

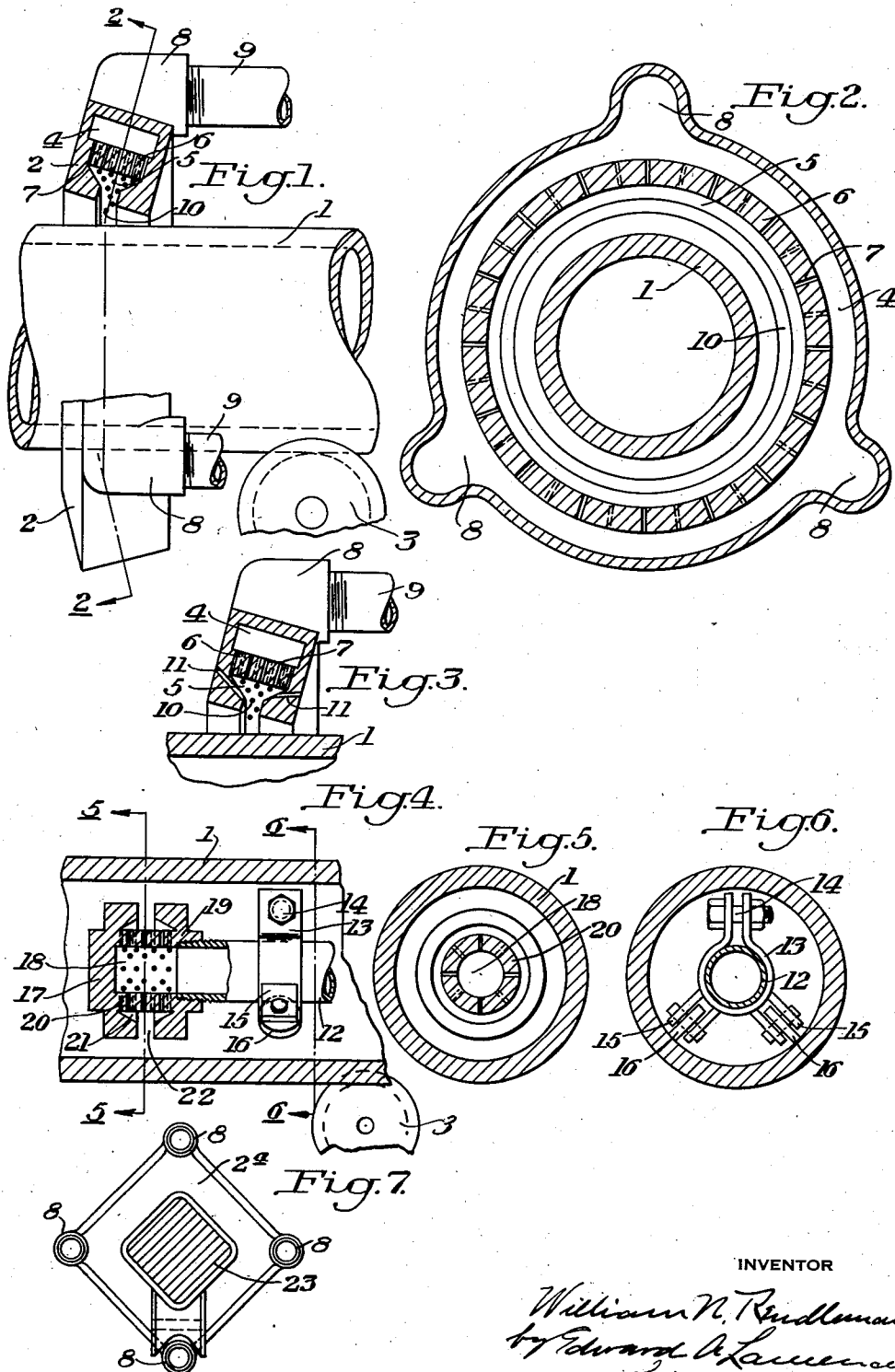
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W. N. RENDLEMAN

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METHOD AND APPARATUS FOR DESCALING METAL

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INVENTOR

William N. Rendleman
by Edward A. Lawrence
his attorney.

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METHOD AND APPARATUS FOR DESCALING METAL

William N. Rendleman, Edgeworth, Pa., assignor
to Spang, Chalfant & Co., Inc., Pittsburgh, Pa.,
a corporation of Pennsylvania

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It is necessary to remove scale from metal bodies, as for instance for the purpose of inspection, to prepare the metal bodies for further treatment or processing, and the like.

It is common practice to sand-blast a metal body for these purposes, but sand-blasting involves high initial cost for equipment and the cost of operation and maintenance are large.

Again, it is common practice to pickle metal bodies in an acid bath for these purposes, but the pickling operation requires expensive equipment and the operation itself is both expensive and time consuming. Again pickling imparts a greasy or dirty surface to the metal which requires subsequent cleaning, as with wire brushes.

Again, it has been proposed to clean the surface of metal bodies by the application of superheated steam, but the temperatures involved in this method are not sufficient to thoroughly and effectively remove scale.

The prime purpose of my invention is to effect a quick and inexpensive removal of scale, leaving a clean surface for inspection or subsequent processing, and without requiring any subsequent brushing or other cleansing.

Other objects will appear from the following description.

In my improved process I remove the scale by the application of pressure gas flames to the surface of the metal, thus raising the temperature of the scale very rapidly, causing a relatively abrupt expansion of the scale which loosens it from the metal body, whereby the pressure of the blast is enabled to blow it from the surfaces from which it has been adhering. Such scale is formed during the processing of ferrous metal bodies at or above the critical temperature range of the material. This scale is generally smooth, thick and very hard and cannot be cut by machining tools. It is difficult to remove such scale by the known process stated above because of its tenacious adherence to the material. Scale of this character generally occurs as the result of heating the material to temperatures required for such operations as forging, rolling, piercing or heat-treating.

I provide novel and practical means for the removal of scale both from the exterior surfaces of the bodies, and also from the interior surface or hollow or pierced metal bodies.

In the accompanying drawing, wherein I have

illustrated the practical improvement and principles of my invention, Fig. 1 is a broken elevation of a length of tubing with my novel ring burner for descaling the exterior surface of the tubing shown partially broken away in section.

Fig. 2 is a cross-sectional view taken along the line 2—2 in Fig. 1.

Fig. 3 is a sectional detail showing a modification of the burner.

Fig. 4 is a broken longitudinal section showing apparatus for descaling the interior of the tube.

Fig. 5 is a cross-sectional view taken along the line 5—5 in Fig. 4.

Fig. 6 is a like view taken along the line 6—6 in Fig. 4.

Fig. 7 is a cross-sectional view showing a modified form of apparatus in use for descaling the exterior surface of the metal body, such as a billet.

Referring first to Figs. 1 and 2, 1 represents the metal tube to be descaled, and 2 represents the ring burner through which the tube is caused to travel upon a suitable conveyor, such as rollers 3.

The burner 2 is preferably an integral casting comprising an outer annular chamber 4, an inner combustion chamber 5 and an intermediate wall 6 which is provided with jet ports 7 for the travel of the gaseous fuel from the chamber 4 to the chamber 5. At a plurality of points around its extent, the chamber 4 is provided with gas inlet ports 8 which are threaded to receive the ends of the gas supply pipes 9 which may be conveniently disposed in parallelism with the travel of the tube. The side walls of the combustion chamber 5 converge inwardly to form an annular flame slot or nozzle 10 which directs the flame against the exterior peripheral surfaces of the tube, the traveling tube being thus encircled in a ring of flame.

In Fig. 3, I show the side walls of the combustion chamber 5 provided with air passageways 11, so that atmospheric air may be drawn into the chamber 5 for mixture with the gaseous fuel.

In case the fuel used does not require the mixture of atmospheric air, as where acetylene and oxygen, natural gas and oxygen, or natural gas and compressed air are admitted through the pipes 9, the ports 11 are not required, but where natural gas is admitted through the pipes 9 and air has not previously been mixed therewith, then I employ the passageways 11 for the admission of atmospheric air to the chamber 5, which chamber thus functions as a mixing chamber.

The intensity of the flame and the travel of the tube are so adjusted that the outer scaled

surface of the traveling tube is rapidly heated without materially raising the temperature of the body of the tube. Such heating causes a relatively abrupt expansion of the scale, thereby loosening it from the tube and the pressure of the flame acts to blow the loosened scale from the tube.

One or more of the ring burners may be employed as required, the same being mounted in tandem and supported in any convenient manner.

The relation between the heating effect of the flames and the speed of travel of the pipe is such that the scale is thermally expanded and released without substantial heating of the metal body such for instance as would tend to change its grain structure.

Referring now to Figs. 4, 5 and 6, wherein I have shown the method and apparatus for descaling the interior of a hollow or pierced metal body, 12 represents a gas or fuel supply pipe extending longitudinally over which the traveling tube 1 is telescoped. To properly center the pipe 12 and its burner relative to the tube, the same is provided with a split collar 13 clamped as at 14 on the pipe, and provided with two spaced-apart and radially-disposed yokes 15 in which are mounted the rolls 16 which bear against and travel on the inner surface of the tube. The end of the pipe 12 is provided with a burner 17, preferably an integral casting, of circular shape, and of sufficiently less diameter than the internal diameter of the tube to space the peripheral surface of the burner away from the inner wall of the tube to provide adequate space for the impinging hot flame. The burner is provided with an axial chamber 18 opening at one end into the threaded port 19 into which the end of the pipe 12 is screwed. The perimetral wall 20 of the chamber 18 is perforated for the outward escape of the gaseous fuel into the annular chamber 21 formed in the burner and surrounding the chamber 18. The side walls of the chamber 21 converge outwardly to form the flame slot or nozzle 22 through which the flames travel outwardly in a radial ring to impinge against the inner wall of the tube. The converging side walls of the chamber 21 may be provided with air passageways similar to the ports 11 in Fig. 3.

In Fig. 7, I show a different character of burner for descaling the exterior surfaces of a metal body, illustrated in the view as a billet 23 of substantially square cross-sectional shape. In this case the burner 2a, instead of being ring type, is square.

By the use of my method and apparatus, I am enabled to remove the scale from either the exterior surfaces or the interior surfaces of a metal body very expeditiously and very thoroughly, and so efficiently that in ordinary practice it is not necessary to subsequently cleanse the surfaces by wire brushing or otherwise.

It is obvious that by a simultaneous application of the flames to the exterior and interior surfaces of a metal body the scale may be removed from all of its surfaces at the same time and by the same operation.

I claim:—

1. In means for cleaning a ferrous metal body by removing scale from the metal body, the combination of a fuel burner having a cylindrical fuel chamber arranged to be connected to the source of fuel, an annular combustion chamber adjacent the fuel chamber, said combustion chamber having converging sides for directing and concentrating the impingement of the burning fuel against the body.

2. In means for cleaning a ferrous metal body

by removing scale from the metal body, the combination of a fuel burner having a cylindrical fuel chamber arranged to be connected to the source of fuel, an annular combustion chamber adjacent the fuel chamber, an annular perforated wall separating the fuel and combustion chamber, said combustion chamber having converging sides for mixing the fuel in said chamber and directing it therefrom.

3. A burner for removing the hard scale formed on the surfaces of a ferrous metal body when heated to a temperature required for piercing the material, the combination of a fuel chamber arranged to be connected to a source of fuel, an annular combustion chamber in superimposed relation with the fuel chamber, an annular wall separating said chambers, and a plurality of fuel passageways in said wall, said combustion chamber formed to provide an annular nozzle for discharging the flame against the surfaces of the ferrous metal body.

4. A burner for removing the hard scale formed on the surfaces of a ferrous metal body when heated to a temperature at or above the critical temperature range of the material, the combination of a fuel chamber arranged to be connected to a source of fuel, an annular combustion chamber in juxtaposition with the fuel chamber, an annular wall separating said chambers, a plurality of fuel passageways in said wall, said combustion chamber formed to provide an annular nozzle for discharging the flame against the surfaces of the ferrous metal body, and means defining an air passage leading into said combustion chamber.

5. Means for removing the hard scale formed on the surfaces of a ferrous metal body when heated to a temperature at or above the critical temperature range of the material, the combination of a burner having an annular discharge nozzle disposed transversely to and in spaced relation with the surfaces to be treated, said nozzle arranged to discharge the flame in a plane substantially radial to the axis of said burner, and means for causing relative movement between the burner and the ferrous metal body.

6. A burner for removing the hard scale formed on the surfaces of a ferrous metal body when heated to a temperature at or above the critical temperature range of the material, the combination of a gaseous fuel burner arranged to surround the metal body and provided with means for directing the flame inwardly against the peripheral surfaces of the latter, and means for causing relative movement between the burner and the body.

7. A burner for removing the hard scale formed on the surfaces of a ferrous metal body when heated to a temperature at or above the critical temperature range of the material, the combination of a gaseous fuel burner having an open center and provided with means for directing the flames inwardly toward its center, and means for causing the metal body to travel through the center of the burner.

8. A burner for removing the hard scale formed on the surfaces of a ferrous metal body when heated to a temperature at or above the critical temperature range of the material, the combination of a gaseous fuel burner arranged to be positioned in the interior of a hollow metal body and to direct flames outwardly against the interior wall of the metal body, and means for causing relative movement between the burner and the metal body.

9. A burner for removing the hard scale formed on the surfaces of a ferrous metal body when heated to a temperature at or above the critical temperature range of the material, the combination of a gaseous fuel burner sufficiently small to enter the interior of a hollow metal body and provided with means for directing the flames outwardly against the interior wall of the metal body, and means for causing the body to travel relatively to the burner.

10. A burner for removing the hard scale formed on the surfaces of a ferrous metal body when heated to a temperature at or above the critical temperature range of the material, the combination of a gaseous fuel burner sufficiently small to enter the interior of a hollow metal body and provided with means for directing the flames outwardly against the interior wall of the metal body, means for centering the burner relative to the body, and means for causing the body to travel relatively to the burner.

11. The method of removing hard scale formed on the surfaces of a ferrous metal body when heated to a temperature at or above the critical temperature range of the material, which comprises the application of a flame having sufficient thermal intensity and velocity to cause an abrupt expansion of the scale to loosen and blow it from the surfaces of the body without materially heating the latter.

12. The method of removing hard scale formed on the surfaces of a ferrous metal body when heated to a temperature at or above the critical temperature range of the material, which comprises causing the body to travel past a zone, wherein the surfaces are progressively subjected to the application of a gaseous flame having sufficient thermal intensity to loosen the scale from the body without materially heating the latter.

13. The method of removing hard scale formed on the surfaces of a ferrous metal body when heated to a temperature at or above the critical temperature range of the material, which comprises causing the body to travel past a zone, wherein the surfaces are progressively subjected to the application of a gaseous flame having sufficient thermal intensity and velocity to cause an abrupt expansion of the scale to loosen and blow it from the surfaces of the body without materially heating the latter.

14. The method of removing hard scale formed on the surfaces of a ferrous metal body when heated to a temperature at or above the critical temperature range of the material, which comprises causing continuous relative movement between the body and a gaseous flame applied about the perimetral surface thereof in a plane substantially normal to the axis of movement, under such conditions of time and temperature as to cause an abrupt thermal expansion of the scale without materially heating the body.

15. The method of removing hard scale formed on the surfaces of a ferrous metal body, when

heated to a temperature at or above the critical temperature range of the material, which comprises causing continuous relative movement between the body and a gaseous flame applied about the perimetral surface thereof in a plane substantially normal to the axis of movement, under such conditions of time and temperature as to cause an abrupt thermal expansion of the scale without materially heating the body, and with sufficient velocity to blow the loosened scale from the surface.

16. The method of removing hard scale formed on the interior surface of a hollow ferrous metal body, when heated to a temperature at or above the critical temperature range of the material, which comprises causing continuous relative movement between the body and a gaseous flame projected radially against the interior surface of the body in a plane substantially normal to the axis of movement, under such conditions of time and temperature as to cause an abrupt thermal expansion of the scale without materially heating the body.

17. The method of removing hard scale formed on the interior surfaces of a hollow ferrous metal body, when heated to a temperature at or above the critical temperature range of the material, which comprises causing continuous relative movement between the body and a gaseous flame projected radially against the interior surface of the body in a plane substantially normal to the axis of movement, under such conditions of time and temperature as to cause an abrupt thermal expansion of the scale without materially heating the body and with sufficient velocity to blow the loosened scale from the interior surface.

18. A method for removing the hard scale formed on the surfaces of a ferrous metal body when heated to a temperature required to roll the material, which comprises the application of a flame having sufficient thermal intensity to cause an abrupt thermal expansion of the scale loosening it from the surfaces of the body without materially heating the latter.

19. A method for removing the hard scale formed on the surfaces of a ferrous metal body when heated to a temperature required for piercing the material, which comprises the application of a flame having sufficient thermal intensity to cause an abrupt thermal expansion of the scale loosening it from the surfaces of the body without materially heating the latter.

20. The method of removing hard scale formed on the surfaces of a ferrous metal body when heated to a temperature at or above the critical temperature range of the material, which comprises the application of a flame having sufficient thermal intensity to cause an abrupt thermal expansion of the scale loosening it from the surfaces of the body without materially heating the latter.

WILLIAM N. RENDLEMAN.