Oct. 4, 1966 A. J. KARDOS ETAL 3,276,759

OXYGEN LANCE MANIPULATOR FOR OPEN HEARTH FURNACES

Filed Aug. 12, 1963 4 Sheets-Sheet 1

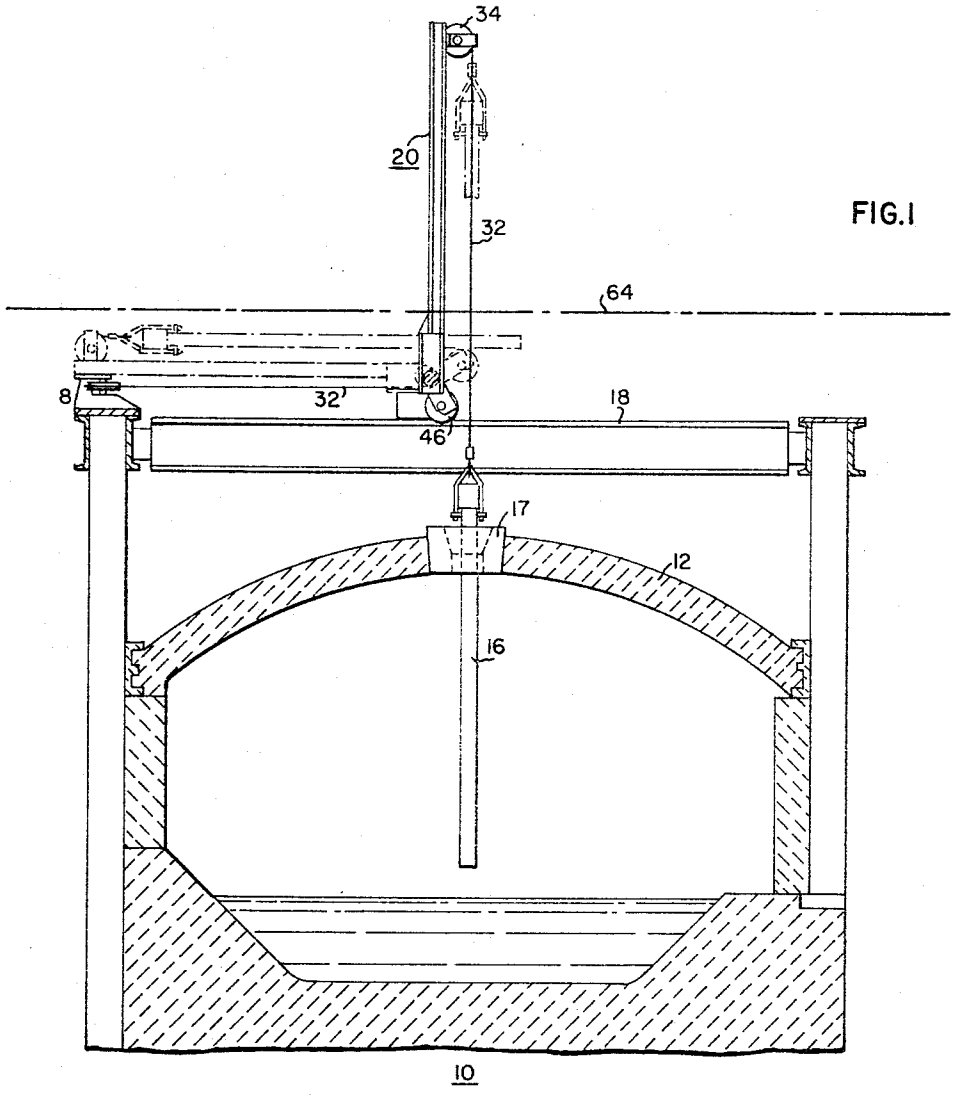


FIG. 1

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FIG.2

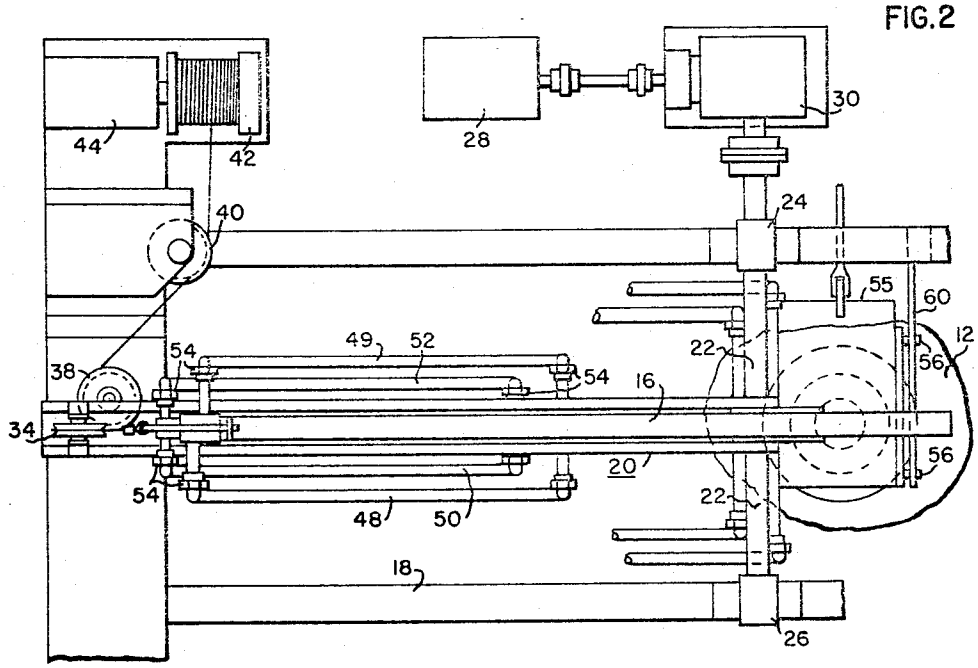
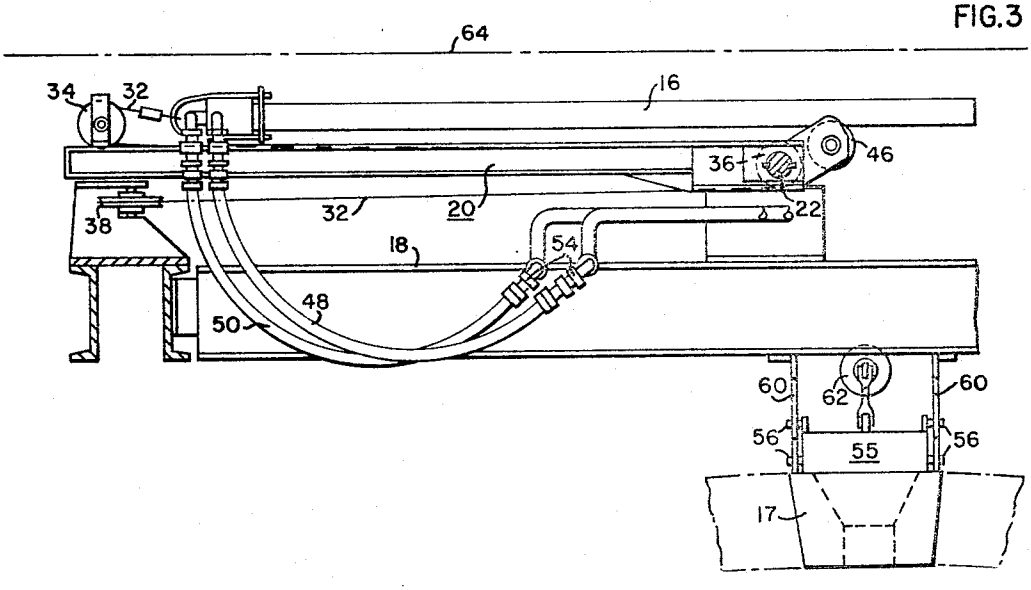


FIG.3



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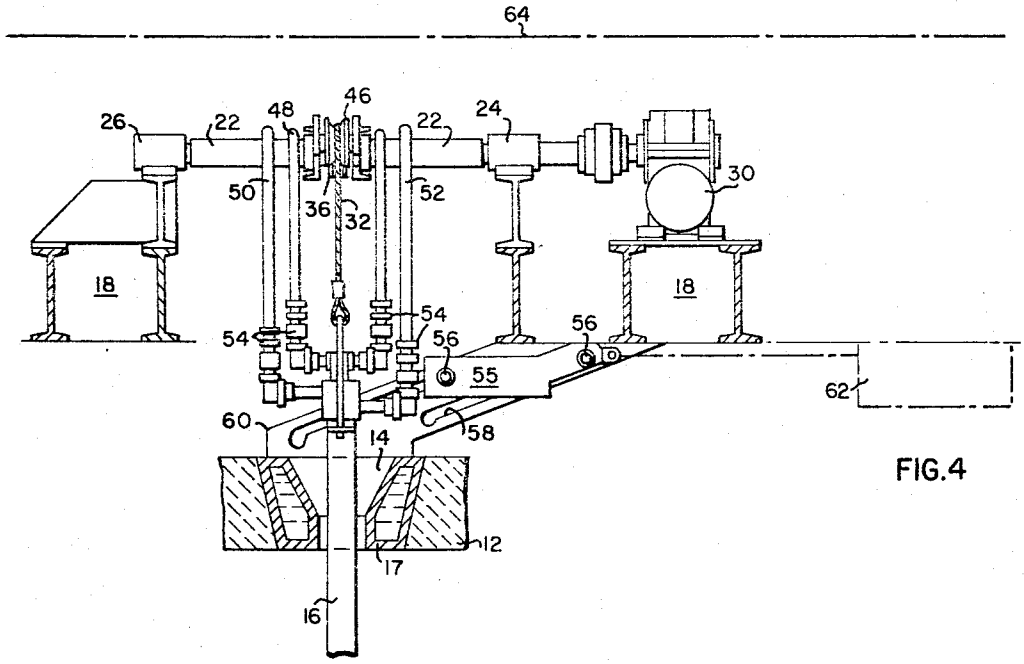
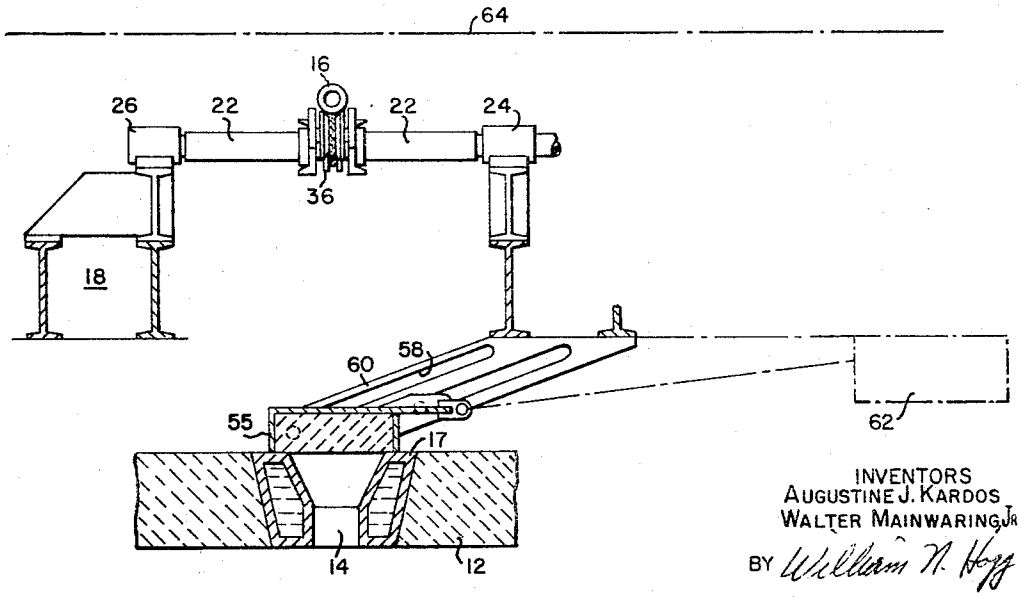


FIG.4

FIG.5



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FIG.6

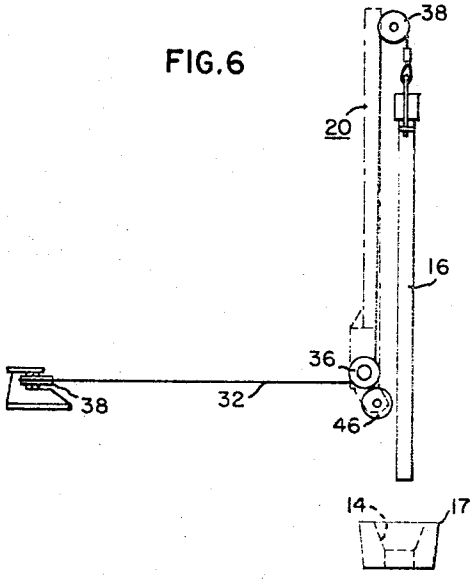
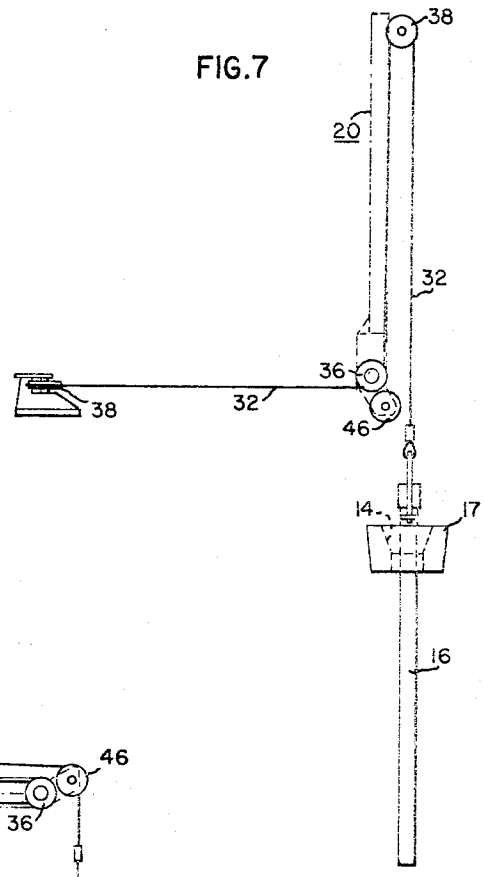


FIG.7



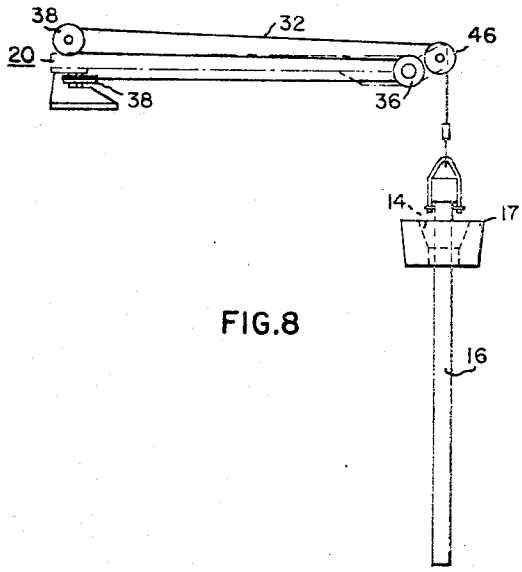


FIG.8

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OXYGEN LANCE MANIPULATOR FOR OPEN HEARTH FURNACES

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Filed Aug. 12, 1963, Ser. No. 301,423
6 Claims. (Cl. 266—34)

This invention relates to apparatus for providing metallurgical oxygen to open hearth furnaces, and more particularly to equipment for inserting and withdrawing oxygen lances through the top of an open hearth furnace.

The use of metallurgical oxygen in open hearth furnaces for making steel is now a common practice. Although there are many types of lances and many ways of arranging the lances for delivering the oxygen, water-cooled lances projecting through the top of the furnace are usually the most desirable. When new open hearth furnaces and shops are built, the furnaces and associated equipment are designed to accommodate roof oxygen lances and equipment associated therewith. In the case of new installations, ample space for the oxygen lances and the associated equipment is provided at the top of the furnace. However, when existing open hearth furnaces are converted to use lance oxygen, sufficient space is not always available on top of the furnace to accommodate the oxygen lance and associated structure required to support the lance for insertion or withdrawal from the furnace. For example, it is quite typical to have at least one bridge-type crane operating on the charging side of the open hearths, and the bridges of these cranes often pass quite close to the top of the furnaces. In this instance, the supporting tower for inserting and withdrawing the lance may be so tall that it would obstruct the crane travel. One possible solution to this problem is to raise the crane so that it would clear the lower assembly; this, however, is an expensive solution, inasmuch as it would entail the raising of the crane tracks and, in some cases, might involve completely rebuilding the roof of the shop.

It is therefore a principal object of this invention to provide a device for inserting and removing an oxygen lance which will not permanently restrict overhead crane movement.

Another object of this invention is the provision of an apparatus for inserting and removing an oxygen lance, which apparatus includes a tower that can be moved out of the way when it is not actually in use for inserting or withdrawing the lance to allow for overhead crane travel.

Still a further, more specific object of this invention is the provision of an apparatus for inserting and removing an oxygen lance, which apparatus includes a tower normally resting in a horizontal position but which can be raised to a vertical position when inserting and removing an oxygen lance, and can be lowered back to the horizontal position when not in use.

Yet another, more particular object of this invention is the provision of apparatus for inserting and removing an oxygen lance, which apparatus has a tower that can be raised to a vertical position to insert and move the oxygen lance, can be lowered to a horizontal position when the oxygen lance is in use, and can also be lowered to the horizontal position when the oxygen lance has been withdrawn, and will support the oxygen lance horizontally

when not in use, so as to provide clearance for overhead cranes when the tower is in the horizontal position.

These and other objects, together with a fuller understanding of the invention, will become apparent from the following description when taken in conjunction with the drawings in which:

FIGURE 1 is an end elevational view, partially in section, showing an open hearth furnace having an oxygen lance and supporting structure of this invention mounted thereon;

FIG. 2 is a plan view of the device of this invention showing the oxygen lance retracted and the support tower folded flat on top of the furnace;

FIG. 3 is an elevational view of the device of FIG. 2 showing the tower and lance in horizontal position when not in use;

FIG. 4 is a front elevational view of the device of this invention showing the lance inserted through a water cooled port into the furnace;

FIG. 5 is a detailed front elevational view, partially in section, of the port cover and its mounting on the furnace;

FIG. 6 is a schematic showing of the support tower raised, ready to insert the lance into the furnace;

FIG. 7 is a schematic showing of the support tower, raised just after the lance has been inserted into the furnace, and

FIG. 8 is a schematic showing of the lance inserted in the furnace and the support tower pivoted back to its retracted position.

Referring now to the drawings, and particularly to FIGURE 1, the device of this invention is shown in conjunction with an open hearth furnace designated generally as **10**. The furnace **10** includes a refractory roof **12** having a port **14** through which an oxygen lance **16** (of any conventional water-cooled design) can be projected. The port **14** is defined by a water-cooled jacket **17**. The device of this invention which is adapted to raise and lower the oxygen lance **16**, is supported by channels and tie rods **18** which form the roof-supporting structure of the furnace **10**.

Referring now to FIGS. 2 and 3, the device of this invention includes a support tower **20** having one end keyed to a shaft **22**, which shaft is journaled for rotation by bearings **24** and **26**. The shaft **22** is connected to a reversible motor **28** through a gear reduction box **30**; thus, the shaft can be rotated by the motor to pivot the tower between the horizontal and the vertical positions shown in FIG. 1. The tower **20** is adapted to support and manipulate the oxygen lance **16** which is secured to the end of a cable **32**. The cable **32** is reeved over a sheave **34** at the remote end of the tower **20**, and thence over a sheave **36** carried by the shaft **22**, then around two sheaves **38** and **40** mounted on the channels **18** and is finally wound on a drum **42** driven by a reversible motor **44**. A sheave **46** is provided on the tower **20** adjacent its connection to the shaft **22**, as can best be seen in FIG. 3. This sheave **46** acts as a support for the lance when the lance is retracted and, as will become apparent, acts as a direction-changing sheave for the cable **32** when the lance is inserted in the furnace in operating position.

Suitable hoses **48** and **49** are provided for supplying the oxygen to the lance from a source (not shown). The oxygen is provided by two hoses instead of one so that the hoses will be balanced on each side of the tower, i.e., one on each side; however, functionally one oxygen hose would suffice. Hoses **50** are provided for the inlet cool-

ing water from a source (not shown), and hoses **52** are provided for the outlet water to empty it in a drain (not shown). Because of the movement of the oxygen lances **16** and support tower **20**, swivel-type couplings **54** are provided where necessary to connect the hoses to the oxygen sources, water inlet sources and outlet drains to permit movement of the hoses without bending or twisting.

Referring now to FIGS. 4 and 5, a cover **55** is provided to prevent heat loss through the port **14** when the lance is not in use. Additionally, the cover **55** prevents flame and heat damage to the lance **16** and the associated lance operating mechanism and furnace structure when the lance is not in use. The cover **55** has a pair of lugs **56** on each side thereof. The lugs engage camming slots **58** formed in guide plates **60** welded to the channels **18**. The cover **55** is operated by an air cylinder **62** which is mounted on the channels **18**. When the air cylinder **62** is actuated in one direction, the camming action of the slots **58** and lugs **56** will cause the cover **55** to rise and retract leaving the port **14** unobstructed, and when the cylinder is actuated in the opposite direction will replace the cover over the port **14**.

Operation

The lance, when not in use, is stored in the horizontal position shown in FIG. 1, and the cover **55** is in position covering the port **14**. As can be seen, when the tower **20** and support lance **16** are in this horizontal position, the lower part of the electric overhead traveling crane bridge, shown schematically by the line **64**, can freely pass over the lance and tower, and its travel is not obstructed by any of the equipment required for the oxygen lance. When it is desired to use the oxygen lance, the crane is first moved away from the vicinity of the lance and tower and the air cylinder **62** is actuated to remove the cover. The motor **28** is then actuated and the tower **20** is rotated by the rotation of shaft **22** until it reaches the vertical position as shown in FIG. 6. If desired, the tower may be moved slightly past this vertical position to allow the oxygen lance **16** to hang freely as a pendulum and not rub or scrape the tower. When the tower is in this vertical position, the lance will be suspended vertically above the port **14**; however, because of normal misalignment problems, the top of the port is somewhat bell-shaped, as shown, to provide guidance for the lance when it is lowered. It is apparent from the examination of the drawings that when the tower is raised the lance will not change positions with respect to the tower to any substantial extent, i.e., the lance will not be moved longitudinally along the tower to any extent other than the movement inherent in the slight change of positions of the cable **32** on the various sheaves. When the tower is in the vertical position and the cover **55** has been retracted, the lance is then inserted into the furnace through the port **14** by actuating the motor **44** to unwind the cable from the drum **42**; as the cable is unwound, the weight of the lance will cause it to descend through the port **14** into operating position, as shown in FIG. 7. After the lance has been lowered into this operating position and the end of the lance which is attached to the cable has passed the sheave **46**, this sheave then becomes a cable sheave as opposed to a lance-supporting sheave, as previously described. The tower is then returned to its horizontal position by actuating the motor **28** in the opposite direction. This position is shown in FIG. 8, and when the tower is in this position the crane can freely pass over it. The height of the lance within the furnace can be changed by actuating the motor **44** which will change the height of the lance to whatever height is required, although the lance cannot be completely removed from the furnace while the tower is retracted. In order to retract the lance, the tower is rotated to its vertical position, the lance is withdrawn by rolling the cable up on the drum **42**, and the tower is then returned to its horizontal position and the cover replaced on the port **14**.

While one embodiment of this invention has been shown and described, various adaptations and modifications may be made without departing from the spirit and scope of the appended claims.

We claim:

1. Apparatus for inserting and retracting an oxygen lance through an opening in the roof of an open hearth furnace comprising, a tower, means to move the tower between a generally horizontal position and a generally vertical position, means supporting an oxygen lance on said tower, said supporting means including means to raise and lower the lance between a retracted position and an operating position when the tower is vertical, said supporting means comprising means for carrying the lance with the tower when the lance is in its retracted position and the tower is moved between its vertical and horizontal position and for maintaining the lance vertical when the lance is in its operating position and the tower is moved between its vertical and horizontal positions.

2. Apparatus for inserting and retracting an oxygen lance through an opening in the roof of an open hearth furnace comprising, a tower having one end pivotally mounted on the furnace, means to pivotally move said tower between a generally horizontal position and a generally vertical position, means supporting an oxygen lance on said tower, said supporting means including means to raise and lower the lance between a retracted position and an operating position when the tower is vertical, said supporting means comprising means for carrying the lance with the tower when the lance is in its retracted position and the tower is moved between its vertical and horizontal position and for maintaining the lance vertical when the lance is in its operating position and the tower is moved between its vertical and horizontal positions.

3. Apparatus for inserting and retracting an oxygen lance through an opening in the roof of an open hearth furnace comprising, a tower having one end pivotally mounted on the furnace, means to pivotally move said tower between a generally horizontal position and a generally vertical position, means supporting an oxygen lance on said tower, said supporting means including cable means and sheave means adapted to raise and lower the lance between a retracted position and an operating position when the tower is vertical, said supporting means comprising means for carrying the lance with the tower when the lance is in its retracted position and the tower is moved between its vertical and horizontal position and for maintaining the lance vertical when the lance is in its operating position and the tower is moved between its vertical and horizontal positions.

4. Apparatus for inserting and retracting an oxygen lance through an opening in the roof of an open hearth furnace comprising, a tower having one end pivotally mounted on the furnace, means to pivotally move said tower between a generally horizontal position and a generally vertical position, means supporting an oxygen lance on said tower, said supporting means including a cable carrying said lance and a sheave adjacent the non-mounted end of the tower over which the cable is reeved, said cable and sheave being adapted to raise and lower the lance between a retracted position and an operating position when the tower is vertical, said supporting means comprising means for carrying the lance with the tower when the lance is in its retracted position and the tower is moved between its vertical and horizontal position and for maintaining the lance vertical when the lance is in its operating position and the tower is moved between its vertical and horizontal positions.

5. The combination of claim **4** further characterized by a second sheave carried by the tower adjacent its pivoted end, said second sheave guiding the lance during movement of the tower to its generally vertical position and supporting the lance during pivotal movement of the tower to its generally horizontal position.

6. Apparatus for inserting and retracting an oxygen lance through an opening in the roof of an open hearth

furnace comprising, a tower, means to move said tower between a first position and a second position, means supporting an oxygen lance on said tower, said supporting means including means to raise and lower the lance between a retracted position and an operating position when the tower is in its first position, said supporting means comprising means for carrying the lance with the tower when the lance is in its retracted position and the tower is moved between its first and second positions and for maintaining the lance in its operating position when the lance is therein and the tower is moved between its first and second positions.

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