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[54] APPARATUS AND METHOD FOR ATTACHING A WORKING DEVICE TO AN OXYGEN LANCE

3 Claims, 2 Drawing Figs.

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[50] Field of Search ..... 266/1, 34, 34.1, (Inquired), 34.2, (Inquired); 287/126; 29/451, (Inquired)

[56] References Cited

UNITED STATES PATENTS

2,133,871	10/1938	Reed	287/126
3,395,908	8/1968	Woodcock	266/34
3,452,476	7/1969	Kise	287/126

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ABSTRACT: Apparatus whereby a working device may be inserted into a bore of an oxygen lance in a basic oxygen furnace, said apparatus comprising an elongated member having an upper portion and a lower portion, a centering means attached to said lower portion thereof and a plurality of flexible filaments attached to and extending radially outwardly from said upper portion of said elongated member.

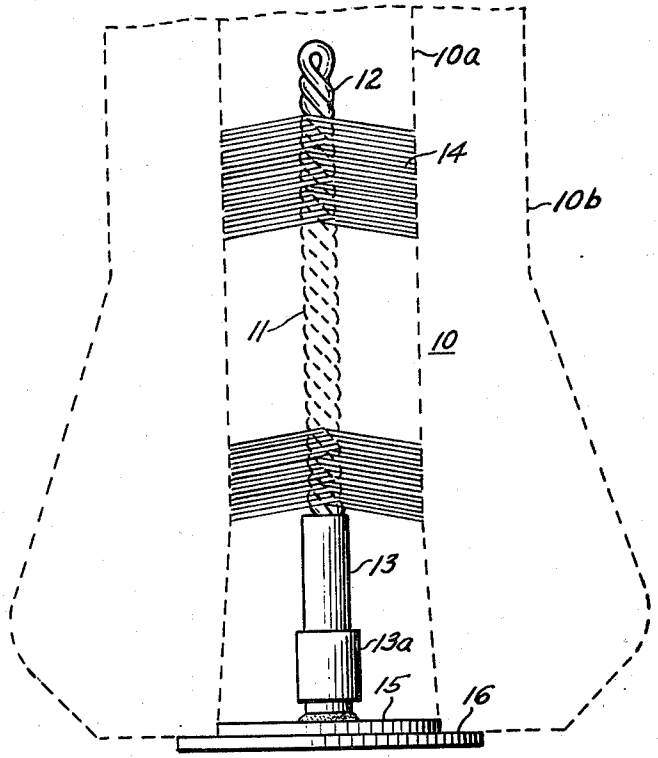
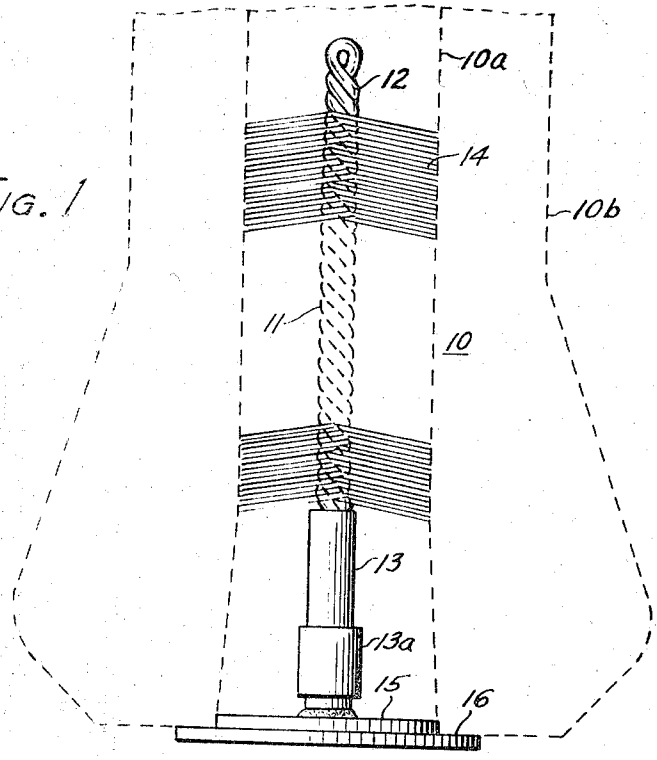


FIG. 1



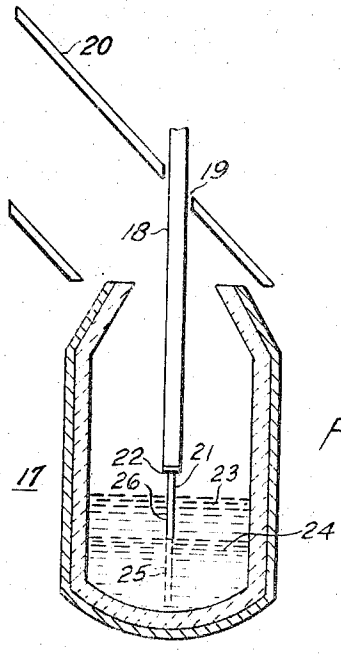


FIG. 2

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APPARATUS AND METHOD FOR ATTACHING A WORKING DEVICE TO AN OXYGEN LANCE

BACKGROUND OF THE INVENTION

In the basic oxygen process of refining steel, it is necessary for the operator to know the temperature and carbon content of the bath so that the bath may be tapped at the proper temperature and at the desired carbon level. It is also necessary for the operator to know the location of the surface of the bath so that the oxygen lance may be positioned at the optimum distance therefrom to obtain the most efficient use of the injected oxygen.

Prior art practices for determining the temperature and carbon content of the bath include the use of known temperature sensing and sampling devices which may be inserted into the furnace while it is in an upright position or after it has been turned down. In the latter case the furnace must then be realigned in an upright position and the refining process continued. The first procedure requires the use of costly and complicated equipment which may be rendered inoperative by the hostile environment prevalent in the area above the furnace while the latter procedure is costly and time consuming.

In order to locate the surface of the bath in the furnace, it has been prior practice either to fasten a solid rod of known length to the outside surface of the oxygen lance by means of a cable or to insert the rod into a bore in the lance and to force a pair of wedges alongside the rod to prevent it from falling into the furnace. Either method of attaching the rod to the lance is extremely hazardous to personnel. They are exposed to high temperatures and dusty environment for relatively long periods of time when they lean over the lance opening in the exhaust hood atop the furnace to attach the rod. Moreover, the rod may be lost due to burning away of the cable or wedges or during removal from the lance.

It is therefore the object of this invention to provide an apparatus which may be quickly and safely attached to a bore in an oxygen lance whereby devices attached thereto may be lowered into the furnace.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a view in elevation of the apparatus of the invention.

FIG. 2 shows the apparatus of the invention in use in a basic oxygen furnace.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the FIGS. and in particular FIG. 1, the apparatus of the invention is shown generally at 10 inserted into the bore 10*a* of an oxygen lance 10*b* shown in phantom. The apparatus of the invention includes an elongated member 11 having an upper portion 12 and a lower portion 13. The upper portion 12 is a filament-retaining means which may be a metallic wire formed into a U-shaped configuration having two equal legs twisted together by any conventional means. A plurality of relatively strong, resilient, flexible filaments 14 are fixedly retained in the upper portion 12 and extend radially outwardly therefrom. The elongated member 11 is attached to centering means 15 by any conventional means, for example, a coupling 13*a*. While it is not necessary, it is preferred to attach a heat shielding and restraining means 16 to the centering means 15. A working device, for example, an immersion thermocouple, may be welded to the bottom portion of centering means 15 or to the bottom of the shielding and restraining means 16 if used, whereby the thermocouple may be lowered into the furnace.

The filaments 14 may suitably be made of steel. They must be flexible, resilient and sufficiently strong to resist deformation under relatively heavy loads which are attached to the apparatus of the invention and which hang vertically downwardly therefrom. The filaments must be flexible so that the apparatus may be inserted into the bore of lance and when required be removed therefrom under applied external force. They must be resilient so that they will reassume their original shape and will be reusable after removal from the bore of the lance. They must be sufficient strength to support a working device such as a thermocouple suspended from the apparatus, but to yield if a greater force or a twisting force is applied thereto, so that the apparatus can be removed from the bore of the lance. It should be possible, if desired, to blow out the apparatus by blowing oxygen through the lance. The ratio of the length of the filaments to the greatest diameter of the bore may be about 1.05 to about 2.0.

The centering means 15 which aids in positioning the apparatus in the bore of the lance may be of metal, for example, steel which will not melt if held for a time at the temperatures prevalent in the atmosphere of a basic oxygen furnace and may be of any suitable shape.

The shielding and restraining means 16 protects the apparatus from the high temperatures and dust prevalent in the atmosphere in the basic oxygen furnace and limits the distance which the apparatus may be inserted into the bore of the lance. The shielding and restraining means 16 may be suitably made of steel and may be of any suitable shape.

At the beginning of a furnace campaign, the inside dimensions of the furnace and the amount of raw material charge are known. The depth of the molten ferrous metal maybe easily determined. Therefore, the distance the oxygen lance must be lowered into the furnace to obtain optimum blowing efficiency is known. This distance is noted on an indicator board adjacent the oxygen lance above the exhaust hood. However, the refractory lining of the furnace is eroded during the campaign. As a result, the inside diameter of the furnace becomes larger resulting in a lower of the surface of the molten ferrous metal in the furnace. To maintain blowing efficiency, it is necessary, periodically, to locate the surfaced of the molten ferrous metal in the furnace. A lance height indicator rod of known length is attached to the lance by means of the apparatus of the invention. The lance is lowered a distance, for example, the original recorded distance, into the furnace and allowed to remain at time sufficient to melt that portion of the rod which extends into the molten ferrous metal. The lance is raised out of the furnace and the remaining portion of the rod removed from the lance and measured. The location of the surface of the molten ferrous metal can then be determined by simple arithmetic.

As noted previously, a working device is attached by conventional means, for example, welding, to the bottom of the centering means for shielding and restraining means, when used. The apparatus of the invention is inserted into the bore of the lance and the working device extends vertically downwardly therefrom. The lance is lowered into the furnace causing the working device to be lowered into the molten bath in the furnace. One such working device is a lance height indicator rod. FIG. 2 shows a lance height indicator rod after is has been attached to the lance by means of the apparatus of the invention and has been lowered into a basic oxygen furnace shown generally at 17. The oxygen lance 18 has been lowered through a hold 19 provided in the exhaust hood 20. The lance height indicator rod 21 is shown extending downwardly from the lance tip 22 through the slag layer 23 into the molten bath 24. The portion 25 of the rod 21 which extends in to the bath 24 is melted by the bath and is, therefore, shown in phantom. The portion 26 of the rod 21 which is in slag layer 23 does not melt and remain attached to the apparatus of the invention and is withdrawn by raising the lance through the hole 19. The lance height indicator rod thus used weighed 10.4 pounds. The filaments of the apparatus were 2.875 inches in length while the bore diameter of the lance was 2.625 inches. The ratio of the filament length to the bore diameter of the lance was 1.2.

While I have described the apparatus of the invention as being used to determine the height of the oxygen lance above the surface of the bath, it is also possible to attach other apparatus thereto such as a thermocouple assembly to obtain the temperature of the bath or molten metal sampler whereby a sample of the molten bath maybe obtained.

I claim:

1. Apparatus adapted to be inserted into a bore of any oxygen lance comprising:

a. an elongated member having an upper portion an a lower portion;

b. a plurality of flexible filaments extending radially outwardly from the upper portion of said elongated member, said filaments being of a length sufficient to forcibly contact the surface of the bore of said lance when said member is inserted therein and of a stiffness sufficient to hold said member therein until released by application of an external force; and

c. means attached to the lower portion of said elongated member to center said member in said bore.

2. Apparatus of claim 1 in which a shielding and restraining means of larger dimension than said bore of said lance is attached to said elongated member below said centering means.

3. Apparatus of claim 1 in which the ratio of the length of the flexible filaments to the bore diameter is from about 1.05 to about 2.0.