May 5, 1970 L. D. GIGANTINO ET AL 3,510,065

DESCALING NOZZLE

Filed Jan. 5, 1968

FIG. 1

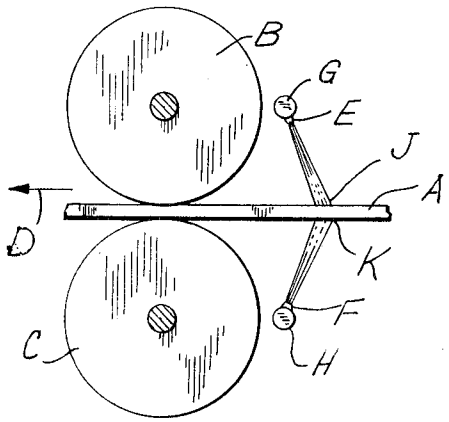
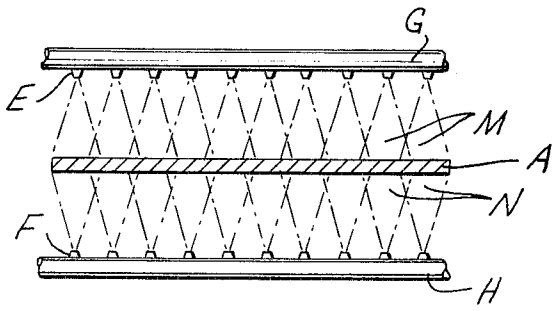


FIG. 2



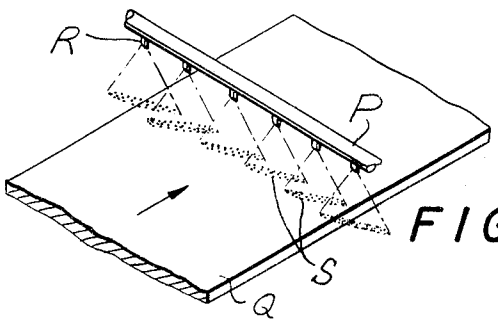
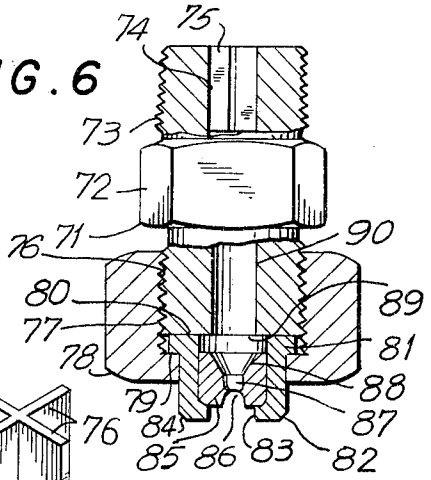


FIG. 3

FIG. 6



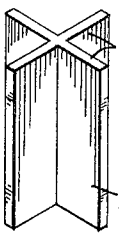


FIG. 7

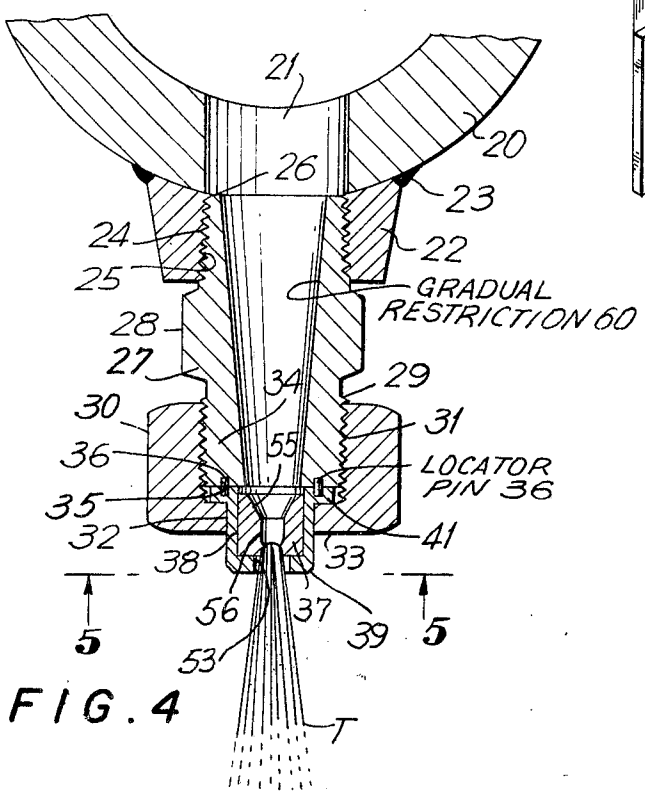


FIG. 4

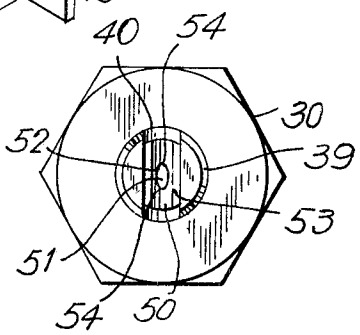


FIG. 5

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DESCALING NOZZLE

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U.S. Cl. 239—590 6 Claims

ABSTRACT OF THE DISCLOSURE

The present disclosure relates to a high pressure descaling nozzle designed to remove surface scale from hot rolled steel during the processing thereof.

Description of the invention

The present invention relates to a nozzle construction for removing scale from hot steel billets.

It is among the objects of the present invention to provide a novel high pressure descaling nozzle, which may be utilized in pressures ranging from 1,800 to 3,000 pounds per square inch to remove scale from hot steel billets.

Another object is to provide a novel high pressure nozzle which may be readily maintained in operating condition over long periods of time, even though there is considerable wear because of the high pressures and velocities employed and which is of such construction that the various elements thereof may be kept in maximum effective operating condition.

Still further objects and advantages will appear in the more detailed description set forth below, it being understood, however, that this more detailed description is given by way of illustration and explanation only and not by way of limitation, since various changes therein may be made by those skilled in the art without departing from the scope and spirit of the present invention.

In accomplishing the above objects according to one embodiment of the invention, the descaling nozzle capable of operating at 1,800 to 3,000 pounds per square inch is provided with an outer holder or cap nut receiving a carbide insert adapted tip through which the high pressure spray is projected at substantial velocity. The body of the nozzle may consist of a mounting member for the cap nut which receives the cup-shaped adapter having a carbide insert with a body which may mount the tip upon a suitable source of fluid or water under very high pressure.

The body may have an elongated inlet passageway of gradually decreasing cross-section toward the tip, or it may have a more compact section with a stream straightening vane. This combination, together with an elliptical shaped orifice will give a very flat elongated hard hitting fan pattern. The fan stream which strikes the hot billet is reduced to a very narrow width where it is most effective and there is a minimum of misting of the spray in the fan stream.

The net result is that more water is concentrated on a narrow or thinner line, greatly enhancing the impact and the descaling or cleaning power.

To assist assembly, when the nozzles are in downward position, magnetic elements may be employed to assure correct positioning and fitting together before the cap nuts are applied. At relatively low cost, carbide or special metal inserts to control and direct the spray may be readily replaced apart from the rest of the nozzle upon evidence of wear or upon predetermined periods of usage, permitting ready reconditioning of the nozzles.

Brief description of drawings

With the foregoing and other objects in view, the invention consists of the novel construction, combination and arrangement of parts as hereinafter more specifically described, and illustrated in the accompanying drawings.

In the drawings wherein like reference characters denote corresponding parts throughout the several views:

FIG. 1 is a diagrammatic side elevational view, illustrating how the nozzles may be applied so as to give a slightly angular impact of spray in opposition to the direction of travel of the material being cleaned.

FIG. 2 is a diagrammatic side elevational view, indicating how the spray pattern of the nozzles may be applied to both sides of a rolled material at the same time.

FIG. 3 indicates the pattern of spray application from one side of the material.

FIG. 4 is a longitudinal axial cross-sectional view upon an enlarged scale as compared to FIGS. 1 to 3, showing the nozzle construction.

FIG. 5 is a bottom plan view of the nozzle of FIG. 4, showing the spray outlet orifice.

FIG. 6 is a longitudinal transverse sectional view of an alternative embodiment of a high pressure nozzle, as shown in FIG. 4.

FIG. 7 is a perspective view of the insert element in FIG. 6 to correct the turbulence of the entering stream.

Referring to FIGS. 1, 2 and 3, there is shown a steel sheet A, which is about to pass through to rolls B and C in the direction D. This steel billet, being in hot condition, tends to form scale on its surface due to the action of the oxygen of the air, and it is important that this scale be removed before it passes between the rollers B and C, as otherwise it may well be impressed into or caused to become embodied with the surface of the steel and thereafter be very difficult to remove, and also with the result of decrease in quality of the steel.

It has been found that, if high velocity, high pressure water sprays of desired shape and size be applied to the hot surface of the steel, the scale can be removed readily before it is forced into the hot steel surface. Normally a series of nozzles may be positioned as indicated at E and F position above and below the steel billet A and supplied with water under high pressure from the conduits G and H. These nozzles may give a contact area at J and K on opposite sides of the billet A in FIG. 1, which will overlap and at the same time give rise to contact areas which will be elongated transversely.

As shown in FIG. 2, the conduits G and H may extend transversely across the billet A, with overlapping patterns indicated at M and N to assure that no portion of the surface of the billet is unprocessed. It is also possible to achieve a similar effect by having a conduit P extend longitudinally across the billet Q with the nozzles R giving elongated spray nozzle patterns successively, as indicated at S.

It has generally been found that the pressure which must be employed will vary between 1,800 and 3,000 pounds per square inch and that a most effective pattern is achieved where the pattern as indicated at N or M has an obliquity of 15° to a perpendicular traverse to the direction of movement of the billet A.

Generally the pattern should be substantially an elongated narrow rectangle having substantially square ends in which the high pressure is maintained substantially over the entire width and length thereof. Referring specifically to the nozzle structure of FIGS. 4 and 5, the conduit **20** in FIG. 4 is provided with an opening **21** and a nipple projection **22** soldered or welded thereto, as indicated at **23**. The interior of the nipple is threaded, as indicated at **24**, to receive the threaded end **25** of the

inside portion **26** of the nozzle. The body **27** has a hexagon central portion **28** and a reduced diameter threaded outlet end portion **29**. The reduced diameter threaded end portion **29** is designed to receive the cap nut **30** having the tapped interior recess **31** and the outlet opening **32** in its back portion **33**.

The body **27** at its outlet end **34** may have fitted into the recesses **35** two or more magnetic locater pins **36** to aid in assembly, particularly when the nozzle is extending in the down position as shown in FIG. 4 and as it would be at position E in FIGS. 1 and 2. The hard metal or special carbide tip portion **37** takes the form of a lightly pressed in insert in the receptacle **38**. The receptacle **38** has a cup portion **39** with a central opening in its bottom as indicated at **40** and it has the outwardly extending flanges **41** with recesses to receive the magnetic pins **36** and correctly locate the cup or receptacle **38** upon assembly.

The magnetic pins **36** are particularly useful in locating the nozzle with its channel **50** at a predetermined angle of 15° to a traverse across the width of the steel sheet.

Instead of having projecting magnetic pins or projecting magnetic elements, it is also possible to have the magnetic inserts of other shapes recessed into the surface with only a single locating pin, which in that case need not be magnetic. This magnetic element may be inserted in portions of the contacting face or in the form of an annulus or doughnut.

Where the pins **36** are not of magnetic material but are merely locater pins, the magnetic material may be included in one or both of the contacting faces and preferably it may be an insert in the lowermost face of the element **27** at the lower end of the threaded portion **29**. One or more pins may be employed or the locater elements may have other shapes to fit in other recesses on the flange **41**.

The hard metal or carbide tip **37** is of very hard metal but it also may be somewhat brittle, so that it can only be pressed into the cup **38** with relatively light pressure or assembled with adhesive. When the tip **37** wears, due to the high pressure and high velocity of the spray or stream indicated at T in FIG. 4, the whole cup **38** may be removed upon removing the cap nut **30**. The hard metal or carbide insert **37** inside of the opening **40** is provided with a cross-channel or groove **50**.

Centrally in the interior of the groove **50** is the orifice **51** of elliptical shape, the sides **52** of which are slightly spaced from the edges **53** of the channel and the ends **54** of which extend longitudinally of the channel **50**. This orifice **51**, together with the convergent passageway **55** and the cylindrical passageway **56**, will give an elongated rectangular narrow high velocity spray pattern indicated at J and K in FIGS. 1 and S in FIG. 3.

With the elliptical shaped orifice well within the face of the cup or receptacle **38** and in the lower part of the channel **50**, with the sides and ends removed from the sides and ends of the channel **50**, a high pressure spray effect is achieved. There is only a minimum of misting of the spray with resultant loss in power, and a high proportion of the water impact is effective on a narrow or thinner line to give maximum impact and maximum descaling or cleaning power.

In lieu of the elongated gradual restriction indicated at **60** in FIG. 4 to enhance the straight directional effect of the high pressure flow through the nozzle structure, it is also possible to utilize a vane structure such as shown in FIGS. 6 and 7.

In this alternative the nozzle body **71** has a hexagonal portion **72** and a pipe threaded inlet portion **73**. This portion has a recess **74** which receives the straightener element **75** having the crossing vanes **76**. The crossing vanes may be employed when desired.

The outlet end of the nozzle body **71** is also threaded as indicated at **75** to screw into the tap portion **77** of the hexagonal cap nut. Between the inside portion **79** of the cap nut and the face **80** of the body of the nozzle **71** will be clamped the flange **81** of the receptacle or cup **82** having the open slot **83** in its space **84**. Inserted therein is the hard material or carbide portion **85** having the transverse slot **86** forming an eliptical orifice in respect to the open inside portion **87** of the tip.

The carbide tip will have a sharply convergent inlet conical portion **88** leading from the relatively wide chamber **89** and the central through bore **90**. Both the nozzles of FIG. 4 and of FIG. 6 will have a straightened flow by the time the high pressure stream meets the carbide tip, one because of the vane structure as shown at **75** in FIGS. 6 and 7 and the other because of the long gradual restriction indicated at **60** in FIG. 4.

As many changes could be made in the above descaling nozzle, and many widely different embodiments of this invention could be made without departure from the scope of the claims, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

Having now particularly described and ascertained the nature of the invention, and in what manner the same is to be performed, what is claimed is:

1. A high pressure, high velocity descaling nozzle having a nozzle body with inlet and outlet exterior threaded end portion and interior central flow channel having straightening means for the flow of high pressure, high velocity water, a cap nut on the outlet end of the nozzle, a removable flanged cup held against the outlet end of the nozzle by said cap nut and a hard material insert in said cup having central axial passageways, a transverse channel at the outlet of the insert provided with an orifice that provides a flat fan pattern in the bottom of the channel, the outlet end of said nozzle body and said cup having locating means to fix their position in respect to each other said locating means, consisting of magnetic elements.

2. The nozzle of claim **1**, said locating means consisting of magnetic pins.

3. The nozzle of claim **1**, said straightening means consisting of an elongated gradually narrowing central passageway interiorly positioned within said body, extending from the inlet to the outlet ends thereof.

4. The nozzle of claim **1**, said straightening means consisting of a radial fin member positioned interiorly in the inlet end of the body in said central flow channel.

5. The nozzle of claim **1**, said outlet end of the nozzle body said cup having magnetic locating means.

6. The nozzle of claim **1**, said hard material insert being positioned within said cup and leaving a wide chamber available at the base of the cup and said insert having a conical inlet passage terminatiang in a cylindrical passage opening into the bottom of the transverse groove.

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EVERETT W. KIRBY, Primary Examiner

U.S. Cl. X.R.

239—552, 590.3, 601, 602