

April 11, 1961

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2,979,270

OXYGEN LANCES FOR OPEN-HEARTH FURNACES AND THE LIKE

Filed Feb. 27, 1959

3 Sheets-Sheet 1

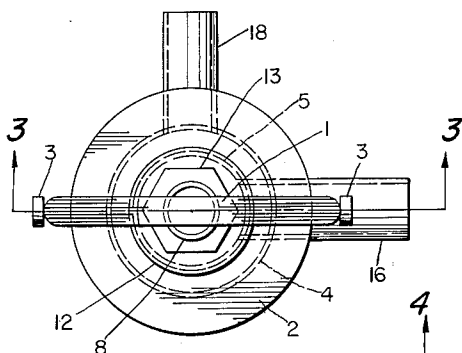


Fig. 1

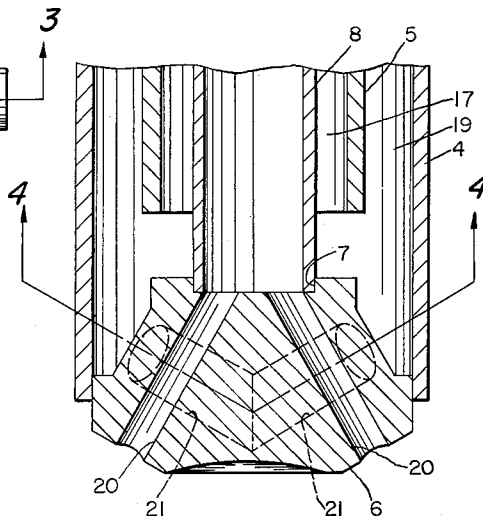


Fig. 3

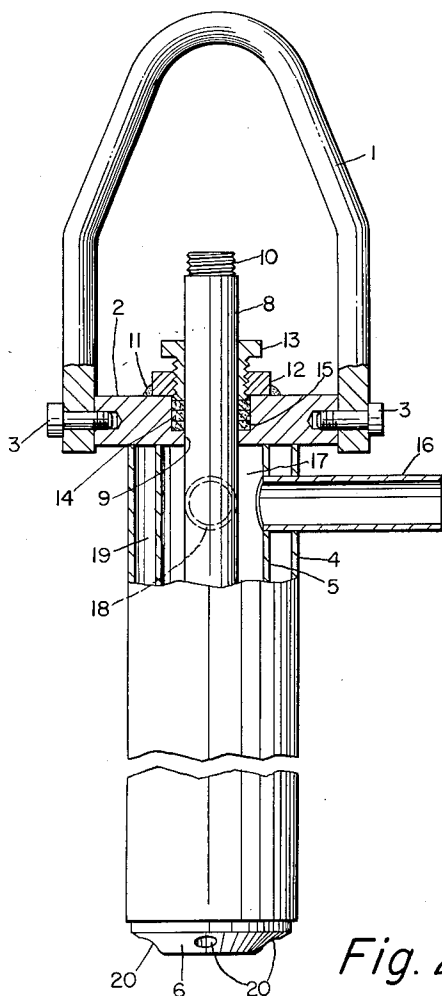


Fig. 2

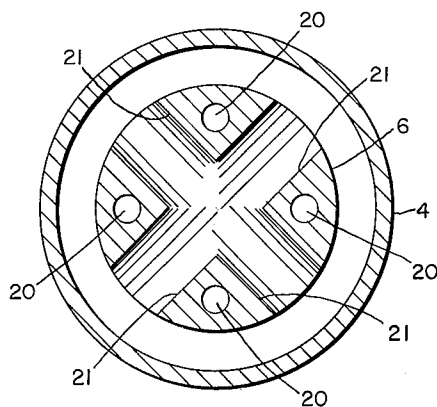


Fig. 4

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3 Sheets-Sheet 2

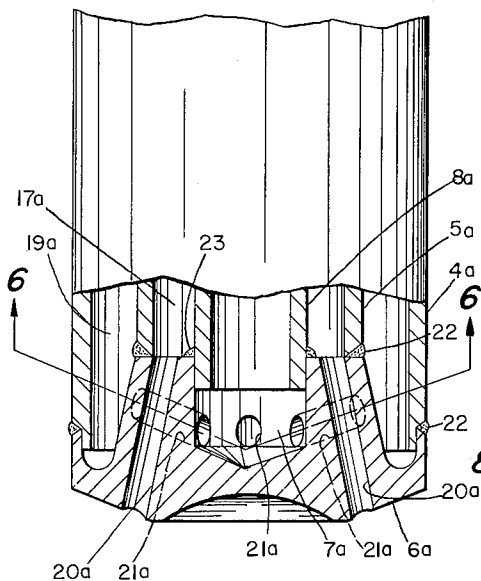


Fig. 5

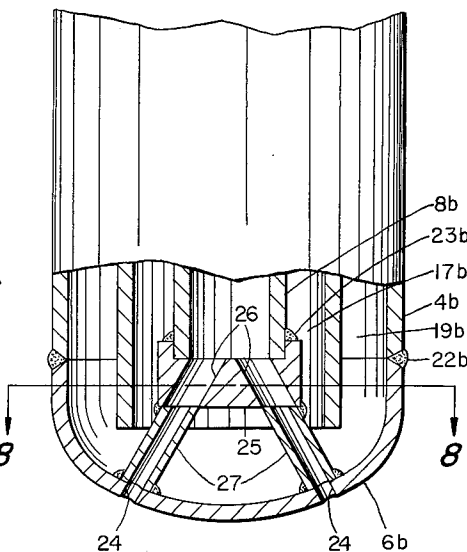


Fig. 7

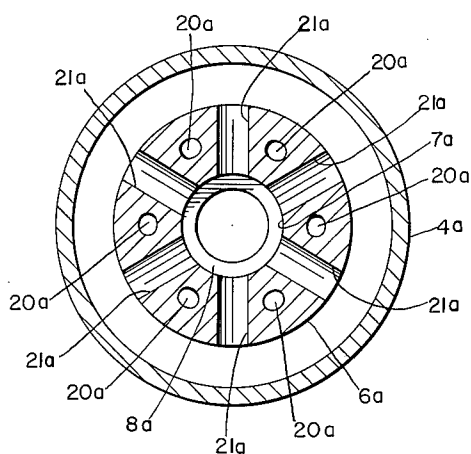


Fig. 6

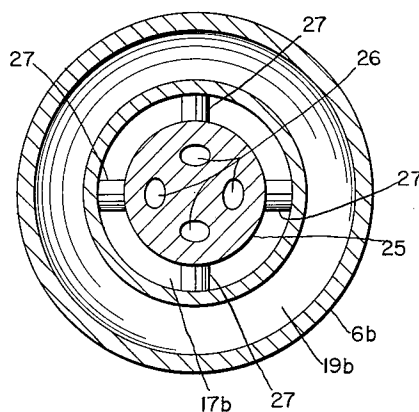


Fig. 8

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3 Sheets-Sheet 3

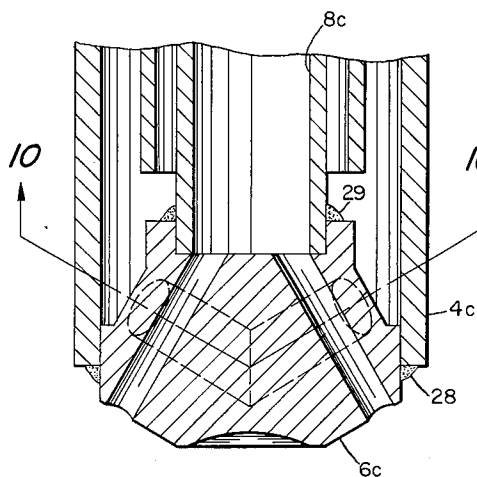


Fig. 9

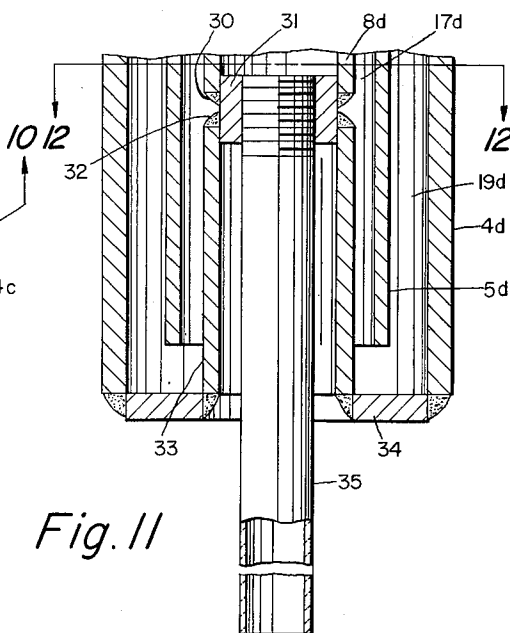


Fig. 11

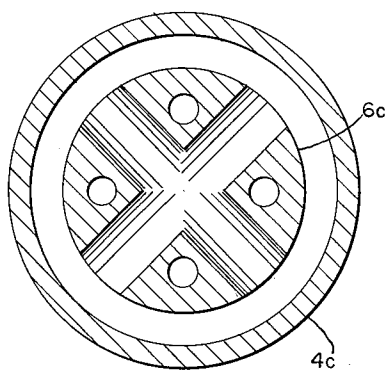


Fig. 10

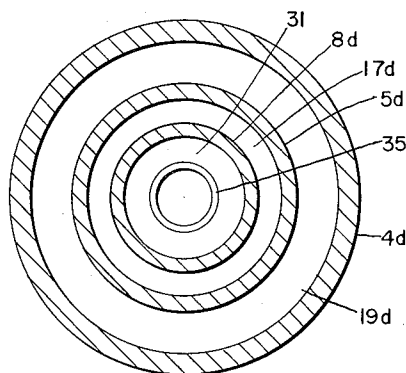


Fig. 12

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OXYGEN LANCES FOR OPEN-HEARTH FURNACES AND THE LIKE

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2 Claims. (Cl. 239—132)

This invention relates generally to oxygen lances, but has reference more particularly to devices of this character which are especially adapted for supplying oxygen to open-hearth furnaces.

A primary object of the invention is to provide devices of this character which are of simple and sturdy construction and particularly useful for feeding oxygen, in controlled amounts, to the molten metal in open-hearth furnaces.

Another object of the invention is to provide devices of this character which are characterized by the incorporation therein of means for efficiently water cooling the parts through which the oxygen passes.

A further object of the invention is to provide devices of the character described, which have incorporated as a part thereof means for transporting and supporting them by means of movable cranes and the like.

A still further object of the invention is to provide devices of the character described, portions of which are easily removable for repair or replacement purposes.

Other objects and advantages of my invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

Fig. 1 is a top plan view of one form of the device;

Fig. 2 is an elevational view, of the device, of Fig. 1, with portions thereof broken away to show certain features of construction;

Fig. 3 is a cross-sectional view, showing a portion of the lower end of the device of Fig. 2, on an enlarged scale, and taken on the line 3—3 of Fig. 1;

Fig. 4 is a cross-sectional view, taken on the line 4—4 of Fig. 3;

Fig. 5 is a view similar to Fig. 3, but showing a modification of the invention;

Fig. 6 is a cross-sectional view, taken on the line 6—6 of Fig. 5;

Fig. 7 is a view similar to Fig. 3, but showing another modification of the invention;

Fig. 8 is a cross-sectional view, taken on the line 8—8 of Fig. 7;

Fig. 9 is a view similar to Fig. 3, but showing a further modification of the invention;

Fig. 10 is a cross-sectional view, taken on the line 10—10 of Fig. 9;

Fig. 11 is a view similar to Fig. 3, but showing still another modification of the invention, and

Fig. 12 is a cross-sectional view, taken on the line 12—12 of Fig. 11.

Referring more particularly to Figs. 1 to 4 inclusive of the drawings, reference numeral 1 designates a bail or support for an oxygen lance, which bail is adapted to be engaged or supported by the hook of a traveling crane or the like (not shown) in order to transport the oxygen lance from one open hearth furnace to another.

The bail or support 1 is pivotally secured or connected to an annular collar 2, as by means of pivot pins or

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bolts 3, which are threadedly secured to the collar, at diametrically-opposite points of the latter.

Welded to the lower face of the collar 2, in concentric spaced relation to each other, are tubular steel members 4 and 5, the member 4 extending downwardly to a level below the lower end of the member 5. Secured within the lower end of the member 4, as by a press fit, is a tip or nozzle 6, made of copper, and the detailed construction of which will be presently described.

The tip or nozzle 6 is provided with a recess 7 centrally of its upper portion, and into which the lower end of a steel conduit or pipe 8 extends, this pipe being secured to the tip or nozzle 6, as by a press fit. The conduit 8 is in concentric spaced relation to the tubular member 5 and extends through a central opening 9 in the collar 2, the upper end of the conduit 8 being provided with threads 10, so as to adapt same for the removable connection thereto of a hose for supplying oxygen to the conduit 8.

In order to provide a fluid-tight seal between the conduit 8 and the collar 2, the collar 2 has welded thereto, as by weld metal 11, a nut 12, in which a bushing 13 is threadedly secured, which bushing is adapted to compress packing 14, disposed in a counterbore 15 of the opening 9, so as to force this packing tightly between the wall of the counterbore 15 and the exterior wall of the conduit 8, thus providing a fluid tight seal between the collar and conduit.

A water inlet pipe 16 is also provided, which extends through the conduits 4 and 5 and communicates with the annular space 17 between the member 5 and conduit 8, and a similar water outlet pipe 18 is provided, which extends through the member 4 and communicates with the annular space 19 between the members 4 and 5.

The nozzle or tip 6 is provided with a series of circumferentially-spaced passageways 20, which extend through the nozzle, in a downwardly and outwardly inclined direction, communicating the lower end of the conduit 8 with the space below the nozzle or tip. The nozzle or tip 6 is also provided with a series of circumferentially-spaced passageways 21, which are in alternate arrangement with the passageways 20, and extend downwardly and inwardly toward the center of the tip, these passageways communicating with each other. The passageways 21 are preferably at least about twice the diameter of the passageways 20.

In the use of the oxygen lance, as described, the lance is carried by means of the hook of a traveling crane to a position above an opening provided in the roof of an open hearth furnace, and the lance is passed downwardly through this opening to a position in which the nozzle or tip 6 is disposed closely adjacent the molten metal in the furnace.

Due to the pivotal connection of the bail or support 1 with the collar 2, the bail may be swung out of line with the axis of the conduit 8, so as to facilitate connection to this conduit of the hose which supplies oxygen to this conduit.

As oxygen is supplied to the conduit 8 and into the furnace through the passageways 20, water for cooling the tip or nozzle 6 is continuously supplied to the passageways 21, the water circulating through the space 17 and upwardly through the space 19. In this way, the entire lance, and especially the tip 6, is maintained at a sufficient low temperature to avoid melting or damage thereto, in spite of the high temperature of the molten metal in the furnace.

In the event that the tip 6 needs replacement, it is not necessary to replace the entire lance, since the tip and the conduit 8 may be easily removed from the collar 2 and members 4 and 5, without disturbing the collar 2 and members 4 and 5.

In the various modifications to be now described, the

upper portions of the lances are the same, in construction, as that shown in Figs. 1 and 2, and need not therefore be shown. The lower portions of the lances are of somewhat different construction, and parts thereof which correspond with those in Figs. 1 to 4 inclusive will be identified by corresponding numerals, but with the addition of letters to the numerals.

In Figs. 5 and 6, a modification of the invention is shown, in which a tip or nozzle 6a, made of copper, is secured to the lower ends of members 4a and 5a, as by weld metal 22. The top or nozzle 6a is provided with a recess 7a centrally of its upper portion, and into which the lower end of the steel conduit or pipe 8a extends, the pipe being secured to the tip or nozzle 8a, as by weld metal 23.

The nozzle or tip 6a is provided with a series of circumferentially-spaced passageways 20a, which extend through the nozzle, in a downwardly and outwardly inclined direction, communicating the lower end of the space 17a with the space below the nozzle or tip. The nozzle or tip 6a is also provided with a series of circumferentially-spaced passages 21a, which are in alternate arrangement with the passageways 20a, and extend downwardly and inwardly toward the center of the tip, these passageways communicating the lower end of the space 19a with the recess 7a.

In the use of this modified form of lance, the oxygen is supplied through the conduit 16 to the passageways 20a, via the space 17a. The cooling water is supplied through the upper end of the conduit 8a, passes through this conduit into the recess 7a, through the passageways 21a, space 19a and out through the pipe 18.

In Figs. 7 and 8, another modification of the invention is shown, in which the tubular member 4b is preferably made of stainless steel, and has secured to its lower end, as by weld metal 22b, a cap or tip 6b, also preferably made of stainless steel, and provided with a series of circumferentially-spaced openings 24, which are inclined to the axis of the member 4b.

The steel conduit 8b has secured to its lower end, as by weld metal 23b, a cap 25, provided with a series of circumferentially-spaced openings or passageways 26, which are in axial alignment with the openings 24. Stainless steel tubes 27 are welded to the caps 25 and 6b and serve to communicate the openings 26 with the openings 24.

In the use of this modified form of lance, the oxygen is supplied through the conduit 8b, and to the openings 24, via the openings 26 and tubes 27. The cooling water is supplied through the pipe 16, passes downwardly through the space 17b upwardly through the space 19b and out through the pipe 18. In this form of the invention, the water is circulated about the pipes 27 and an efficient cooling effect is obtained.

In Figs. 9 and 10, a further modification is shown, in which the construction is substantially the same as that shown in Figs. 3 and 4, with the exception that the nozzle or tip 6c is secured to the tubular member 4c, as by weld metal 28, and to the conduit 8c, as by weld metal 29.

In Figs. 11 and 12, a still further modification is shown, in which tubular steel members 4d and 5d are employed, as well as the conduit 8d. The tubular member 5d terminates at a level above that of the lower end of the member 4d, and the conduit 8d terminates at a level substantially above that of the lower end of the member 5d.

The conduit 8d has secured within its lower end, as by weld metal 30, an interiorly-threaded bushing 31, which, in turn, has secured thereto, as by weld metal 32, a tubular element 33, which, in effect, is an extension of the

conduit 8d and extends to the level of the lower end of the member 4d. The space between the member 4d and tubular element 33 is closed, as by means of an annular steel plate 34, which is welded to the lower ends of the member 4d and element 33.

Removably secured to the bushing 31, is a long tube 35, made of a high-temperature resistant ceramic material, this tube being adapted to carry oxygen from the conduit 8d to a point adjacent the molten metal in the furnace.

In this form of the invention, the cooling water is supplied through inlet 16, passes downwardly through the space 17d upwardly through the space 19d and out through the pipe 18.

It is thus seen that I have provided devices of the character described which are of simple and sturdy construction, and well adapted for the purposes for which they have been designed, being cooled in a thorough and highly efficient manner.

It is to be understood that the form of my invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes may be made in the shape, size and arrangement of parts thereof, without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. In a device of the character described, a supporting collar, three concentrically arranged spaced tubular members secured to said collar and depending therefrom, a nozzle or tip supported by at least one of said tubular members, said nozzle or tip made as a one-piece member of copper having a series of passageways consisting of circumferentially-spaced inclined bores diverging downwardly and outwardly through said nozzle or tip for the passage of oxygen therethrough, and a series of circumferentially-spaced passageways therein for the passage of a cooling fluid, said last-named passageways consisting of bores arranged circumferentially alternately with said first-named passageways, and extending inwardly and downwardly toward the center of said tip and converging in a common junction near the center of said tip, said junction being separated from the outer ends of said first-named passageways by a mass of said one piece member.

2. In a device of the character described, a supporting collar, three concentrically arranged spaced tubular members secured to said collar and depending therefrom, means for passing oxygen through the innermost of said tubular members, means for circulating a cooling fluid through the other tubular members, a nozzle or tip supported by at least one of said tubular members, said nozzle or tip made as a one-piece member of copper having a series of passageways consisting of circumferentially-spaced inclined bores leading from said innermost tubular member and diverging downwardly and outwardly through said nozzle or tip for the passage of oxygen therethrough, and a series of circumferentially-spaced passageways therein for the passage of said cooling fluid, said last-named passageways consisting of bores arranged circumferentially alternately with said first-named passageways, and extending inwardly and downwardly toward the center of said nozzle or tip and converging in a common junction near the center of said tip, said junction being separated from the outer ends of said first-named passageways by a mass of said one piece member.

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