe apparatus comprising a carriage; means mounted on said carriage for propelling the same; a plurality of blowpipes supported by said carriage and tending to intensely heat parts of said blowpipes, each of said blowpipes having a chamber in heat exchanging relation to the intensely heated part thereof; a combined heat dissipating and liquid receiving means common to all of said blowpipes and supported by said carriage; and a plurality of conduit means severally establishing closed communication between such liquid receiving means and each of said chambers.

7. Apparatus for thermo-chemically removing metal from a surface of a metal body such as a steel billet, comprising the combination of a blowpipe for applying an oxidizing stream obliquely against and lengthwise of said surface; a blowpipe carrier; a supporting frame; means adjustably connecting said carrier to said frame; means movably connecting said blowpipe to said carrier for holding said blowpipe nozzle positioned in such oblique stream applying relation to said surface and for movement of said blowpipe along said carrier in a direction toward and away from said surface; and mechanism including a lever and a foot pedal movably mounted thereon, cooperating with said blowpipe connecting means for moving said blowpipe relatively to said carrier and away from said surface, said mechanism including means operable by movement of said pedal for releasably retaining said lever and said blowpipe in a predetermined position.

8. Apparatus for thermo-chemically removing metal from a surface of a metal body such as a steel billet, comprising the combination of a blowpipe for applying an oxidizing stream obliquely against and lengthwise of said surface; a blowpipe carrier; a supporting frame; means adjustably connecting said carrier to said frame; means movably connecting said blowpipe to said carrier for holding said blowpipe nozzle positioned in such oblique stream applying relation to said surface and for movement of said blowpipe along said carrier in a direction toward and away from said surface; and mechanism including a lever, a pawl carried thereby, and a toothed member engageable by said pawl, said mechanism being arranged for moving said blowpipe relatively to said carrier and away from said surface and for releasably retaining said blowpipe in a predetermined position.

9. Apparatus for thermo-chemically removing metal from a surface of a metal body such as a steel billet, comprising the combination of a blowpipe having a nozzle for applying an oxidizing stream obliquely against and lengthwise of said surface; and adjustable carrier for said blowpipe; means so connecting said blowpipe to said carrier that said blowpipe is supported by but freely movable relatively to said carrier; and mechanism connected to said blowpipe and to said carrier for maintaining said blowpipe nozzle in an operating position adjacent said surface and said stream in substantially uniform angular relation to the longitudinal axis of said body regardless of irregularities and twists along successive portions of said body; said mechanism comprising a shoe secured against said nozzle and to said blowpipe supporting means and adapted to engage the surface to which said stream is applied, and a second shoe secured to said carrier and adapted to engage a surface of said body adjoining the surface to which said stream is applied.

10. Apparatus for thermo-chemically removing metal from a surface of a metal body such as a steel billet, comprising the combination of a blowpipe having a nozzle for progressively applying an oxidizing stream obliquely against and lengthwise of said surface to remove a stratum of metal therefrom; a shoe adapted to bear against the new surface produced and to space said blowpipe nozzle relatively thereto; a blowpipe support; said shoe being rigidly secured to said blowpipe support and having a portion in contact with said nozzle for supporting and protecting the same; and mechanism connected to said blowpipe support for supporting said blowpipe and said shoe and for providing free movement thereof toward and away from said sur-

face; said mechanism including resilient means adapted to cushion the pressure of said shoe against said surface.

11. Apparatus for thermo-chemically removing metal from a surface of a metal body such as a steel billet, comprising the combination of a blowpipe having a nozzle for progressively applying an oxidizing stream obliquely against and lengthwise of said surface; a support for said blowpipe; mechanism yieldingly carrying said blowpipe support for providing movement of said blowpipe toward and away from said surface; a shoe adapted to bear against said surface and to space said blowpipe relatively thereto; said shoe being rigidly secured to said blowpipe support and having a portion in contact with said nozzle for supporting and protecting the same; and resilient means for cushioning both the movement of said blowpipe and pressure of said shoe against said surface.

12. In apparatus for removing surface metal from a metallic body, the combination with a movable carriage operatively disposed with respect to such body and having a depending supporting member; of a group of heads each having blowpipe nozzles and each secured on said supporting member for producing a plurality of oxidizing gas streams arranged to be directed at an acute angle to a surface of the metallic body and in the direction from which metal is to be removed; means for relatively moving said blowpipe nozzles and said body; an auxiliary member having a parallel linkage connecting the same to said supporting member and provided with means for pivotally supporting each nozzle head as an independent unit; and means for maintaining at will each nozzle head individually in an inoperative position spaced from said surface of the body.

13. In apparatus for removing surface metal from a metallic body such as a steel billet and the like, the combination with means for holding such body in a position to be operated upon when at least a portion of a surface thereof has been raised to the oxygen ignition temperature; of means including associated heads and nozzles for delivering oxygen gas as a plurality of streams in a direction having a major component extending in the direction in which the surface removing operation is to be effected and impinged at an acute angle to the plane of the operating direction; means including a carrier having a plurality of members and parallel linkages for pivotally attaching the latter to said carrier, said members removably supporting said associated heads and nozzles in operating positions with respect to said surface and being capable of a limited parallel motion in planes perpendicular to said operating plane, a movable carriage supporting said carrier and attached members and provided with propelling means whereby said associated heads and nozzles may be moved in said operating direction to effect surface removal, and means for individually adjusting and securing each of said associated heads and nozzles in desired operating positions upon a respective one of said members.

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