July 13, 1943. J. H. BUCKNAM ET AL 2,323,974

PROCESS OF AND APPARATUS FOR CONDITIONING METAL BODIES

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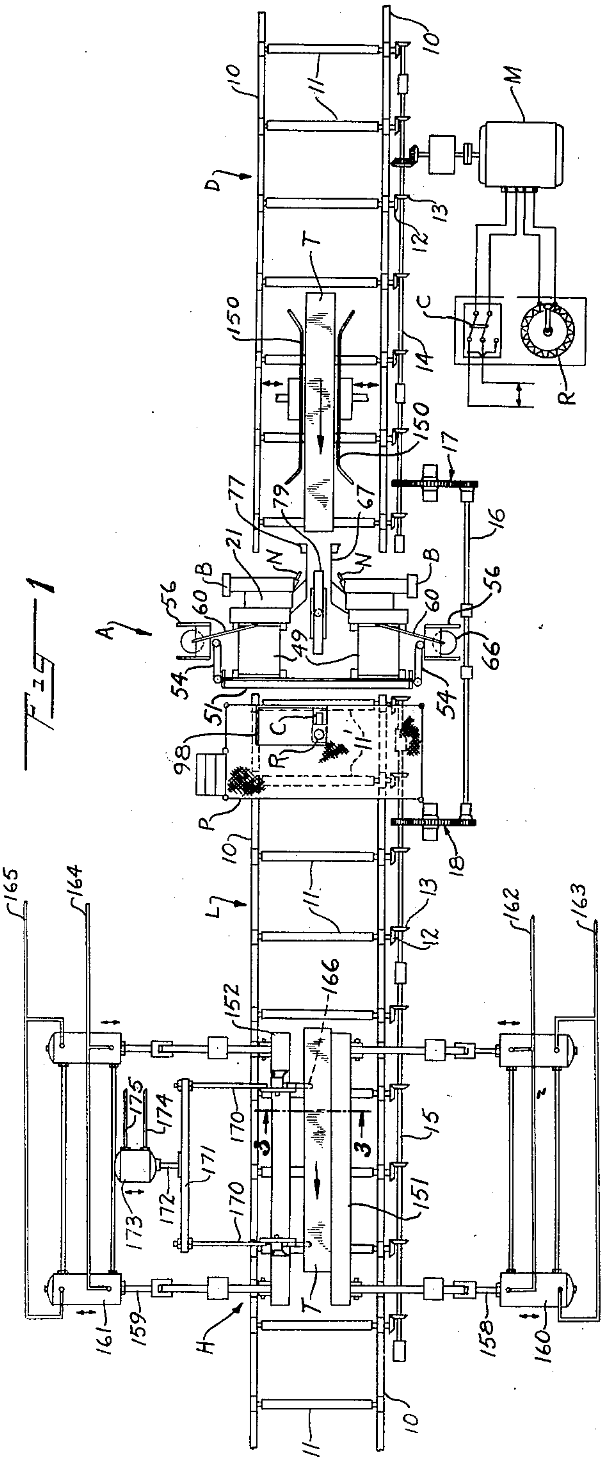

FIG. 1

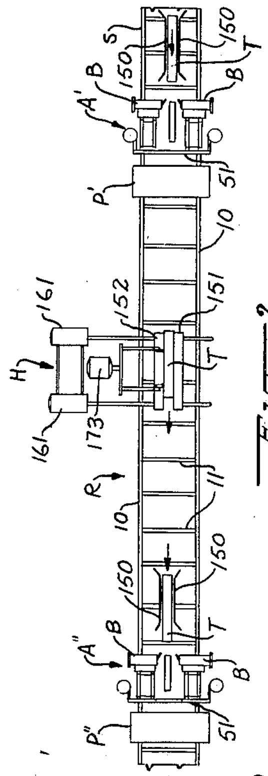

FIG. 2

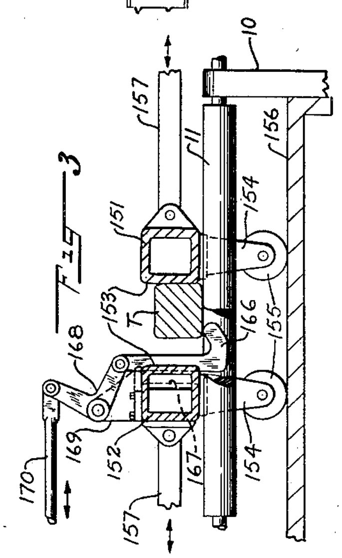

FIG. 3

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PROCESS OF AND APPARATUS FOR CONDITIONING METAL BODIES

Filed July 11, 1936 5 Sheets-Sheet 2

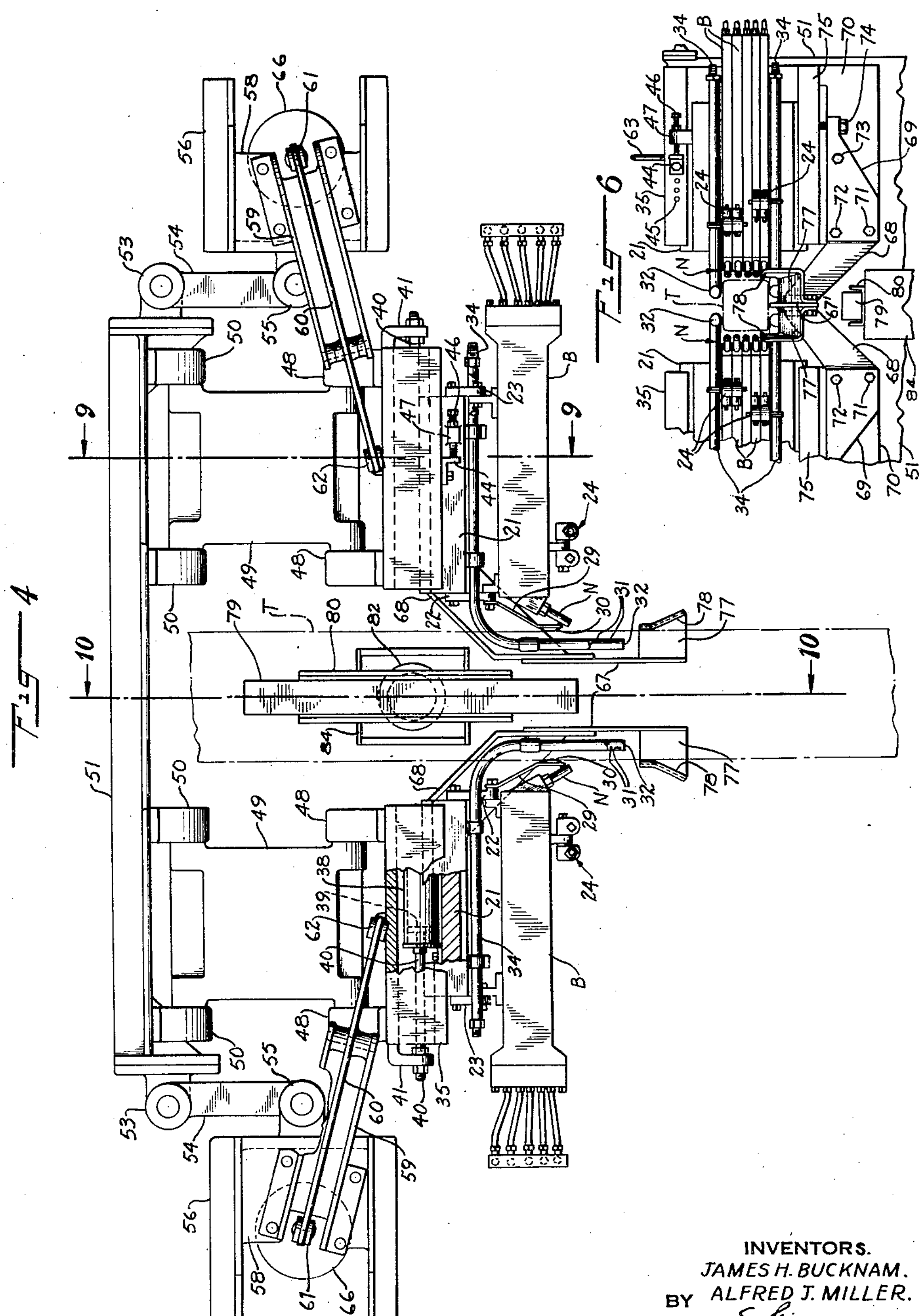

Fig. 4

Fig. 6

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PROCESS OF AND APPARATUS FOR CONDITIONING METAL BODIES

Filed July 11, 1936 5 Sheets-Sheet 3

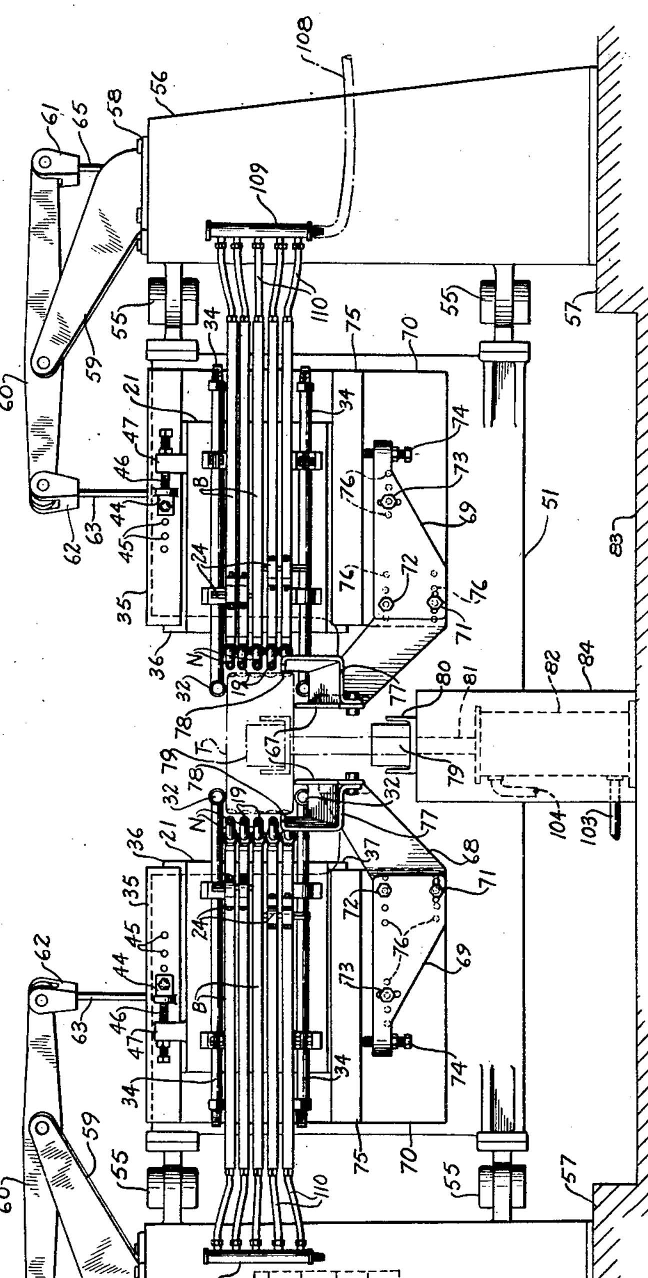

FIG. 5

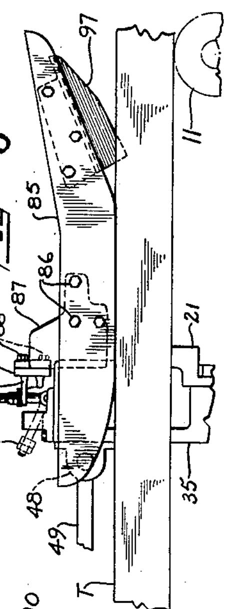

FIG. 8

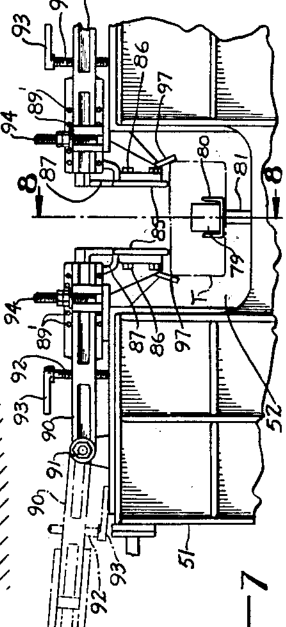

FIG. 7

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PROCESS OF AND APPARATUS FOR CONDITIONING METAL BODIES

Filed July 11, 1936 5 Sheets-Sheet 4

Fig. 9

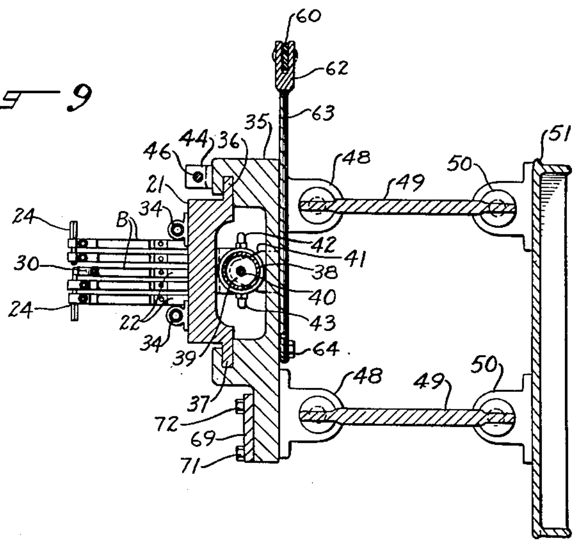


Fig. 10

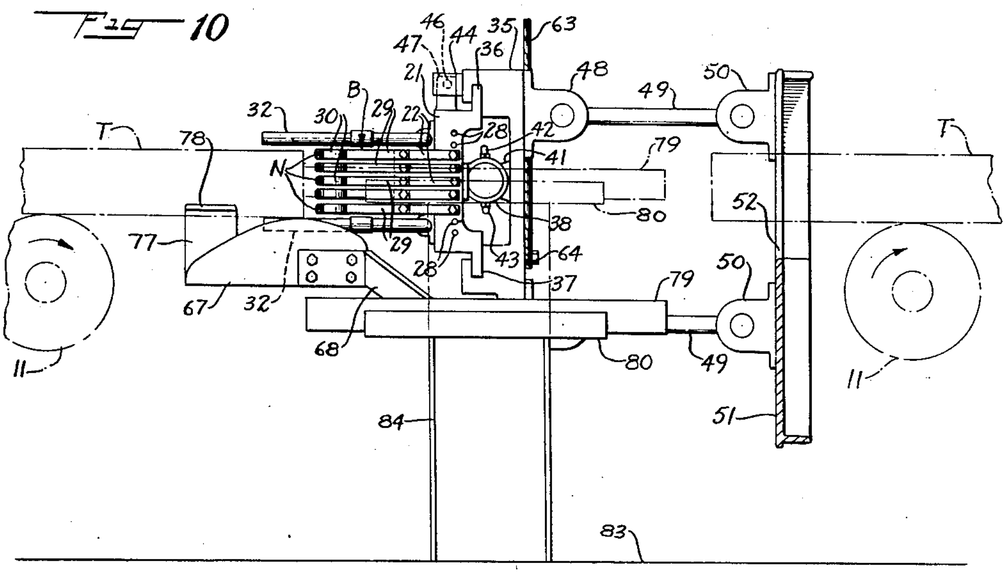
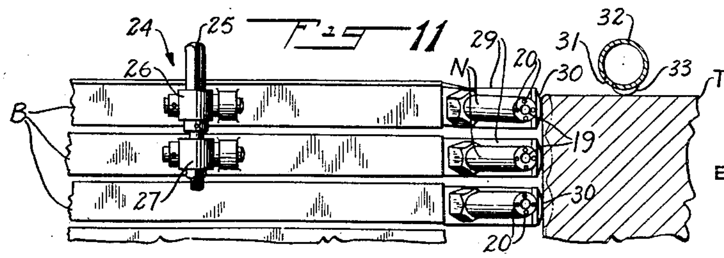


Fig. 11



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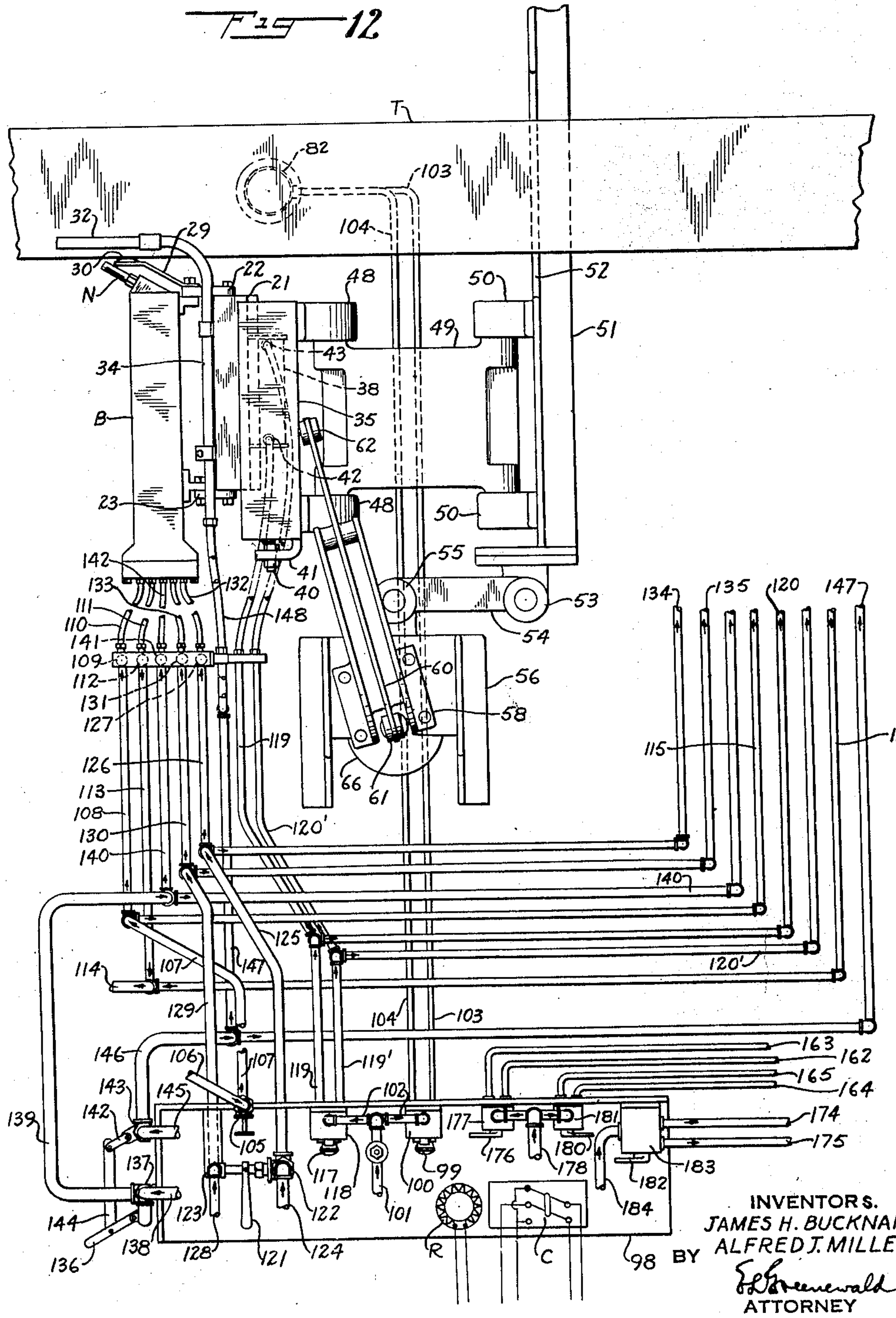
July 13, 1943. J. H. BUCKNAM ET AL 2,323,974

PROCESS OF AND APPARATUS FOR CONDITIONING METAL BODIES

Filed July 11, 1936 5 Sheets-Sheet 5

Fig 12



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Patented July 13, 1943 2,323,974

UNITED STATES PATENT OFFICE

2,323,974

PROCESS OF AND APPARATUS FOR CONDITIONING METAL BODIES

James H. Bucknam and Alfred J. Miller, Cranford, N. J., assignors to The Linde Air Products Company, a corporation of Ohio

Application July 11, 1936, Serial No. 90,204

28 Claims. (Cl. 148—9)

This invention relates to the art of conditioning the surfaces of metal bodies, and more particularly to a process of and apparatus for surfacing semi-finished steel shapes, such as billets, blooms, bars, and slabs, which are utilized in the manufacture of steel products.

In the manufacture of steel, the ingots, while they are at an elevated red heat temperature, are subjected to several rolling operations to reduce their cross section and provide elongated semi-finished shapes from which finished steel products are produced. During such rolling operations, defects and seams appear in the surfaces of the semi-finished shapes and, in order to reduce the number of rejections of finished products subsequently produced, it is desirable to condition such shapes to remove surface defects and seams.

Within recent years, small areas on semi-finished steel shapes have been deseamed manually by progressively applying an oxidizing gas stream obliquely against surfaces which may be heated to their oxygen ignition temperature by applying high temperature heating flames simultaneously with the oxidizing stream. Manual deseaming has not been entirely satisfactory because it is relatively slow and because the semi-finished shapes must cool from a red heat temperature before an operator can perform the deseaming operation, and the semifinished shapes must be reheated to an elevated temperature before subsequent rolling operations can be performed. The elimination of surface defects from metal billets is generally termed billet conditioning and the removal of a layer of surface metal to produce a new surface substantially free of defects has been variously termed desurfacing, surfacing, skinning, scarfing, or scalping. As hereinafter employed, the term desurfacing will be understood to include the operation set forth in this paragraph.

In accordance with our invention, procedure and apparatus are provided whereby the desurfacing of semi-finished shapes can readily be effected thermo-chemically with relatively voluminous oxidizing gas streams during the normal and progressive production of the semi-finished steel, so that a substantial reduction in the cost of manufacturing steel products is effected by eliminating the loss of time in the cooling and subsequent reheating of the semi-finished steel shapes. Additional economy may be effected by removing the surface metal while the shapes are still hot from a preceding rolling operation, since less gas is then used in removing a given quantity of metal and the period of preheating local portions of the surfaces to their oxygen ignition temperature is substantially reduced or eliminated. Additional heat is desirably applied to such hot surfaces when using the present invention, because further advantages are realized, the speed of desurfacing is increased considerably, less heat is lost in transit, and sufficient heat is thereby added to the semi-finished shapes, so that they can immediately pass to the finishing rolls without first placing them in reheating furnaces.

The principal objects of our invention are: to provide a process of conditioning or desurfacing bodies of ferrous metal, preferably while such bodies are at an elevated red heat temperature and in transit between rolling operations in a steel rolling mill; to provide apparatus for carrying out the process which can readily be incorporated in a conventional rolling mill of a steel plant, whereby the desurfacing of semi-finished steel shapes becomes an integral step in the processing and conditioning of steel; to provide a procedure and apparatus for thermo-chemically removing a stratum of metal from a portion of the surface of a metal body while preventing the accumulation of slag or molten metal on an adjoining surface portion of the body; to provide improved apparatus adapted to desurface semi-finished steel shapes while they are either at room temperature or at an elevated red heat temperature; to provide mechanism for stopping and positioning successive semi-finished steel shapes on the conveyor rollers before each desurfacing operation is initiated; to provide means for simultaneously delivering gas streams obliquely against two longitudinal surfaces of the successive semi-finished shapes whereby two entire sides thereof are are conditioned in a single pass; to provide mechanism for automatically maintaining the gas delivering means either in an operative or inoperative position; to mount the gas delivering means in such a manner that they are freely movable or "float" in a plane transverse to the movement of the semi-finished shapes so that desurfacing can be initiated irrespective of the position of the semi-finished shapes on the conveyor rollers; to provide guiding means associated with the gas delivering means whereby each gas delivering means adjacent a surface of a semi-finished shape is independently movable and guided so that, irrespective of any twisting and changes in contour of the steel shapes at the two opposing surfaces to be desurfaced, the gas delivering means adjacent each surface is always properly positioned to desurface the entire face of the steel shape; and to provide mechanism whereby one or two operators can effectively control the operation of desurfacing successive bodies of ferrous metal at one or two desired points in a mill while the bodies are being moved in the direction of their length.

These and other objects and novel features of this invention will become apparent from the following description and the accompanying drawings. In the drawings:

Fig. 1 is a plan view diagrammatically illustrating an embodiment of this invention comprising a desurfacing apparatus interposed between two conveyor sections of a steel mill, one conveyor being provided with means for guiding successive metallic bodies and the other conveyor being provided with mechanism for tilting the bodies;

Fig. 2 is a plan view similar to Fig. 1, diagrammatically illustrating two spaced desurfacers similarly aligned with conveyors equipped with guiding means ahead of each desurfacer and work-tilting mechanism between the two desurfacers;

Fig. 3 is an enlarged view, partly in section and taken at line **3—3** of Fig. 1, illustrating the mechanism for turning over or tilting the metallic bodies;

Fig. 4 is an enlarged plan view, partly in section, of the desurfacer shown in Fig. 1;

Fig. 5 is a front view, in elevation, of the desurfacer shown in Figs. 1 and 4;

Fig. 6 is a fragmentary front view of a modified form of desurfacer similar to that shown in Figs. 4 and 5;

Fig. 7 is a fragmentary rear view of a modified form of desurfacer similar to that shown in Figs. 4 and 5;

Fig. 8 is a fragmentary view taken at line **8—8** of Fig. 7;

Fig. 9 is a sectional view taken at line **9—9** of Fig. 4;

Fig. 10 is an elevational view, partly in section, taken at line **10—10** of Fig. 4;

Fig. 11 is an enlarged fragmentary front view, showing part of one gang of desurfacing blowpipes and an associated blast manifold in position to operate on a billet;

Fig. 12 is a plan view of a part of the apparatus shown in Figs. 1 and 2, and diagrammatically illustrates a control panel and connections for controlling the operation of one gang of blowpipes and nozzles during a desurfacing operation.

In the practice of the present invention, successive bodies of ferrous metal moving in the direction of their length, for example, along a pass line of a steel mill conveyor may be conditioned by desurfacing during or subsequent to rolling operations in a steel mill and while they are at an elevated red heat or rolling temperature. When operating on billets or the like which have a rectangular cross-section, this may be accomplished at one or two desired points in a mill by progressively applying wide substantially vertical oxidizing gas streams obliquely against and lengthwise of opposite vertical sides of the body in such a manner as to remove the surface stratum of metal progressively from successive portions of such non-adjoining surfaces; then turning the body about its longitudinal axis through an angle of 90°, and thereafter either moving it to a second desurfacing station or back to the first desurfacing station, to remove the surface stratum of metal progressively from successive portions of the remaining two sides of the body. During the application of these oxidizing streams, with or without associated preheating flames, air blasts may be directed against the surfaces adjoining those being treated and transversely of the oxidizing streams (and preheating flames), to counteract any accumulation of slag and molten metal on such adjoining surfaces.

Referring to Fig. 1 of the drawings, the desurfacing apparatus A may form a unitary part of a steel rolling mill for processing and conditioning of semi-finished steel shapes. In existing steel plants, the improved desurfacer may be substituted for a section of a conveyor of a continuous rolling mill, and the conveyor sections immediately ahead of and following the desurfacer can be placed under the control of a single operator who also controls all of the operating mechanism of the desurfacing apparatus.

As diagrammatically shown in Fig. 1, the two conveyor sections D and L constituting runways at the delivery and leaving sides of the desurfacer A may comprise a plurality of supporting frames **10** provided with bearings on which are journaled rollers **11** for supporting and for moving successive ferrous metal bodies, such as rectangularly shaped steel billets T, from a blooming mill or stand of rolls of a continuous rolling mill past the conditioning apparatus A directly to the next roll stand or the finishing rolls of the mill. The rollers **11** in the conveyor sections D and L may be driven by a single variable speed motor M provided with a speed regulating rheostat R and a control lever C. As shown, each roller **11** is connected through bevel gears **12** and **13** to a main drive shaft **14** or **15**, and these drive shafts are connected through a shaft **16** and suitable gearing indicated generally at **17** and **18**, respectively, so that all of the rollers in the two conveyor sections are driven by the motor M. Rollers **11'** at the desurfacer A constitute a work support or table for moving the billets through the desurfacer and between the metal removing units B and tools N thereof. Across and above the rollers **11'** of the conveyor section L is arranged an operator platform P which carries the control mechanism, hereinafter to be described, as well as the rheostat R and control switch C of the motor M, so that an operator can readily observe the progress of desurfacing and the condition of the desurfaced billets as they leave the desurfacer. At the same time, the arrangement is such that there is provided a common control station having controls by means of which the operator has personal charge of the entire process.

The desurfacer A has metal removing units comprising oxidizing and fuel gas delivering means constructed and arranged to simultaneously desurface in a single pass opposite vertical sides of each of the billets T. The gas delivery means may consist of two spaced and opposed groups of blowpipes B and their nozzles N disposed opposite the sides of the billets to be desurfaced. As best shown in Fig. 11, each nozzle N may have a central passage **19** for delivering a comparatively large volume of oxidizing gas, such as oxygen or oxygen-containing gas, which will be discharged from the nozzle orifice desirably substantially at atmospheric pressure and will impinge against the surfaces at a velocity desirably between about 200 to 1000 feet per second. However, high discharge pressures and velocities may be employed under some conditions. A plurality of passages **20** surround the central passage 19 and deliver a combustible gas mixture, such as a mixture of oxygen and acetylene, to provide high temperature heating jets. The nozzles are arranged at an acute angle, preferably between 10 to 35 degrees, to the surfaces operated upon, with the individual gas streams delivered in the general direction of the desurfacing operation.

The blowpipes B to which the nozzles N are detachably secured are rectangular in cross section and relatively narrow as compared with their width so that, when they are assembled adjacent to each other, as shown in Fig. 5, the nozzles are relatively close to each other and the individual gas streams merge to provide single gas streams which extend across the entire widths of the vertical sides operated upon. The passages in the nozzles communicate with passages in the blowpipes B, and the gases, as well as cooling water which is circulated through the blowpipes, are supplied through suitable connections at the rear end of the blowpipes, in a manner to be described.

Each blowpipe B is independently mounted on a blowpipe slide 21 by a pair of links 22 and 23 which are secured to the ends of the slide and to the forward and rear parts of the blowpipe, as best shown in Figs. 4 and 10. With this arrangement, the desired spacing of the nozzles can be readily obtained. Since it may be desirable to adjust the top and bottom blowpipe B of each group during operation of the apparatus, so that the gas streams delivered extend to the extreme edges of the vertical sides of the billets, an adjustment of these blowpipes is provided by means which is shown generally at 24 in Figs. 4 and 11. Referring to Fig. 11, such adjustment means may comprise a stud 25 which is rotatable and axially immovable in a sleeve 26 secured to the top blowpipe B. The lower threaded end of the stud 25 extends through and is axially movable in a threaded opening in a sleeve 27, which is fixed to the blowpipe adjacent to the top blowpipe. In each group of blowpipes B, the top and bottom blowpipes are loosely mounted on the blowpipe slides 21, while the intermediate blowpipes are rigidly or fixedly mounted thereon in their desired position. By turning the squared outer end of the stud 25, the stud can be moved axially through the sleeve 27 to move the top blowpipe B toward or away from the adjacent blowpipe to set the nozzle N associated with the top blowpipe in the desired position. Although five blowpipes and nozzles are shown in each group, additional threaded openings are provided at the ends of the blowpipe slides 21, the openings 28 at one end of a slide being shown in Fig. 10, so that larger billets can be desurfaced by mounting additional blowpipes on the slides 21 below and above those illustrated.

To protect the tips of the nozzles N during a desurfacing operation and at the same time maintain them a desired distance from the vertical sides of the billets T, each nozzle is provided with a shoe 29 having one end fixed to the nozzle and the opposite end connected to the link 22, as best shown in Figs. 4 and 10. The portions of the shoes 29 which bear against and ride in the channels or grooves produced by the gas streams are preferably coated at 30 with a wear resisting metal which will withstand the intense heat of the surfaces from which metal has been removed.

During desurfacing, part of the impinging gas and flame tends to flow over the top and bottom surfaces of the billets T, forcing slag and removed metal onto these surfaces; and, when the billets are at a red heat temperature, the slag and removed metal in many instances adhere to and are welded to the billet surfaces. Obviously, such adhering slag and metal is objectionable, because it may produce defects in billets after subsequent rolling operations. Such accumulation of slag and molten metal is counteracted or prevented by suitable means. As best shown in Fig. 11, a gaseous or fluid blast may be discharged obliquely onto and outwardly across these surfaces during a desurfacing operation to deflect away from such surfaces the unused component of the desurfacing flame and gas, as well as slag and molten metal, to inhibit adherence of such slag and metal on the top and bottom surfaces. The force of these blasts is greater than the force of those parts of the gas streams extending above and below the surfaces being desurfaced.

Referring to Figs. 4, 5 and 11, gaseous blasts of sheet-like form may be discharged from a plurality of outlets 31 in manifolds 32 which extend parallel to the conveyor section D and are positioned close to and above and below the top and bottom surfaces and back from the edges of the billets during desurfacing. The portions of the manifolds 32 likely to contact the heated surfaces of hot billets are protected by a suitable wear resisting metal deposited thereon, as indicated at 33. The manifolds 32 are closed at one end and connected at their other end to the curved inner ends of pipes 34 which are mounted on the blowpipe slides 21 above and below the top and bottom blowpipe B of each group. The outer ends of the pipes 34 are connected to a source of compressed gas, such as air or oxygen or a mixture thereof, the discharge of which is controlled by the operator, as will be described later.

In each unit assembly, blowpipe means comprising the blowpipes B, nozzles N, shoes 29 associated with the nozzles N, and a pair of manifolds 32 are all mounted on a blowpipe slide 21. The two slides 21 are severally movably mounted on a pair of supporting members, such as brackets 35, so that the slides and the parts carried thereby can be maintained either in an operative position with the shoes 29 of the nozzles N bearing against the substantially vertical sides of a billet, or in an inoperative position with the nozzles N spaced a considerable distance from such sides. To accomplish this, each bracket 35 is U-shaped, as shown in Figs. 9 and 10, and in the spaced arms at the front face of the bracket are formed grooves which receive the upper and lower flanges 36 and 37 of a blowpipe slide 21. In the spaces between the rear faces of the slide 21 and the front face of the bracket is mounted a fluid actuated device, such as a compressed air cylinder 38 and a piston 39 therein, for moving the slide along the bracket. Referring to Fig. 4, the cylinder 38 is rigidly secured to the rear side of the slide 21, and the piston 39 has a piston rod 40 which is connected at its outer end to an arm 41 secured to the bracket 35.

Compressed air delivered through the upper connection 42, referring to Figs. 4, 9 and 12, into the space at the left end of the piston 39, causes the cylinder 38, slide 21, blowpipes B and nozzles N to move toward the left and assume the inoperative position away from the vertical side of a billet. Conversely, compressed air delivered through the lower connection 43, into the space at the right hand side of the piston 39, causes the cylinder, slide and blowpipes to move toward the right so as to position the nozzles N adjacent to the vertical side of a billet.

Since the blowpipes B and nozzles N are moved with considerable force to their operating position, it is desirable to adjust or limit their movement so that the nozzles N and shoes **29** will not be damaged when they strike a vertical side of a billet. To this end, lugs or stops **44** may be secured to the brackets **35** at any one of a plurality of spaced openings **45**, as shown in Fig. 5, and adjacent these lugs **44** the ends of threaded studs **46** are adapted to bear, the studs **46** being carried by lugs **47** secured to the blowpipe slides **21**. The stops **44** can be fixed at any one of the openings **45**, depending upon the size of the billets being desurfaced, and the position of the threaded studs **46** can be accurately adjusted on the lugs **47** whereby the nozzles N can be maintained at their desired operating position.

The brackets **35** are preferably supported in such a manner that the blowpipes B and nozzles N carried thereby are freely or universally movable in any direction in a plane transverse to the direction of movement of the billets T, so that desurfacing of billets can be readily initiated irrespective of the position of the billets on the conveyor section D. This is accomplished by pivotally connecting the rear faces of the brackets **35** at **48** to the forward ends of horizontal plates or links **49**, the rear ends of which are pivotally connected at **50** to a vertical plate **51**. Two horizontal plates or vertically swingable parallel links **49** are associated with each bracket **35**, as best shown in Figs. 9 and 10, and the ends of all of these plates **49** are pivotally connected to the single vertical plate or connecting member **51**. This common connecting member **51** extends transversely of the apparatus at the rear end thereof and is provided with a central U-shaped recess or opening **52**, best shown in the modification illustrated in Fig. 10, in line with the space between said devices **35** whereby the billets can freely pass through the apparatus during desurfacing.

The vertical connecting member **51** is pivotally connected at **53** at each of its corners to the rear ends of vertical plates or horizontally swingable parallel links **54**, as shown in Figs. 4 and 5, and the forward ends of these links **54** are pivotally connected at **55** to a supporting frame comprising spaced vertically extending portions, such as columns, pedestals or posts **56** which may be secured to a concrete base **57**. With this construction the pivotally connected horizontal plates **49** permit an independent vertical or up and down movement of each group of blowpipes B and nozzles N, and the pivotally connected vertical plates **54** permit a transverse movement of both groups of blowpipes and nozzles in unison.

In order that the blowpipes B, slides **21** and brackets **35** will be freely movable vertically and yet remain supported in the desired operating range, their weight is counter-balanced in a suitable manner. For this purpose the posts **56** are U-shaped in section and have plates **58** secured to their upper ends upon which are mounted brackets **59** that extend upwardly and obliquely toward the front of the apparatus, as shown in Figs. 4 and 5. To the outer ends of the brackets **59** are pivotally secured lever arms **60**, which have clevis members **61** and **62** pivotally connected thereto at their opposite ends. A heavy wire cable **63**, depending downward from each clevis member **62**, is secured at its lower end at **64** to the rear face of the bracket **35**, as shown in Figs. 9 and 10; and another heavy wire cable **65** depends downward from each clevis member **61** into the interior of a post **56**; and upon this cable are supported a number of heavy weights **66**. The counter-balancing mechanism just described is adjusted in a suitable manner, as will be described hereinafter, whereby the blowpipes B and nozzles N of each group will be maintained in their desired operating position.

Since each group of blowpipes B and nozzles N is independently movable vertically and both groups are transversely movable as a unit, it is possible to provide separate guiding means which cooperates with the billets and each group of nozzles N. Referring to Figs. 5 and 10, each guiding means associated with a group of blowpipes B may comprise a vertically disposed guide plate **67** which is parallel with the conveyor section D and adapted to bear against the underside of a billet near a vertical side thereof. The upper edge of each guide plate is convex-shaped with the forward part sloping downward for a considerable distance, as shown in Fig. 10. The rear end of each guide plate **67** is secured to the upper end of a guide arm **68** which extends obliquely downward and rearward toward a bracket **35**. As best shown in Fig. 5, each guide arm **68** forms one arm of a relatively large angle member, the other arm of which serves as a bracket **69** which is mounted on an apron or plate **70** secured to and depending from a bracket **35**. In mounting the bracket **69** on an apron **70**, the bolt **71** at the lower inner corner is first loosely fastened. The two bolts **72** and **73** which form a triangle with the bolt **71** are then loosely fastened in slots formed in the apron **70**. With this arrangement, the desired position of the guide plate **67** can be obtained by turning a threaded stud **74** which extends through an opening at the outer end of the bracket **69** and bears against the underside of a forwardly extending flange **75** formed at the upper edge of the apron **70**. After the guide plate **67** is at its desired position, the bracket **69** is rigidly secured to the apron **70**. A number of slots or openings are formed in the aprons **70**, as indicated at **76**, whereby the brackets **69** can be mounted on the aprons **70** in many different positions, so that the guide plates **67** can be properly positioned for billets of different sizes. With this arrangement, the guide plates **67** automatically follow the underside of the billets, and every vertical movement of these plates **67** is transmitted to the brackets **35** upon which the blowpipes B and nozzles N are mounted. In this manner, the nozzles N automatically move vertically with the guide plates to insure that the gas streams will always be effectively delivered to the entire vertical sides of billets being desurfaced, even though the billets may be twisted, bent, or have irregular contours. Further, each group of nozzles is guided by its own independent guide plate **67** because in many instances the surface contour of billets is considerably different at its opposite sides.

The successive billets T will not all be in the same position on the rollers **11** of the conveyor section D, before being presented to the desurfacer A. In order that desurfacing may be initiated automatically each time a billet approaches the desurfacer, means is provided whereby both groups of nozzles N will move transversely a limited amount to be in position to initiate a desurfacing operation. This may be accomplished by securing to the lower edge of each guide plate **67**, at the forward end thereof, the flange of an

L-shaped member 77, as shown in Figs. 4, 5 and 10, the vertical arm of which extends above the top edges of the plate 67 and is provided with an inwardly extending flange 78. The rear portion of this flange is substantially parallel to the guide plate 67 and bears against the vertical side of a billet during desurfacing. From this rear portion toward the front portion thereof, the vertical arm of each L-shaped member 77 flares outwardly. Thus, when a billet is being moved toward the desurfacer and is off-center on the rollers 11 with respect to the normal central position of the guide plates 67 and nozzles N and associated blowpipes B, the billet will strike the flared portion of a member 77. Since the member 77 is carried by the bracket 35 which in turn is pivotally mounted on the vertical plate 51 at the rear of the apparatus, the plate 51 will move transversely of the conveyor sections D and L and shift both groups of blowpipes B and nozzles N, which are pivotally mounted thereon, to a position substantially in alignment with the forward end of the billet. As the billet moves forward, it rides along the top edges of the guide plates 67 and the flanges 78 of the L-shaped members 77. Since the rear portions of the flared flanges 78 also bear against the vertical sides of the billet during desurfacing, the blowpipes B and nozzles N are guided transversely as well as vertically, and in this manner a universal movement of both groups of nozzles N is provided in a plane transverse to the direction of movement of the billets. Even though the two groups of blowpipes B and associated nozzles N are moved laterally when a billet T is not in exact alignment with the normal central position of the blowpipes and nozzles, it will be seen by referring to Fig. 4, that such movement is transmitted from the L-shaped members 77 to the brackets 35 from a region ahead of the position of the nozzles N. Thus, the contour of the billet may not be the same at the position of the nozzles N and the region where the side of a billet contacts the L-shaped member 77. In such instances, the nozzles N can freely move laterally with and against the air pressure in the cylinders 38. Stated another way, the air pressure in the cylinder 38 biases the nozzles N toward the vertical side of a billet, but when the contour of the billet changes and tends to force the nozzles N and blowpipes B backward on the bracket 35, the pneumatic operating means provided for biasing the nozzles to their operating position permits the slides 21 and gas delivering means carried thereby to move laterally against the pressure of the air within the cylinders 38.

The top edges of the guide plates 67 and edges of the flanges 78 are preferably coated with a suitable wear resisting metal which will withstand the intense heat of the surfaces against which they bear. To insure a positive guiding in the vertical direction, a sufficient number of weights 66 is provided so that the lever arms 60 tend to lift the brackets 35 and guide plates 67 which they carry. In practice it has been found that, when the total weight of the weights 66 exceeds by about 50 pounds the weight of the parts of the desurfacer mounted on the transverse vertical plate 51, the guide plates 67 effectively guide the nozzles N vertically with changes in contour of the billets during desurfacing.

When successive billets are delivered on the conveyor section D, the operator stops the driving motor M as each billet approaches the desurfacer. In many instances the ends of the billets are sheared off or cropped after the billets have been desurfaced. In such cases, the operator controls the driving motor M until the forward end of each billet is about 4 or 5 inches past the tips of the nozzles N, after which the nozzles are moved to their operative position, adjacent the vertical sides, so that a desurfacing operation can be initiated. In some instances the ends of billets are cropped before they are desurfaced for example by the customary hot shear associated with the steel mill bloom conveyors, and in such cases it is necessary to initiate a desurfacing operation at the extreme forward end of each billet. To position the billets properly in such cases so that unnecessary maneuvering of the billets is avoided in the loading station portion of the conveyor D, suitable stopping mechanism is provided. Referring to Figs. 4 and 5, such stopping mechanism may comprise a heavy steel bar 79 which is rectangular in section and disposed parallel to and in alignment with the conveyor section D. The bar 79 is rigidly secured within a shorter channel member 80, which in turn is secured intermediate its ends to the upper end of a fluid-actuated piston rod 81 of a fluid cylinder 82 which is mounted in the pit 83 of the concrete base 57. The rod 81 is operated in a well known manner to raise and lower the bar 79, the upper and lower positions of this bar being shown in dotted and solid lines, respectively, in Fig. 5. In the lower position of the bar 79, the channel 80 rests across the open end of a casing 84 which houses the cylinder 82. The forward end of the bar 79 is properly positioned so that, when a billet strikes this bar, the billet will be in such a position in the loading station that desurfacing can be commenced at the extreme forward end of the billet. Although the stopping mechanism is of rugged construction, it is not intended to stop billets when they are moving at a rapid rate on the conveyor section D. Even in such cases, the operator controls the driving motor M so that the billet is moving very slowly when it is about to be stopped by the bar 79.

When the billets to be desurfaced are relatively large in cross section or are bent and twisted considerably, it is preferable to employ two independent guide plates 67 each associated with a group of blowpipes B and nozzles N. When billets relatively small in cross section are to be desurfaced, a single guide plate may be used to guide both groups of blowpipes and nozzles. Such a modification is shown in Fig. 6 wherein a single guide plate 67', similar in shape to the plate 67 shown in Fig. 1, is provided. Both L-shaped members 77 having flanges 78 are secured to the forward end of the plate 67', and the two guide arms 68 extending forward and upward from the brackets 69 are secured to the rear end of this plate. With this arrangement, both groups of blowpipes and nozzles move vertically in accordance with movements of the single guide plate 67' as it rides and bears against the underside of billets being desurfaced.

The guiding means associated with the blowpipes and nozzles may be arranged to bear against the top as well as the underside of billets. Such a modification is shown in Figs. 7 and 8, and may comprise vertically disposed guide plates 85 which bear against the top surfaces of billets. These plates 85 are relatively long, are convex shaped at their rear ends, and extend upwardly and deflect outwardly at their front ends. Intermediate their ends each guide plate is secured at 86 to the vertical portion of an angle bracket 87, the horizontal portion of which bracket is secured at 88 to a plate 89 welded to the inner end of an arm 90. A plurality of openings may be formed on the plate 89, as indicated at 89', so that the bracket 87 can be secured at different positions on the plate 89 to maintain the guide plate 85 at any desired position, depending upon the size of the billets to be desurfaced. The arm 90 is pivotally mounted at 91 on the bracket 35, and intermediate its ends is provided with a threaded opening through which extends a stud 92 adapted to bear against the top surface of the bracket 35. By turning a handle 93 fixed to the stud 92, the guide plate 85 may be adjusted to its desired vertical position; and the guide plate can be maintained in this position by a stud 94 which is pivotally connected to the bracket 35, the stud having a lock nut and being adapted, when in a vertical position, to fit into a recess formed on a lug 95 which is fixed to the rear side of the plate 89. When it is desired to move billets along the conveyor and not desurface their vertical sides, each guide unit can be swung about the pivotal connection at 91 to an inoperative position, as indicated in dotted lines in Fig. 7.

To the inner surface of the front portion of each guide plate 85 is secured a small rectangular-shaped bar 96, and to the outer edge of this bar is fixed an angle member 97 having its front end deflecting outwardly and its rear end extending downwardly so that it will bear against the vertical side walls of a billet, as shown in Fig. 7. With this arrangement, each group of blowpipes and nozzles is guided vertically as well as laterally with changes in contour of the top and side walls of the billet, such guiding movements being transmitted to the blowpipes through the vertical guide plate 85 and angle member 97. In this modification, it is preferable that the weight of the parts supported by each wire cable 63 exceed by about 50 pounds the total weight of the weights 66, so that the guide plates 85 will effectively bear on the top surfaces of the billets and guide the blowpipes and nozzles with changes in contour of the billets.

As in the embodiment described above and illustrated in Figs. 4 and 5, the guide plates 85 and angle members 97 are effectively utilized to shift both groups of blowpipes B and nozzles N laterally, so that the nozzles N will be properly positioned to initiate a desurfacing operation. In this modification, if a billet approaching the desurfacer is not in alignment with the normal central position of the groups of nozzles N, the billet will strike the outwardly deflecting front ends of the angle members 97. This will cause the guide plates 85 to shift laterally, and in so moving will also move laterally the brackets 35 which carry both groups of blowpipes and nozzles. The surfaces of the angle members 97 and bars 96 which contact and bear against the surfaces of the billets are coated with a suitable wear resisting metal which will withstand the high temperature of the billet.

In some instances it may be desirable to move the billet sideways in the loading station of conveyor D so that they will not be too far out of alignment with the desurfacer A before a desurfacing operation is initiated. To this end spaced and parallel guide bars 150 having diverging ends are provided ahead of the desurfacer, as shown in Fig. 1, these bars being supported above the rollers 11 in any suitable manner and preferably adjustable so that billets of different sizes can pass between the guide bars.

After a billet passes through the desurfacer A at one desired point in the mill and the opposite vertical sides thereof are desurfaced, it may be desirable (where only one desurfacer is employed) to tilt or turn over the billet on the leaving conveyor section L and move the billet back to the loading station of conveyor D so that its other two vertical sides can be desurfaced by the same desurfacer. Such apparatus H for turning over the billets on the conveyor section L is diagrammatically shown in Figs. 1, 2, and 3, and may comprise a pair of heavy movable guides 151 and 152 which are hollow and rectangular-shaped in cross section. To the inner walls of these guides may be secured steel wearing faces 153 which can be replaced when they are worn out. To the lower walls of the guides 151 and 152 are secured depending arms 154 having rollers 155 journaled at the lower ends thereof which are adapted to move on a roller bed 156 disposed beneath the rollers 11 of the conveyor section L. The ends of the guides 151 and 152 are connected to arms 157 which in turn are connected to fluid-actuated devices, such as the outer ends of the plungers 158 and 159 of hydraulic cylinders 160 and 161, respectively. Water under pressure is delivered through the pipes 162, 163, 164, and 165 to the cylinders 160 and 161, as will be hereinafter described, to move the guides 151 and 152 into and out of their operative positions. After a billet has passed through the desurfacer A and it is adjacent to the guides 151 and 152, the guide 151 is moved inwardly the full extent of movement of the plunger 158, as thereafter the guide 152 is moved inwardly a slight distance to the position shown in Fig. 3. A plurality of hooks 166 are disposed at one side of the guide 152 (only two being shown in Fig. 1), and in their lower position fit into recesses 167 formed at the inner face of the guide. The upper end of each hook is pivotally connected to one arm of a bell crank 168 which is pivotally secured to a bracket 169 mounted on the top face of the guide 152. The opposite arm of each bell crank 168 is pivotally connected to one end of a connecting rod 170, the opposite end of which is connected to a bar 171 which is secured to the outer end of the plunger 172 of an air cylinder 173.

With the guides 151 and 152 in the position shown in Fig. 2, compressed air is delivered through pipe 174 into the cylinder 173, which will retract the plunger 172 and raise the hooks 166 to tilt the billet T and turn it over about its own axis onto an adjacent side. After the billet is turned 90°, compressed air is admitted to pipe 175 into the cylinder 173 which will move the plunger 172 inwardly whereby the hooks 166 are lowered into their recesses 167. The guide 152 is then moved inwardly to move the billet T sideways or laterally against the guide 151 so that the billet will be in alignment with the desurfacer A for movement back to the delivery conveyor D. The guides 151 and 152 are moved to their outermost position, and the billet T is moved backward on the conveyor section L and past the apparatus A by reversing the direction of rotation of the driving motor M through proper movement of the switch C. The parallel guide bars 150 will tend to maintain the proper alignment of the billet T when it is moved onto the conveyor section D, and the direction of rotation of the driving motor M is again reversed through the switch C to move the billet forward and toward the desurfacer to desurface the other sides of the billet.

When two desurfacers are employed as an integral part of a steel mill in the processing and conditioning of semi-finished steel shapes, they are spaced apart a suitable distance so that successive desurfacing may be effected at two desired stations in the mill. As diagrammatically shown in Fig. 2, for example, the two desurfacers A′ and A′′ may be positioned at the opposite ends of an intermediate conveyor section R. A platform P′ is provided for one operator for controlling the operation of the first desurfacer A′ and the conveyor section S; and a similar platform P′′ is provided for a second operator for controlling the second desurfacer A′′ and the conveyor section R, the second operator preferably controlling the operation of the apparatus H for turning over the billet T which is disposed between the two desurfacers. With such an arrangement, the necessity for reversing the direction of movement of the billet to desurface all sides thereof is avoided, and the desurfacing can be effected with greater speed and economy.

It has previously been stated that the control mechanism for operating the apparatus, as well as the motor control, are mounted on the operator platform P at the rear of the apparatus and thus are located at a common remote control station. Referring to Fig. 12, the different control levers necessary may be arranged on a small table 98, and suitable pipes and flexible conduits may be provided for conducting gases, water and air to different parts of the apparatus. The control mechanism will perhaps be best understood from the operation of the apparatus, particularly the embodiments illustrated generally in Figs. 4 and 5, which is substantially as follows:

It will be assumed that the proper number of blowpipes B and nozzles N have been mounted by means of the links 22 and 23 on the blowpipe slides 21, so that the entire vertical sides of particular size billets can be desurfaced in a single pass; that the intermediate blowpipes B have been rigidly secured in their desired position, whereby the individual gas streams delivered by the nozzles N will merge and in effect form a single large stream which impinges against and extends across the entire vertical sides of billets; that the top and bottom blowpipes B of each gang of nozzles N have been positioned by the adjustment means 24, so that the nozzles associated with these blowpipes will deliver gas streams to the extreme edges of the vertical sides; that the manifolds 32 are properly positioned on the slides 21 to deliver gaseous blasts to the top and bottom surfaces of the billets which will prevent slag and removed metal from collecting and adhering on the sides not being desurfaced; that the lugs or stops 44 are positioned at the proper openings 45 in the main brackets 35 and the cooperating studs 46 adjusted, so that the extent of movement of the slides 21 is limited the desired amount when the slides are actuated inwardly to place the blowpipes B and nozzles N in an operative position; that the guide brackets 69 have been mounted on the aprons 70 in the preferred position and adjustment made with the studs 74, whereby the vertical guide plates 67 and lateral guide flanges 78 will bear at the desired positions on the vertical and undersides of the billets during a desurfacing operation; and that the blowpipes B and nozzles N are in their inoperative position.

With the above assumed conditions, an operator standing on the platform P is ready to assume operation of the apparatus. Assuming that the ends of the billets T have been cropped and that desurfacing must be initiated from the extreme forward end of each billet, the operator moves lever 99 of an air control valve 100 from an "off" position to a position whereby compressed air is delivered from a suitable source through pipes 101 and 102, the valve 100, and conduit 103 to the lower portion of the air cylinder 82, as shown in Figs. 12 and 5. This will raise the stopping bar 79 to its upper position, as indicated in dotted lines in Fig. 5.

When a billet T on the conveyor section D approaches the desurfacer, the operator slows down the speed of the driving motor M through the control rheostat R, so that the billet moves very slowly on the conveyor D and comes substantially to a complete stop at the instant the billet strikes the stopping bar 79. In this position, the tips of the nozzles N are adjacent the forward end of the billet and effective to initiate a desurfacing operation from the extreme forward end of the vertical sides. The operator then immediately moves the lever 99 of the air valve 100 to a second operating position whereby the air admitted to the air cylinder 82 through the conduit 103 is permitted to discharge into the atmosphere and air is delivered from the valve 100 through conduit 104 into the upper portion of the cylinder 82. This will lower the stopping bar 79 to an inoperative position below the billet T, as shown in solid lines in Fig. 5, and the lever 99 is subsequently moved to its off position, which shuts off the supply of air to the cylinder 82.

When the ends of billets are cropped after the desurfacing operation, the stopping bar 79 and operating mechanism therefor may be eliminated. In such instances, the operator reduces the speed of the driving motor M as each billet approaches the desurfacer, and the billet is brought to a stop on the conveyor after the extreme forward end of the billet has passed the tips of the nozzles N.

Before the first billet is desurfaced, the valve 105 is opened to permit water to circulate through the blowpipes B so that they will be continuously cooled and also effect cooling of the nozzles N. Water under pressure will thus flow from a suitable source of supply through pipe 106, valve 105, pipe 107, and conduit 108 to the inner end of a vertical manifold 109, as shown in Figs. 5 and 12. From this manifold water is delivered through a plurality of flexible conduits 110 to each blowpipe B, and flows therefrom through other flexible conduits 111 connected to a manifold 112, the lower end of which is connected to conduit 113 communicating with a water outlet pipe 114. Water is also delivered to and returned from the group of blowpipes B at the opposite side of the apparatus through pipes 115 and 116 which communicate with the pipes 107 and 114, respeceively.

With the cooling water circulating through the blowpipes B and the stop bar 79 in its lower or inoperative position, the operator moves the lever 117 of a second air valve 118 from an "off" position to a position which will deliver air from the pipes 101 and 102 through the valve 118 and conduit 119 to the lower connection 43 of the air cylinder 38, as shown in Fig. 12. The cylinder 38 at the opposite side of the desurfacer is operated in the same manner, and air is delivered thereto through the branch pipe 120 which communicates with the conduit 119. This will cause the air cylinders 38 and blowpipe slides 21 upon which they are mounted to move inwardly toward the vertical sides of the billet to place the nozzles N in their operating position.

Although desurfacing can now be initiated, with the billets at an elevated red heat temperature, it may be desirable to deliver high temperature heating jets to the vertical sides. This is accomplished by moving the handle 121 which simultaneously opens valves 122 and 123 to permit a combustible gas, such as acetylene, and a combustion supporting gas, such as oxygen, to be delivered to the blowpipes B. The combustible gas flows from a source of supply through pipe 124, valve 122, pipe 125 and conduit 126 to the lower end of a manifold 127; and the combustion supporting gas flows from a source of supply through pipe 128, valve 123, pipe 129 and conduit 130 to the lower end of a vertical manifold 131. From these manifolds 127 and 131 the gases are delivered through a plurality of flexible conduits 132 and 133, respectively, to each blowpipe B, and these gases are effectively mixed in the blowpipes B to provide a combustible gas mixture which is delivered from the passages 20 of the nozzles N. To regulate the proportion of combustible gas entering into this gas mixture, a valve may be provided at the lower end of the manifold 127. These gases are also delivered to the blowpipes B at the opposite side of the apparatus in the manner just described, and branch pipes 134 and 135, which are connected to pipes 125 and 129, are provided for this purpose.

The jets of combustible gas will ignite when they impinge against the heated surfaces of the billet, and, since these surfaces may be substantially at the temperature at which oxygen will react thermo-chemically therewith, oxygen or an oxidizing gas having a high proportion of oxygen is immediately delivered to the blowpipes B. This delivery of oxygen is effected by moving the lever 136 of a valve 137 which permits oxygen to flow from a source of supply through pipe 138, valve 137, pipe 139, and conduit 140 to the lower end of a manifold 141. The oxygen flows from the manifold 141 through a plurality of conduits 142 to each of the blowpipes B, and a relatively voluminous amount of oxygen is discharged from the passage 19 of each nozzle N and discharged against the hot vertical sides of the billet.

The control mechanism is preferably arranged so that the delivery of gaseous blasts to the top and bottom sides of the billet is automatically effected when the oxygen supply valve 137 is opened. To accomplish this, the control lever 142 of a valve 143 is connected through a link 144 to the control lever 136 of the oxygen valve 137. When the oxygen valve 137 is opened, therefore, the valve 143 is opened at the same time to permit the flow of a gas, such as air or oxygen or a mixture thereof, from a source of supply through pipe 145, valve 143, pipes 146 and 147, and a conduit 148 which communicates with the pipes 34 to which the manifolds 32 are connected.

Substantially at the moment the oxygen and air valves 137 and 143 are opened, the operator moves the control lever C of the driving motor M whereby the billet passes from the delivery conveyor section D to the leaving conveyor section L. The high temperature heating jets and relatively voluminous oxidizing gas streams discharged from the nozzles N are discharged against the vertical surfaces across their entire widths, the oxidizing gas reacting with the heated surface metal and causing it to ignite and burn. This burning or oxidization of surface metal takes place progressively as successive portions of heated surface metal are subjected to the influence of the oxidizing gas, a reaction zone or "puddle" being constantly maintained at the point of impingement of the gas on the surfaces. A stratum of metal is thus removed from each surface and a plurality of contiguous shallow parallel channels or grooves having gradually sloping sides are produced, as best indicated in dotted lines at the side walls of the billet T shown in Fig. 5. The oxidizing gas stream forces away the oxidized molten surface metal from the reaction zone, and this mixture has been termed a "slag." Although surface metal can be reduced completely to an oxidized form, it has been found in practice that a portion of the surface metal can be removed while in a partially oxidized state and another portion in an unoxidized state and molten form, thus effecting considerable economy in the amount of oxidizing gas required to remove a stratum of surface metal from a body of ferrous metal.

After the completion of the desurfacing operation, the handle 121 is moved to its off position to close the valves 122 and 123 and stop the flow of combustible gas and combustion supporting gas to the blowpipes B; and the handle 136 is moved to its off position to close the valves 137 and 143 and stop the flow of oxygen to the blowpipes B and to stop the flow of air to the manifolds 32. At the same time the lever 117 of the air valve 118 is moved to a position which will deliver air from the pipes 101 and 102 through the valve 118 and conduit 120' to the upper connection 42 of the air cylinder 38. Air is delivered to the air cylinder 38 at the opposite side of the desurfacer in a similar manner through branch conduit 120' which communicates with the conduit 119'. This will cause the air cylinders 38 and blowpipe slides 21 to move outwardly to their inoperative position.

When the desurfaced billet is adjacent the guides 151 and 152, the operator stops the driving motor M through the control C and the guide 151 is moved inwardly, as described above, by moving the lever 176 of valve 177 to a position which will deliver water under pressure from the branched pipe 178 through the valve 177 to pipe 163. After the guide 151 is in its innermost position, the lever 180 of valve 181 is moved to a position which will deliver water under pressure from the pipe 178 through the valve 181 to pipe 165. This will cause the guide 152 to move inwardly and, when the guide has moved a sufficient distance to a position that will enable the hooks 166 to turn over the billet T, the lever 180 is moved to a position which will close the valve 181 and stop the guide 152. The operator then moves the lever 182 of an air valve 183 to a position which will deliver air under pressure from the pipe 184 through the valve 183 to the pipe 174 to cause the plunger 172 of the air cylinder 173 to retract whereby the hooks 166 are raised to turn over the billet T; and, when this has been done, the lever 182 is moved to a position which will deliver air under pressure from the pipe 184 through the valve 183 to pipe 175, thereby causing the hooks 166 to be lowered into their recesses 167. The lever 180 is again moved to open the valve 181 to effect further inward movement of the guide 152 to move the billet against the guide 151, as described above. The levers 176 and 180 are then moved to a position which will deliver water under pressure through the valves 177 and 181 to the pipes 162 and 164, respectively, to cause the guides 151 and 152 to move backward to their inoperative position. Thereafter, levers 176 and 180 are moved to their off position to close the valves 177 and 181.

After the billet T has been turned over and aligned by the guides 151 and 152, the switch C is moved so that the motor M will drive the rollers of the conveyor sections D and L in such a direction that the billet T is moved backward on the conveyor section L and onto the conveyor section D. The direction of rotation of the driving motor M is then reversed through the switch C to move the billet T forward again to repeat the desurfacing operation described above on the other two sides of the billet.

After the billet is completely desurfaced, it leaves the conveyor section L and, since considerable heat is soaked into the billet during desurfacing and especially where this desurfacing is effected just ahead of the next roll stand, the successive billets are still at a hot rolling temperature and pass immediately to these finishing rolls without the necessity of placing the billets in reheating furnaces.

The operation just described is the same in the embodiment diagrammatically illustrated in Fig. 2, the operator standing on the platform P' may control only the operation of the first desurfacer A'; while the operator standing on the second platform P'' may control the apparatus H for turning over the billets T as well as the operation of the second desurfacer A''.

In order to disclose the broad principles of the invention, several embodiments thereof have been illustrated and described. Obviously, certain features of the invention may be used independently of others and changes may be made in various parts of the apparatus without departing from the essentials of the invention. For example, although the hereindisclosed processes and mechanisms are especially adapted for conditioning or desurfacing semi-finished rectangular steel shapes while they are at a red heat and in transit between successive rolling operations, it will be understood that the same principles are applicable to the surfacing of billets, blooms, etc., which are taken from stock and are cold or at ordinary atmospheric temperature, and to the conditioning of surface portions of round, polygonal and other shapes having non-rectangular cross-sections and requiring more or less than a 90° turn about their axes to successively present adjoining or non-adjoining portions thereof for surfacing treatment. Furthermore, other types of blowpipes may be employed to progressively apply wide streams of gas obliquely against and lengthwise of the longitudinal surfaces undergoing treatment.

What is claimed is:

1. A process of desurfacing a metal body such as a steel billet, which comprises relatively moving said body and a gas-applying means; during such movement progressively and simultaneously applying streams of oxidizing gas obliquely against non-adjoining longitudinal surface portions of said body to remove a stratum of metal from each of such portions at least the area of said surface portions to which said oxidizing gas streams are applied being at an ignition temperature and said surface portions being disposed so that slag flow therefrom is assisted by gravity to the same degree; then turning said body about its longitudinal axis to present other non-adjoining surface portions for a similar desurfacing treatment in a similar position; and progressively and simultaneously applying streams of oxidizing gas obliquely against such other non-adjoining surface portions to remove from each of the latter a stratum of metal.

2. A process of conditioning a metal body such as a steel billet, which comprises hot rolling said body; propelling such hot rolled body in the direction of its length and, during such movement and while said body is still at an elevated temperature, applying obliquely against a longitudinal laterally disposed surface thereof a wide stream of oxidizing gas to remove with assistance of gravity the surface stratum of metal from said surface, the metal to which said stream is applied being at an ignition temperature; then turning said body about its longitudinal axis to present in laterally disposed position another longitudinal surface for similar treatment; again propelling said body in the direction of its length while applying obliquely against such other surface a wide stream of oxidizing gas to remove with the same assistance of gravity the surface stratum of metal from such other surface; and thereafter again rolling said body.

3. Apparatus for conditioning a metal body such as a steel billet, comprising the combination of mechanism for propelling said body in the direction of its length; means for applying a high temperature surface conditioning gas stream against a longitudinal surface portion of said body while the latter is propelled by said mechanism; means operatively associated with said mechanism for turning said body about its longitudinal axis to present another surface portion thereof into position for applying such stream thereagainst; and a common control station provided with means for controlling said body propelling mechanism, said gas stream applying means, and said body turning means.

4. Apparatus for conditioning a metal body, such as a steel billet, while said body is at an elevated temperature and in transit between successive rolling operations, comprising the combination of conveyor means for receiving a body discharged from one rolling device and for delivering the body to the next rolling device; mechanism cooperatively associated with said conveyor means for simultaneously applying high temperature defect-removing gas streams against non-adjoining surfaces of said body while the latter is propelled by a part of said conveyor means; and means, between said devices and associated with said conveyor means, for turning said body about its longitudinal axis to position other non-adjoining surfaces for simultaneous removal of defects therefrom.

5. Apparatus for conditioning a surface of a metal body such as a steel billet, comprising the combination of a horizontally pivoted supporting member; a frame; means pivotally connecting said supporting member to said frame for horizontal transverse movement; blowpipe means carried by and slidable horizontally along said supporting member; and mechanism, operatively connected to both said supporting member and said blowpipe means, for moving the latter along said supporting member.

6. Apparatus for simultaneously conditioning the longitudinal and substantially vertical surfaces on opposite sides of a steel billet and the like having a substantially rectangular cross section, such apparatus comprising the combination of an adjustable connecting member; a pair of spaced brackets; a pair of links severally pivotally connected to said member and to said brackets for supporting said brackets in a horizontal direction and permitting vertical move-

ment thereof with respect to said member; counterbalancing means connected to each bracket; a pair of spaced apart blowpipe units severally slidably connected to said brackets and adapted to simultaneously apply streams of oxidizing gas obliquely against and lengthwise of said vertical surfaces; mechanism for moving said units toward or away from one another; means connected to said units and engageable by said body to position said streams relatively to said surfaces; means for effecting relative longitudinal movement between said body and said streams; and means operable to engage said body to interrupt its movement relatively to said streams.

7. Apparatus for desurfacing a steel billet and the like of substantially rectangular cross-section while the same is at an elevated temperature and in transit between successive hot rolling operations, which comprises in combination means for moving the hot billet in the direction of its length with two opposite longitudinal surfaces thereof disposed vertically; means for applying obliquely against and lengthwise of both of said surfaces during such movement, streams of oxidizing gas having a width substantially equal to the vertical height of such surfaces, to remove a stratum of metal from each of said surfaces at least a portion of the metal to which said streams are applied being at an ignition temperature; means for turning said body through an angle of 90° about its longitudinal axis to present its other two longitudinal surfaces in vertical position for surfacing treatment; means for again moving said billet in the direction of its length; means for applying obliquely against and lengthwise of both of such other surfaces, streams of oxidizing gas having a width substantially equal to the vertical height of such other surfaces to remove a stratum of metal from each of the latter; a common control station; and mechanism at said common control station for controlling the movement and the turning of said billet as well as the application of said oxidizing gas streams thereto.

8. Apparatus for conditioning a metal body such as a billet and the like comprising means for supporting and propelling said body in the direction of its length; column means adjacent said supporting and propelling means; blow-pipe means for applying high temperature surface conditioning gas streams against and lengthwise of a longitudinal-vertical surface of said body; and mechanism connecting said blowpipe means to said column means providing both horizontal and vertical floating movement of said blowpipe means under the influence of the contour of said body including means for counterbalancing at least a substantial portion of the weight of said blowpipe means and connecting mechanism.

9. Apparatus for conditioning a metal body such as a steel billet, comprising the combination of two spaced apart devices, each of which is constructed and arranged to apply a high temperature surface conditioning gas stream obliquely against and along a respective adjacent longitudinal surface of said body when disposed between said devices; means for supporting and lengthwise propelling said body between said devices and streams; means for supporting said devices arranged to provide free movement of each of said devices both horizontally and vertically in planes transverse to the longitudinal axis of said body; and mechanism operable by said body for adjusting said devices both vertically and horizontally relatively to said body as the latter is propelled between said devices to apply the streams substantially uniformly to the successive portions of two longitudinal surfaces of said body irrespective of variations in the shape of the body.

10. Apparatus for conditioning a substantially vertical surface of a metal body such as a steel billet, comprising the combination of means for supporting said body with a longitudinal surface thereof substantially vertical; blowpipe means constructed and arranged to deliver a vertically wide stream of oxidizing gas obliquely against and lengthwise of said vertical surface; means for relatively moving said blowpipe means and said body at a uniform rate lengthwise of said surface to remove a uniform stratum of metal therefrom; means for supporting said blowpipe means constructed and arranged to provide free movement thereof both horizontally and vertically in a plane transverse to the longitudinal axis of said body; mechanism operable by said body for adjusting said blowpipe means both vertically and horizontally in said transverse plane to maintain said blowpipe means substantially uniformly positioned with respect to said surface during said relative movement; and other mechanism for moving said blowpipe means toward and away from said vertical surface.

11. Apparatus for conditioning a surface of a metal body such as a steel billet, comprising the combination of blowpipe means constructed and arranged to deliver a wide stream of oxidizing gas obliquely against and lengthwise of said surface; means for relatively moving said blowpipe means and said body at a uniform rate lengthwise of said surface to remove a uniform stratum of metal therefrom; means for supporting said blowpipe means constructed and arranged to provide free movement thereof both horizontally and vertically in a plane transverse to the longitudinal axis of said body; mechanism operable by said body for adjusting said blowpipe means both vertically and horizontally in said transverse plane to maintain said blowpipe means substantially uniformly positioned with respect to said surface during said relative movement; and other mechanism for moving said blowpipe means toward and away from said surface.

12. Apparatus for simultaneously conditioning surfaces on opposite sides of a metal body, such as a steel billet, comprising the combination of a pair of spaced apart movable devices each having blowpipe means for simultaneously applying streams of oxygen-containing gas against said surfaces; separate mechanisms on said devices and connected with said blowpipe means operable to move said blowpipe means toward or away from one another; a common connecting member connected to both of said devices and having a recess in line with the space between said devices, to provide a free passage for the metal body against the opposite surfaces of which said streams are applied; a frame; and means pivotally connecting said common connecting member to said frame for supporting said common connecting member and for providing free lateral movement of said common connecting member and said devices thereon in unison in response to variations of the lateral positions of said surfaces.

13. Apparatus for simultaneously conditioning surfaces on opposite sides of a metal body, such as a steel billet, comprising the combination of a pair of spaced apart movable devices each having blowpipe means for simultaneously applying

streams of oxygen-containing gas against said surfaces; separate mechanisms on said devices and connected with said blowpipe means for moving said blowpipe means toward or away from one another; a frame including spaced columns; a transverse connecting member carried by said columns, and connected thereto by means providing free transverse movement thereof with respect to said columns; and means separately and adjustably connecting each of said devices to said transverse connecting member.

14. Apparatus for simultaneously conditioning surfaces on opposite substantially vertical sides of a metal body, such as a steel billet, comprising the combination of a pair of spaced apart movable devices each having blowpipe means for simultaneously applying streams of oxygen-containing gas against said surfaces; separate mechanisms on said devices and connected with said blowpipe means for moving said blowpipe means toward or away from one another; a connecting member; means individually connecting said devices to said connecting member providing free vertical movement of said devices in a direction transversely of the horizontal dimensions of said surfaces; and means for yieldingly counteracting downward movement of each device.

15. Apparatus for simultaneously conditioning surfaces on opposite substantially vertical sides of a metal body, such as a steel billet, comprising the combination of a pair of spaced apart movable devices each having blowpipe means for simultaneously applying streams of oxygen-containing gas against said surfaces; separate mechanisms on said devices and individually connected with said blowpipe means for moving said blowpipe means toward and away from one another; adjustable stops on said devices for limiting the movement of said blowpipe means toward one another; a connecting member; and means individually connecting said devices to said connecting member providing free vertical movement of said devices in a direction transversely of the horizontal dimensions of said surfaces.

16. Apparatus for conditioning the longitudinal and substantially vertical surfaces on opposite sides of a steel billet and the like having a substantially rectangular cross section, such apparatus comprising the combination of a horizontally adjustable connecting member; a pair of spaced brackets; link means severally pivotally connected to said connecting member and to said brackets for supporting said brackets in a horizontal direction and permitting vertical movement thereof with respect to said member; counterbalancing means connected to each bracket; a pair of spaced apart blowpipe units severally slidably connected to said brackets and adapted to condition said vertical surfaces; mechanism for moving said units toward or away from one another; and guide means connected to said units and engageable by said body to position said blowpipe units individually vertically as well as horizontally relatively to said surfaces.

17. In apparatus for conditioning at least one longitudinal surface of a ferrous metal body, such as a steel billet, the combination comprising a supporting frame having spaced apart vertically extending portions; a transverse connecting member; horizontally swingable parallel links pivotally connected to said transverse connecting member and to said frame portions, respectively; at least one blowpipe supporting bracket; vertically swingable parallel links connected to said bracket and to said transverse connecting member, respectively; and blowpipe means secured to said bracket; whereby said bracket and said blowpipe means are universally movable in a plane transverse to said body.

18. In apparatus for conditioning at least one longitudinal surface of a ferrous metal body, such as a steel billet, the combination comprising a supporting frame having spaced apart vertically extending portions; a transverse connecting member; horizontally swingable parallel links normally extending rearwardly of said supporting frame and having forward portions pivoted to said frame portions and rear portions pivoted to said transverse connecting member; at least one blowpipe supporting bracket; vertically swingable parallel links connected to said bracket and to said transverse connecting member; and blowpipe means secured to said bracket; whereby said bracket and said blowpipe means are universally movable in planes transversely of said body.

19. Apparatus, according to claim 18, in which said vertically swingable links extend forwardly of said transverse connecting member and have rear portions pivoted to said transverse connecting member and forward portions pivoted to each of said brackets.

20. In apparatus for conditioning at least one longitudinal surface of a ferrous metal body, such as a steel billet, the combination comprising supporting means; at least one blowpipe supporting bracket; transversely swingable links pivotally connected to said supporting means and to said bracket, respectively, whereby said bracket is freely movable transversely of the surface to be operated upon; at least one blowpipe means for projecting gas against said surface; said blowpipe means being slidably connected to said bracket for adjustment therealong in a direction toward and away from said surface; and means for sliding said blowpipe means in either direction along said bracket.

21. An apparatus for conditioning a substantially rectangular body of hot metal in transit from a blooming-mill to a bar-mill which comprises means for conveying said body of hot metal from said blooming-mill, means adapted to shear said rectangular metal into predetermined lengths, means adapted to skin two sides of said lengths of hot metal while in transit, means adapted to turn said skinned metal to position the unskinned sides of said metal in position for skinning, means adapted to skin the sides of the turned body of metal and means adapted to convey said hot metal to other processing devices.

22. In an apparatus for conditioning lengths of substantially rectangular hot metal in transit from a blooming-mill to other processing devices, the combination of means for conveying said lengths of hot metal from said blooming-mill; means adapted to skin two sides of said lengths of hot metal while in transit; means adapted to turn said skinned metal to position the unskinned sides of said lengths of metal in position for skinning; means adapted to skin the unskinned sides of the turned lengths of metal; and means adapted to convey the skinned lengths of hot metal to said other processing devices.

23. In a billet scalping machine, in combination, a metal removing unit having a work table for moving the work into a loading station, billet handling mechanism at said station comprising groups of elongated horizontally disposed members supported respectively on opposite sides of the table for movement toward and away from the table, power actuated means for advancing

the members of both groups to position a billet on the work table, and means for relieving the pressure on one set of members to enable the other set of members to push the billet.

24. In a billet scalping machine, in combination, a metal removing unit having a work table for moving the work into a loading station, billet handling mechanism at said station comprising groups of elongated horizontally disposed members supported respectively on opposite sides of the table, and hydraulically operated means for advancing said members to exert pressure simultaneously on opposite sides of a billet on the table and thereby position the billet.

25. In a machine for surfacing metal bars, in combination, a metal removing unit having a metal removing tool positioned to operate on opposite sides of a bar, a work support for moving work from a loading station to carry a bar into operative relation to the tool, a runway for conveying an unfinished bar to the loading station, power-actuated means for transferring the bar from said runway to said work support, a second runway for conveying the finished bar away from the loading station, and a bar turning mechanism located between the work support and said second runway operative to turn the bar about its longitudinal axis through an angle such as to present a different side of the bar for operation of said tool thereon.

26. In a machine for surfacing metal bars, in combination, a metal removing unit having metal removing tools positioned for operating on opposite sides of a bar simultaneously, a work support for moving work from a loading station to carry a bar into operative relation to the tools, a runway for conveying an unfinished bar to the loading station, power-actuated means for transferring the bar from said runway to said work support, and a second runway for conveying the finished bar away from the loading station, said power-actuated mechanism being operative to transfer a finished bar from the work support to said second runway.

27. An apparatus for conditioning a substantially rectangular body of hot metal such as a steel billet produced by operations including hot rolling, which comprises means for conveying said body of hot metal from said operations; means cooperatively associated with such body-conveying means for interrupting the movement of said body and for positioning said body for desurfacing; means adapted to thermo-chemically desurface two sides of said body of hot metal while in transit; means adapted to turn said body to position the undesurfaced sides of said metal in position for desurfacing; means adapted to thermo-chemically desurface the undesurfaced sides of said body of metal; and means for conveying said body of hot metal to other processing devices.

28. In a process of desurfacing a substantially rectangular steel billet, the steps which comprise propelling the rectangular steel billet in the direction of its length while maintaining the two opposite surfaces of the billet which are to be desurfaced in a vertical position; during such propulsion of the billet, applying streams of oxidizing gas obliquely against zones extending across such vertically disposed surfaces only, the metal against which said streams are applied being at the ignition temperature; after such vertically disposed surfaces have been substantially completely desurfaced, turning the billet 90° about its longitudinal axis so as to dispose vertically the other two opposite longitudinal surfaces thereof which remain to be desurfaced; subsequently propelling said billet in the direction of its length while maintaining vertical such other two longitudinal surfaces; and during such subsequent propulsion of the billet, applying streams of oxidizing gas obliquely against zones extending across such vertically disposed other surfaces only, to substantially completely desurface the latter surfaces, the metal against which said streams are applied being at the ignition temperature, whereby all four surfaces are substantially equally subjected to the influence of gravity during the desurfacing thereof and consequently the resultant desurfacing of each of such four surfaces is substantially identical.

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