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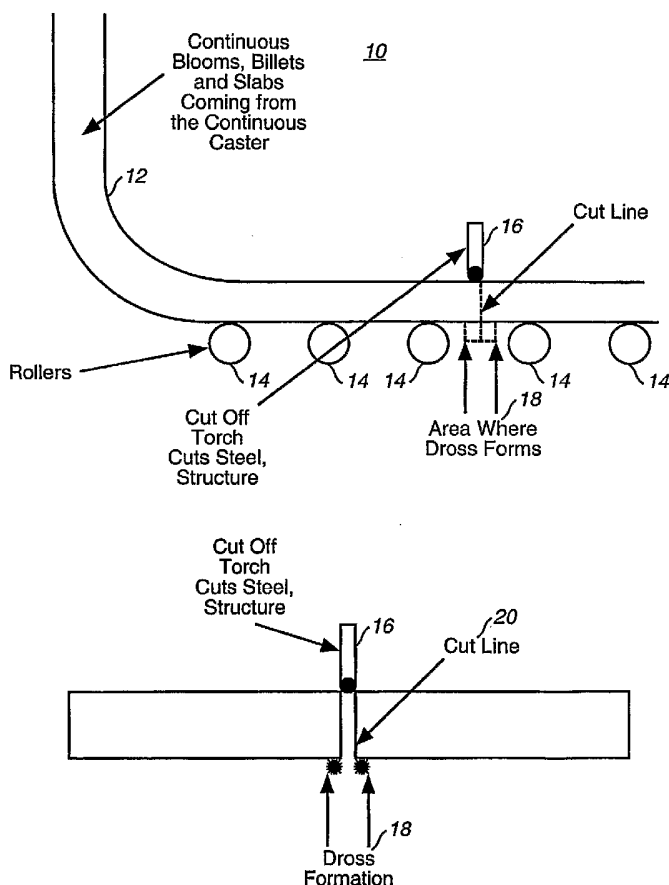
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(54) Title: DROSS REMOVAL SYSTEM AND METHOD



(57) Abstract: A system for dross removal on steel products has a housing. A heat source is attached to the housing. An oxygen jet is pointed perpendicular to the heat source.



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DROSS REMOVAL SYSTEM AND METHOD

Related Applications

5 The present invention claims priority on provisional patent application, Serial No. 60/559,664, filed on April 5, 2004, entitled "Method and Apparatus for Dross Removal on Steel Products".

Field of the Invention

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 The present invention relates generally to the field of steel processing and more particularly to a dross removal system and method.

Background of the Invention

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 In the steel making process, steel slabs and other steel structures are cut along their widths after exiting a continuous caster. This step is necessary before the steel structures can enter subsequent steel making processes. During the cutting process, which commonly occurs in-line after the continuous caster, there

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is a molten metal residue or dross formed at the point where the oxygen torch flame exits the steel structure.

This residue or dross is made up of a mixture of base metals and ferrous oxides and creates an unsmooth surface. The dross must be removed for
5 subsequent steel making processes. Failure to remove the dross, results in an unacceptable end product.

Traditionally, the dross has been manually burnt off or chiseled off which is labor intensive, slow and cannot be part of a seamless manufacturing process. Another approach has been to use an automated machine that removes the dross
10 with rotating mechanically hammers. These deburring machines require a significant amount of power, require frequent maintenance and as a result are very expensive to operate.

Thus there exists a need for dross removal system that can be part of a seamless manufacturing process, is not labor intensive, is cost efficient and does
15 not require frequent maintenance.

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Summary of Invention

A system for dross removal on steel products that overcomes these and other problems has a housing. A heat source is attached to the housing. An oxygen jet is pointed perpendicular to the heat source. The heat source may be a flame. The oxygen jet may be coupled to a source of pure oxygen or to a source of compressed air. The flame may be perpendicular to a line of dross. A cooling system may be attached to the heat source. The housing may be on wheels.

In one embodiment, a method of dross removal includes the steps of heating a portion of a line of dross with a heat source that is projecting perpendicular to the line of dross. The heat source is moved along the line of dross. A stream of oxygen moves behind the heat source. The step of heating may include creating a flame. The step of heating the portion of the line of dross may include heating the dross to a temperature sufficient to make the dross molten. A rate of movement at which the portion of the line of dross becomes molten may be determined. The heat source may be cooled. A source of pure oxygen or compressed air may be coupled to the stream of oxygen.

In one embodiment, a system for dross removal on steel products has a housing. A burner is attached to the housing. A cooling system pumps liquid around the burner. An oxygen stream is pointed towards the heat

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source. The housing may be on wheels. The oxygen stream may be coupled to a compressed air source or a pure oxygen source. The burner may be made of copper. The burner may have a pair of flames.

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Brief Description of the Drawings

FIG. 1A is a cross sectional view of a continuous caster system in accordance with one embodiment of the invention;

5 FIG. 1B is a cross section of a section of steel with dross in accordance with one embodiment of the invention;

FIG. 2 is a block diagram view of a dross removal system in accordance with one embodiment of the invention;

10 FIG. 3 is a perspective view of a dross removal system in accordance with one embodiment of the invention;

FIG. 4 is a perspective view of a dross removal system in accordance with one embodiment of the invention; and

FIG. 5 is a cross sectional view of a dross removal system in accordance with one embodiment of the invention.

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Detailed Description of the Drawings

The dross removal system and method described herein is an automated system having a heat source that heats the dross to a molten state. A stream of oxygen is directed at the molten dross which causes the dross to fall off the steel structure.

FIG. 1A is a cross sectional view of a continuous caster system 10 in accordance with one embodiment of the invention. The continuous blooms, billets and slabs 12 exit the continuous caster at temperature at which the steel is almost molten. The slabs 12 then move along rollers 14. At preset points the slab 12 stops and is cut into sections by a cutting torch 16. Dross 18 forms on both sides of the exit of the cut. FIG. 1B shows a close up of the cut line 20. The torch 16 cuts through the steel slab 12 and creates the dross formations 18 on the underside of the steel slabs 12.

FIG. 2 is a block diagram view of a dross removal system 30 in accordance with one embodiment of the invention. The dross removal system 30 has a housing 32. The housing 32 holds a heat source 34. The heat source 34 has an exit 36 that points toward the dross when the system 30 is in use. The heat source 34 is commonly a combustible gas and creates a flame at the exit 36. The housing 32 also holds a source of oxygen 38 that has an exit 40 that forms a stream of oxygen. The source of oxygen 38 may be pure oxygen or may be compressed air. In one embodiment, the stream of oxygen 40 is essential

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perpendicular to the direction the flame 36 is pointed. The housing 32 holds a motor 42 that drives a plurality of wheels 44. The housing 32 also has a guide 46. In one embodiment, the wheels 44 run inside a guide. Other mechanisms for guiding and moving the housing are also contemplated by the invention and are well know to those skilled in the art. The housing 32 also holds a cooling system 48. The cooling system 48 circulates a cooling liquid 50 through the heat source 34 to keep it from melting. In one embodiment, the heat source 34 is a burner with a flame or flames as its output. The burner is made of cooper in one embodiment. The cooling liquid flows in cooling channels in the burner.

FIG. 3 is a perspective view of a dross removal system 50 in accordance with one embodiment of the invention. A steel structure 52 is sitting on a plurality of rollers 54. The steel structure 52 has a line of dross 56 along an edge of the steel structure 52. A burner 58 projects hot flames onto the dross formation 56. Commonly the flames are perpendicular to the line of the dross 56. The burner 58 moves along the length of the dross 56. A stream of oxygen 60 then blows the molten dross 56 off the steel structure 52. In one embodiment, a method of dross removal includes the steps of heating a portion of a line of dross with a heat source that is projecting perpendicular to the line of dross. The heat source is moved along the line of dross. A stream of oxygen moves behind the heat source. The step of heating may include creating a flame. The step of heating the portion of the line of dross may include heating the dross to a temperature sufficient to make the dross

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molten. A rate of movement at which the portion of the line of dross becomes molten may be determined. The heat source may be cooled. A source of pure oxygen or compressed air may be coupled to the stream of oxygen.

FIG. 4 is a perspective view of a dross removal system 70 in accordance with one embodiment of the invention. This figure is looking through the steel structure 72 to the dross removal device 74. The dross 76 is shown along the bottom edge of the steel structure 72. The dross removal device 74 has a burner 78 that heats the dross to a molten state. An oxygen jet 80 follows behind the burner 78 to blow the dross off the steel structure. The dross removal device 74 has a housing 82 with a number of wheels 84.

FIG. 5 is a cross sectional view of a dross removal system 90 in accordance with one embodiment of the invention. In this embodiment, the dross removal system is used to remove dross from a circular cross section steel structure 92. A burner 94 heats a portion of the line of dross. An oxygen jet 96 then blows the dross off the steel structure 92. A turning device 98 is used to rotate the steel structure 92. Note that the heat source can be any heat source that is capable of efficiently raising the temperature of the dross so that it is in an essentially molten state. So the heater could be a laser or a source of infrared radiation or any other device that meets the requirements of the system.

Thus there has been described a dross removal system and method that can be part of a seamless manufacturing process, is not labor intensive, is cost efficient and does not require frequent maintenance.

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While the invention has been described in conjunction with specific embodiments thereof, it is evident that many alterations, modifications, and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alterations, modifications, and variations in the appended claims.

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Claims

What is claimed is:

- 5 1. A system for dross removal on steel products, comprising:
- a housing;
- a heat source attached to the housing; and
- an oxygen jet pointed perpendicular to the heat source.
- 10 2. The system of claim 1, wherein the heat source is a flame.
3. The system of claim 1, wherein the oxygen jet is coupled to a
- source of pure oxygen.
- 15 4. The system of claim 1, wherein the oxygen jet is coupled to a
- source of compressed air.
5. The system of claim 2, wherein the flame is perpendicular to a
- 20 line of dross.

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Claims

What is claimed is:

- 5 1. A system for dross removal on steel products, comprising:
- a housing;
- a heat source attached to the housing; and
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- 10 2. The system of claim 1, wherein the heat source is a flame.
3. The system of claim 1, wherein the oxygen jet is coupled to a
- source of pure oxygen.
- 15 4. The system of claim 1, wherein the oxygen jet is coupled to a
- source of compressed air.
5. The system of claim 2, wherein the flame is perpendicular to a
- 20 line of dross.

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6. The system of claim 5, further including a cooling system
attached to the heat source.

7. The system of claim 1, further including a plurality of wheels
5 attached to the housing.

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8. A method of dross removal comprising the steps of:

(a) heating a portion of a line of dross with a heat source that is projecting perpendicular to the line of dross;

5 (b) moving the heat source along the line of dross; and

(c) moving a stream of oxygen behind the heat source.

9. The method of claim 8, wherein step (a) further includes the step of creating a flame.

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10. The method of claim 8, wherein step (a) further includes the step of heating the portion of the line of dross to a temperature sufficient to make the dross molten.

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11. The method of claim 8, wherein step (b) further includes the step of determining a rate of movement at which the portion of the line of dross becomes molten.

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12. The method of claim 11, further including the step of cooling the heat source.

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13. The method of claim 8, wherein step (c) further includes the step of providing a source of pure oxygen.

14. The method of claim 8, wherein step (c) further includes the step
5 of providing a source of compressed air.

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15. A system for dross removal on steel products, comprising:

a housing;

a burner attached to the housing;

5 a cooling system pumping liquid around the burner; and

an oxygen stream pointed towards the heat source.

16. The system of claim 15, wherein the housing has a plurality of wheels.

10

17. The system of claim 15, wherein the oxygen stream is coupled to a compressed air source.

18. The system of claim 15, wherein the oxygen stream is coupled to a pure oxygen source.

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19. The system of claim 15, wherein the burner is made of copper.

20. The system of claim 15, wherein the burner is a pair of flames.

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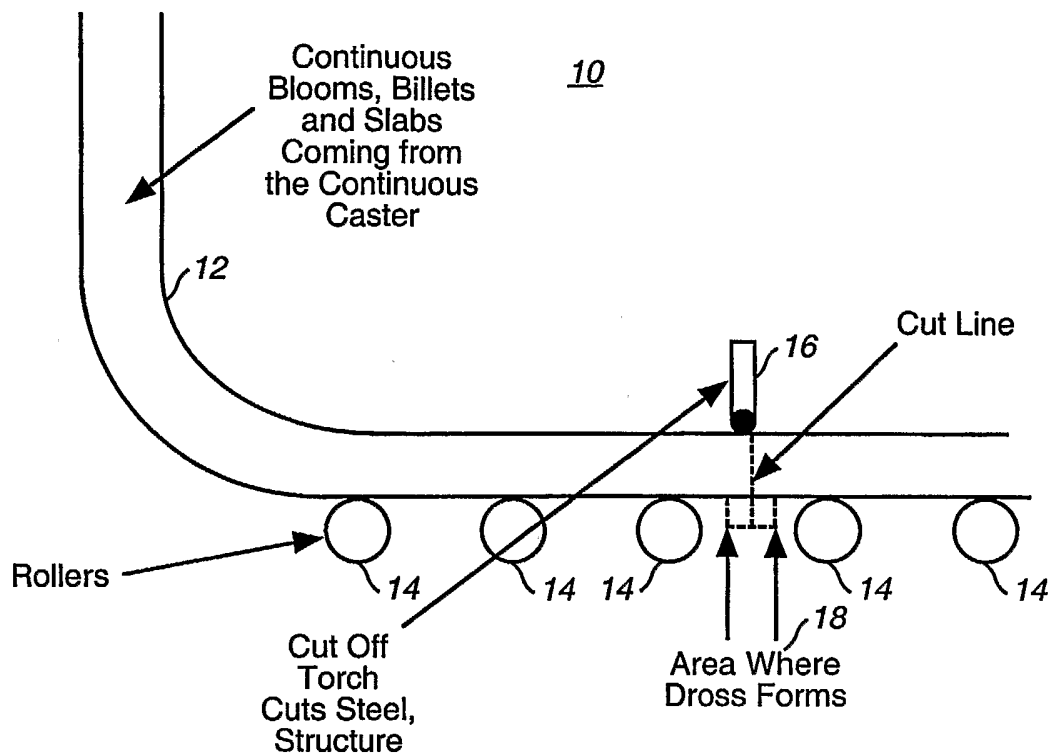


FIG. 1A

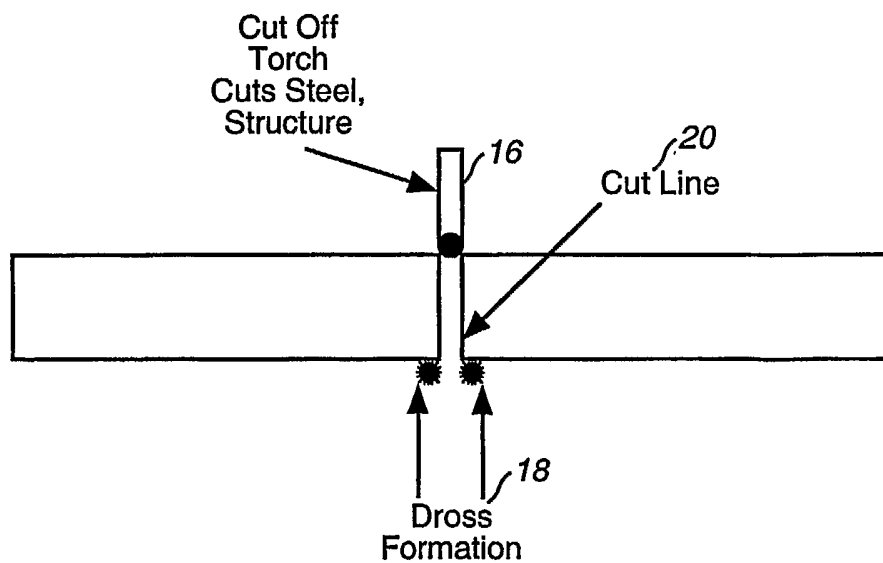


FIG. 1B

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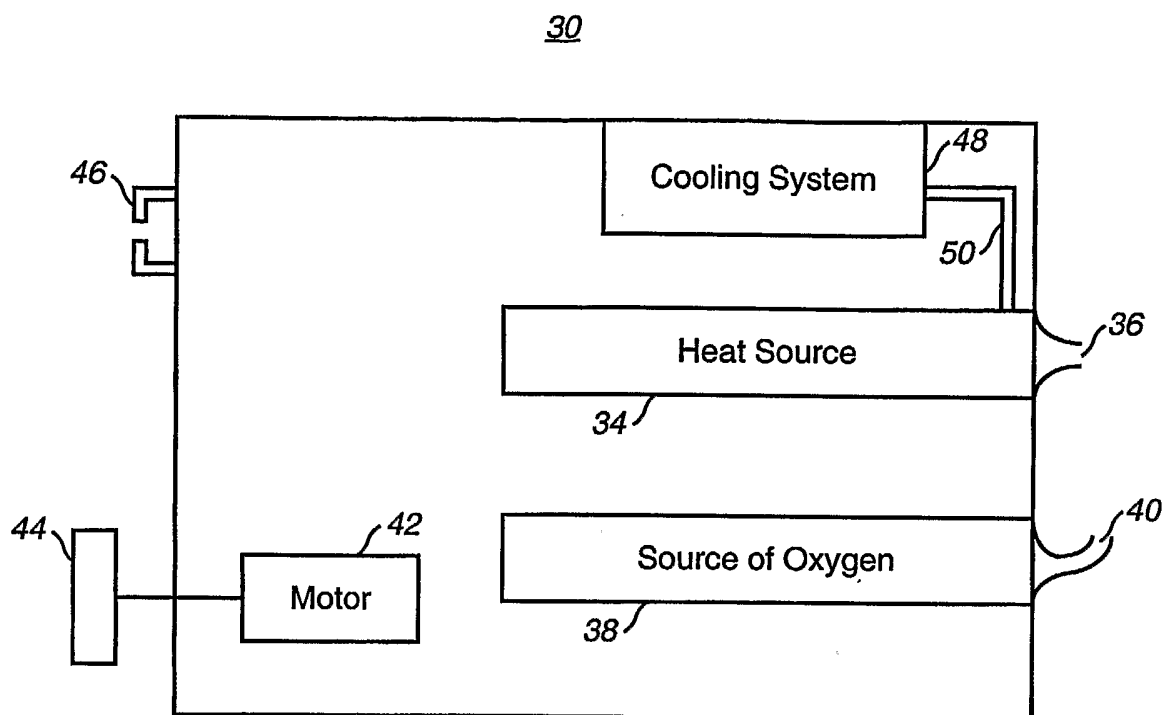
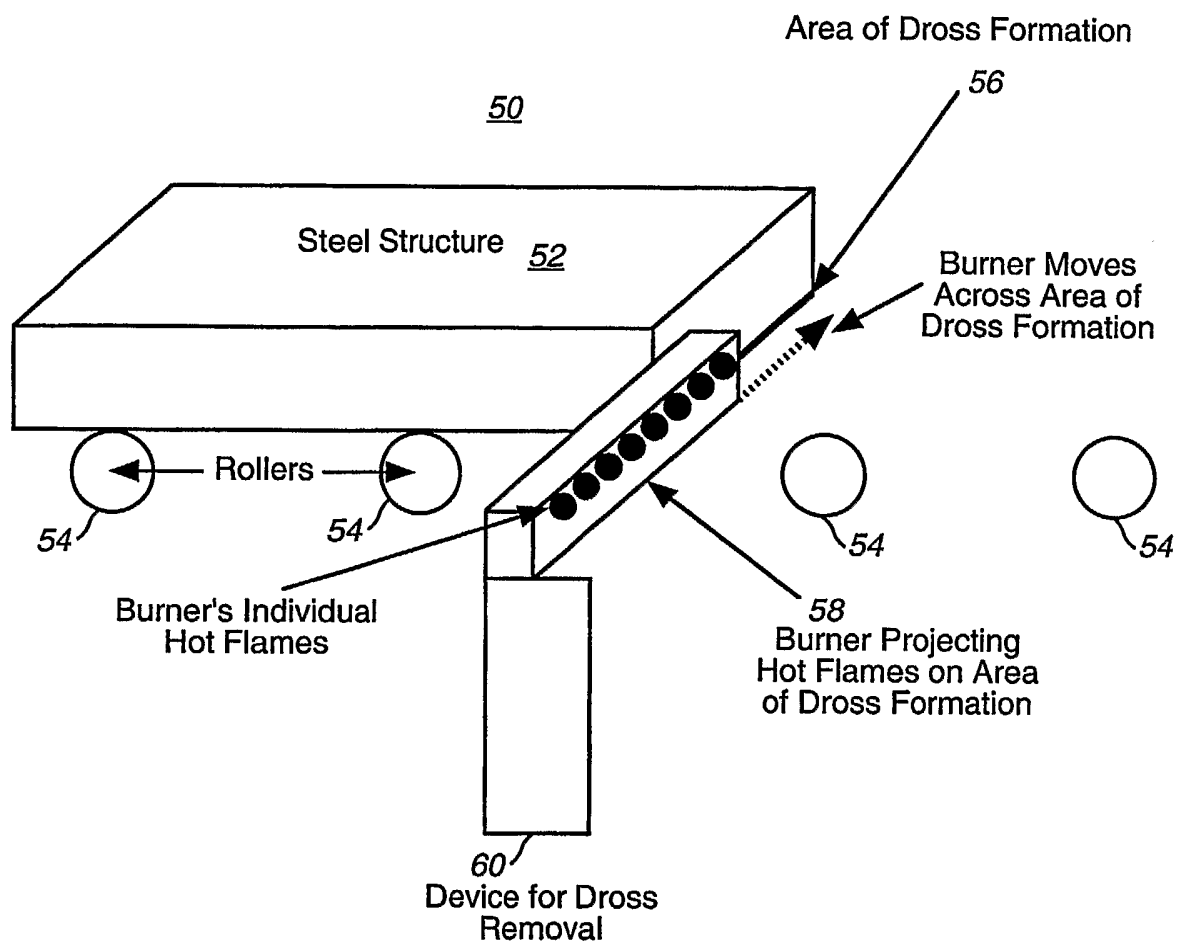


FIG. 2

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**FIG. 3**

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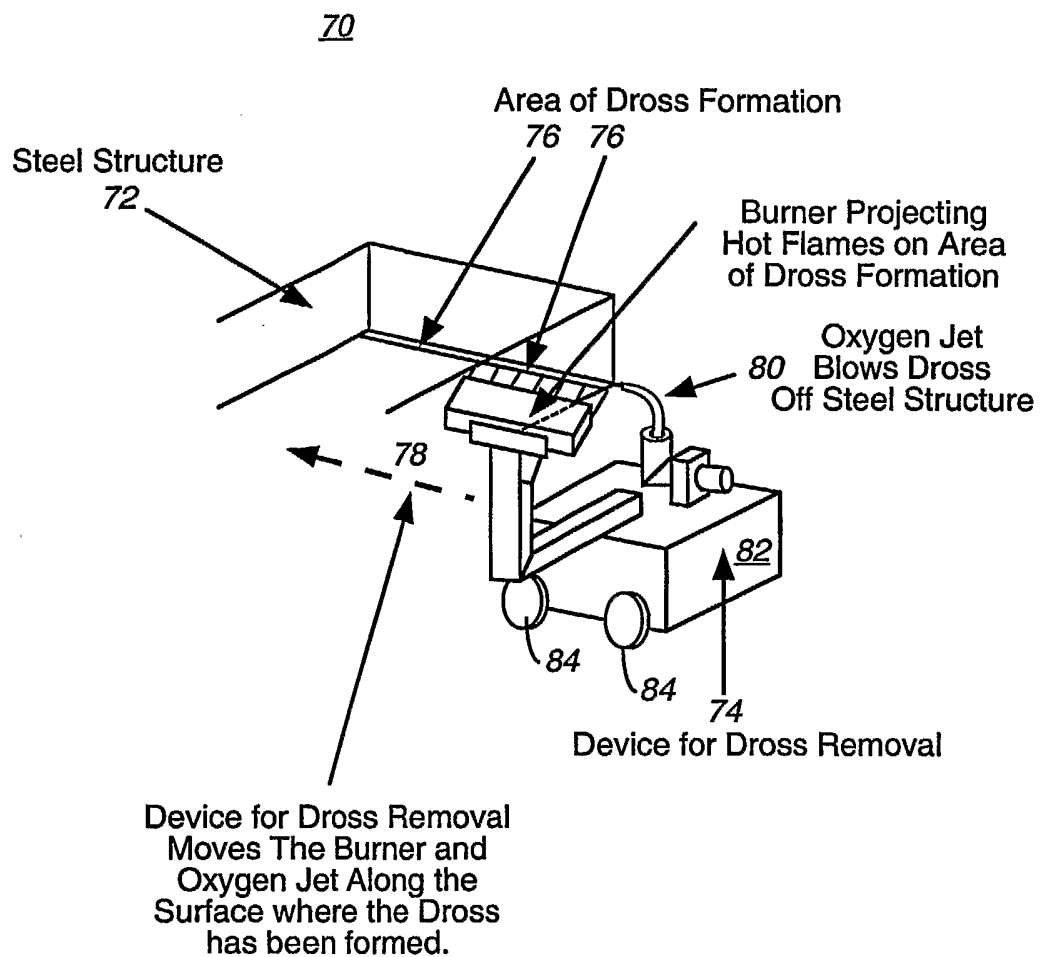


FIG. 4

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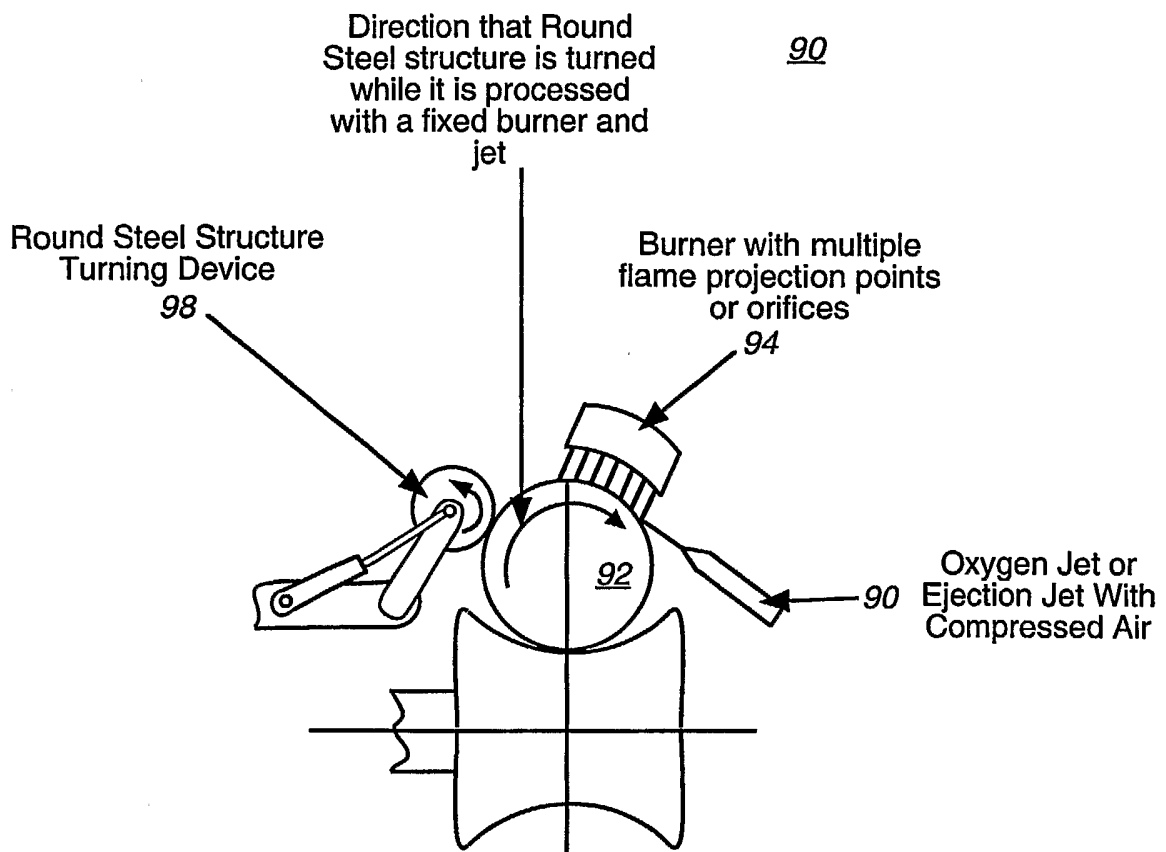


FIG. 5