Sept. 29, 1970 R. B. McCREADY ET AL 3,531,005

METHOD OF TRANSPORTING A STEELMAKING FURNACE

Original Filed July 25, 1966 2 Sheets-Sheet 1

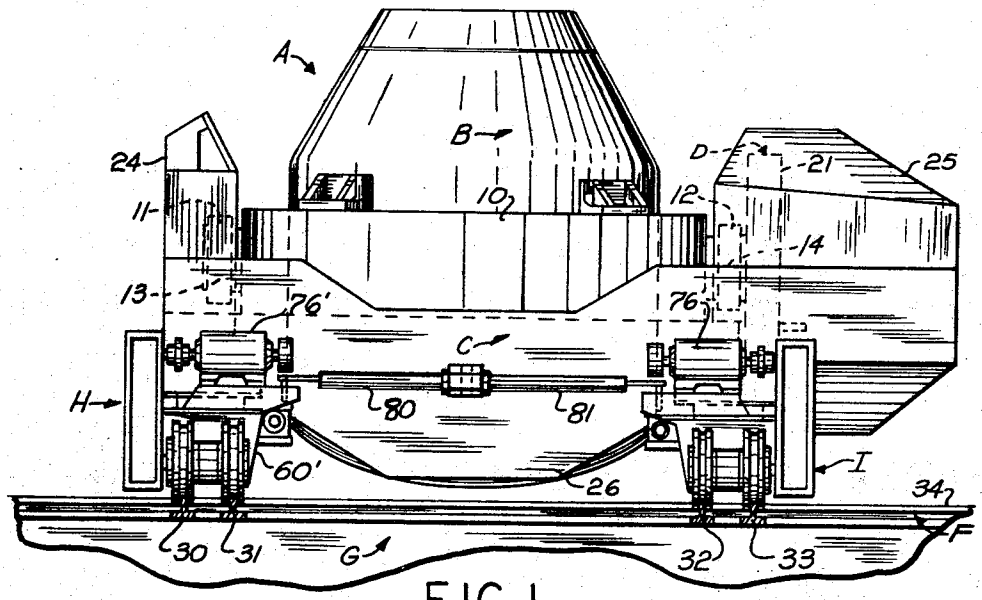


FIG. 1

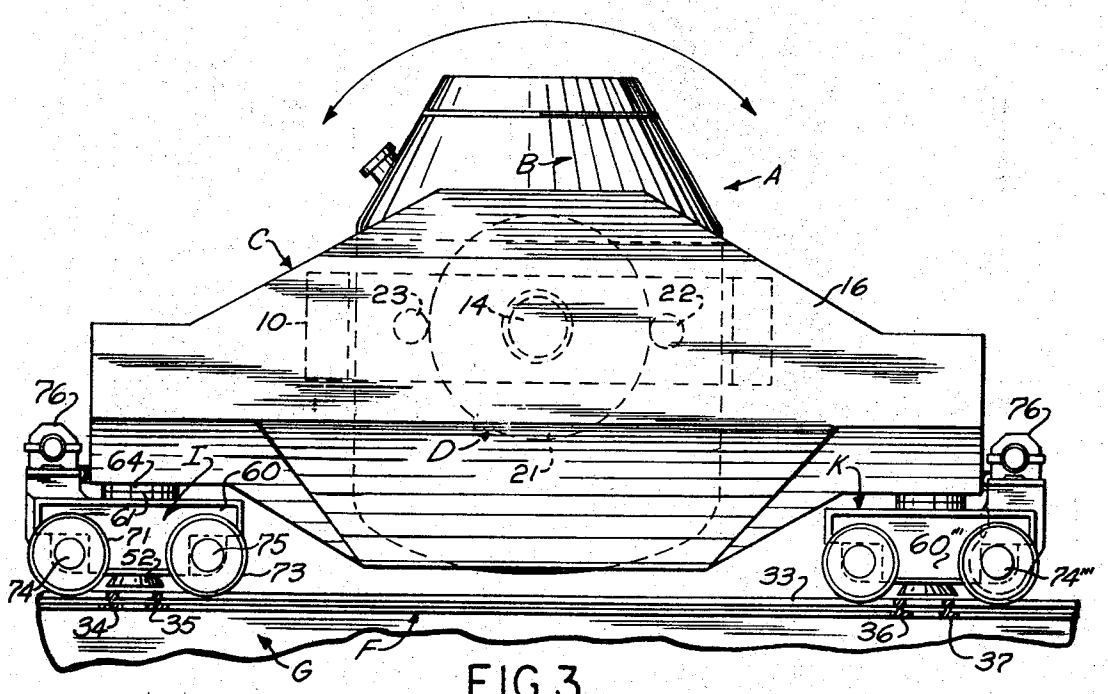


FIG. 3

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METHOD OF TRANSPORTING A STEELMAKING FURNACE

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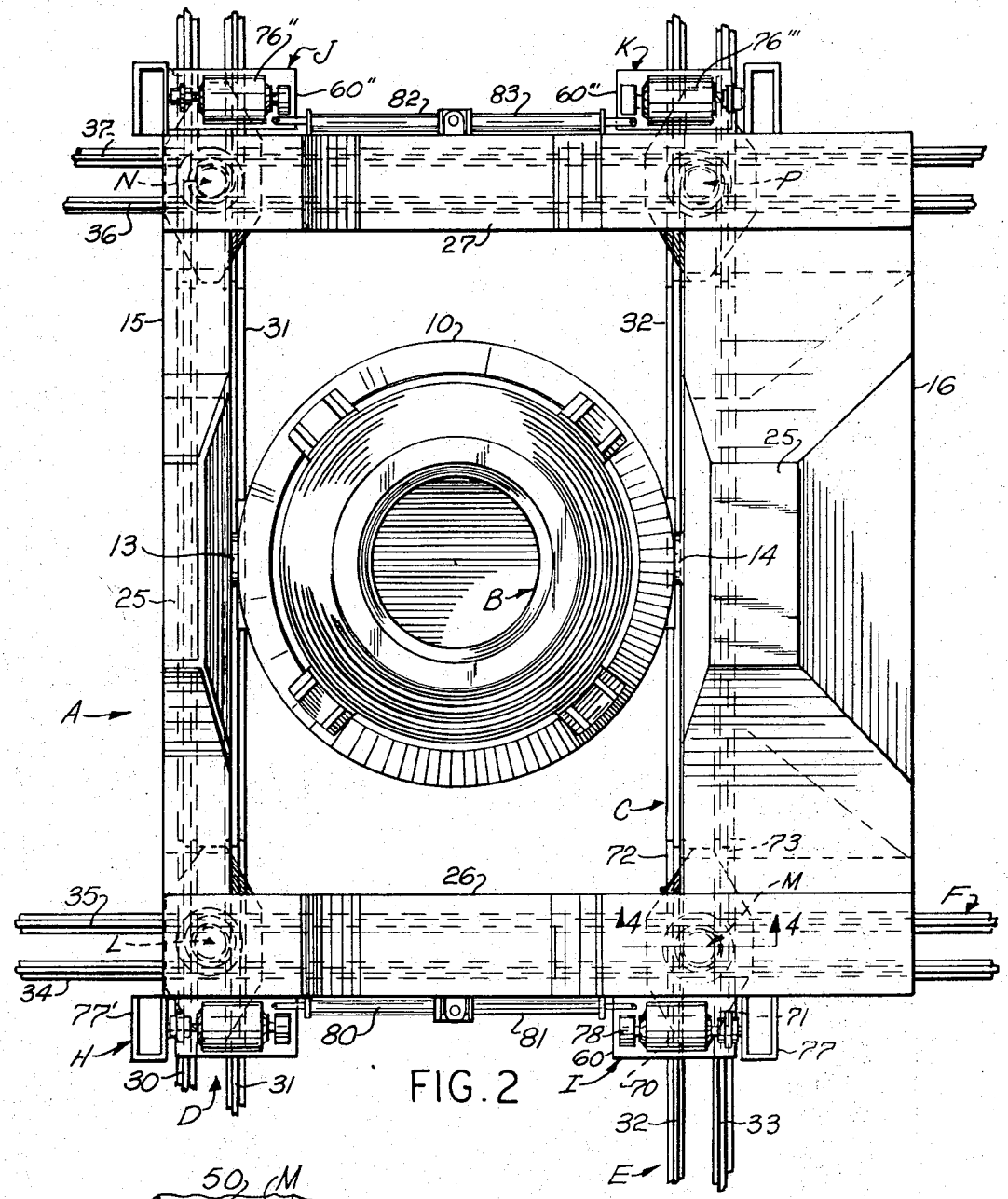


FIG. 2

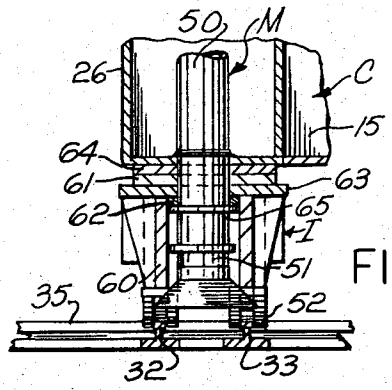


FIG. 4

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METHOD OF TRANSPORTING A STEELMAKING FURNACE

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Application July 25, 1966, Ser. No. 567,721, now Patent No. 3,469,832, dated Sept. 30, 1969, which is a continuation-in-part of application Ser. No. 514,321, Dec. 16, 1965. Divided and this application Feb. 5, 1969, Ser. No. 840,548

Int. Cl. B61f 5/00; B61k 5/02

U.S. Cl. 214—152 2 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for making steel by the basic oxygen process wherein the furnace includes a plurality of wheeled trucks for facilitating movement to and from normal operating or blowing position for such operation as charging, pouring, servicing, etc.

RELATED APPLICATIONS

This application is a division of application Ser. No. 567,721, filed July 25, 1966, now Pat. No. 3,469,832, for "Method and Apparatus for Making Steel," which application is a continuation-in-part of application Ser. No. 514,321, filed Dec. 16, 1965, now Pat. No. 3,312,544, entitled, "Method and Apparatus for Making Steel," and which is incorporated herein by reference.

The present invention relates to steelmaking and more particularly to apparatus used in the making of steel, especially by the basic oxygen process.

Present day steelmaking installations using the basic oxygen lance process usually include a plurality of furnaces or furnace vessels pivotally supported at their blowing positions for oscillation about horizontal axes to facilitate charging, pouring, etc. The furnace vessels are usually stationary, that is, not movable from one location to another in the installation. The vessels require relining and/or other servicing periodically, usually about every two weeks. The present practice is to charge, pour, reline and/or perform other operations and/or services upon the vessels while they are in their operating or blowing positions. It takes considerable time to pour and charge and three or more days to reline a vessel. During pouring and charging the blowing operation is necessarily interrupted and during relining the furnace is out of production. When the steel being produced for a processing installation that requires a predetermined constant or substantially constant supply of metal, an additional furnace vessel or additional furnace vessels with the necessary auxiliary equipment must be provided over the number which would be required to supply the demand for steel if the furnace vessels, etc. could be operated continuously. The necessity of providing an additional furnace vessel or vessels with their auxiliary blowing equipment, etc. increase the overall operating cost of the installation.

It has heretofore been proposed to remove the furnace vessels to a service area for relining, etc., and replace the removed vessel by another during the relining operation thus utilizing the auxiliary equipment, such as, the charging, blowing, pouring apparatus, etc., to better advantage and thereby reduce the overall cost of production for an installation of any given capacity. Prior attempts in this respect have, however, either been limited to furnaces of small capacity, required successive floor space and/or were slow in operation, etc.

The present invention provides a new and improved method of making steel by the basic lance oxygen process wherein the furnace vessel is supported at all times on wheels which are in fact a part of the vessel unit so that the vessel is readily movable from its normal operating or blowing position for other operations including, charging, preheating, pourinfi, etc., and for servicing, such as relining, etc., as desired.

More particularly the invention provides an oxygen lance-type furnace vessel permanently supported on wheels and movable along a track system comprising two intersecting tracks, and otherwise so constructed that it can be readily transferred to and from its blowing position and from one to the other of the intersecting tracks, thus facilitating its movement between its blowing position and other operating positions such as, charging, preheating, pouring positions, etc., and/or service positions, such as, a relining position, spaced from the blowing position.

Another of the objects of the invention is the provision of a novel and improved movable furnace of the character referred to having a truck or trucks adapted to engage intersecting tracks and which comprise means for transferring the furnace from one track to the other which does not require any turning radius, thus making the furnace maneuverable in close quarters.

The vessel unit of the invention preferably comprises a plurality of trucks and a plurality of hydraulically operated jacks or rams for lifting the trucks clear of one track at an intersection of two tracks to permit rotation of the trucks to a position above the other track and subsequently lowering the trucks to engage the trucks with the second track.

DESCRIPTION OF DRAWINGS

FIG. 1 is a front elevational view of a steelmaking furnace usable in the present invention;

FIG. 2 is a plan view of the furnace shown in FIG. 1;

FIG. 3 is a side elevational view of the furnace shown in FIG. 1, looking from the right; and

FIG. 4 is an enlarged fragmentary sectional view approximately on the line 4—4 of FIG. 2.

DESCRIPTION OF PREFERRED EMBODIMENT

While the preferred apparatus for practicing the invention is shown and described in considerable detail it is to be understood that the invention is not limited to the use of the particular apparatus.

Referring to the drawings the reference character A designates generally a movable furnace vessel unit or assembly comprising a furnace vessel B of conventional construction carried on a trunnion ring **10** pivotally supported for oscillation about a generally horizontal axis in bearings **11** and **12** into which suitable cylindrical bosses **13** and **14** formed integral with the trunnion ring **10** at opposite sides thereof project. The bearings **11** and **12** are carried by side members **15** and **16**, respectively, of a built-up frame, generally rectangular in plan. The frame, designated generally by the reference character C, is formed for the most part by metal plates welded together.

The furnace vessel B is oscillatable in the bearings **11** and **12** for charging, pouring, etc., by a suitable drive designated generally as D. The drive D is not shown in detail as it may be of any suitable construction and the source of power may be an electric motor, a fluid motor or an internal combustion engine, etc. Suffice it to say that the drive D, including a bull gear **21** keyed to the boss **14** on the right-hand side of the trunnion ring **10**, as viewed in FIGS. 1 and 2, and driven by pinions **22** and **23**. The left-hand bearing **11** is enclosed in a protective housing **24** and the right-hand bearing **12** and the drive D in a housing **25**. Both housings form part of the

frame C, but are constructed to provide ready access to the operating mechanism enclosed therein.

The front and rear frame members **26** and **27**, as viewed in FIGS. 1 and 2, are depressed intermediate their ends, as shown in the figures referred to, to provide additional clearance for the furnace vessel B when tilted but this is not essential.

In the installation shown, it is assumed that the furnace unit A has been moved from its normal operating or blowing position and is supported on the track E at its intersection with a cross track F and in position to be transferred to the track F. The track E, shown, comprises double or paired spaced rails **30**, **31** and **32**, **33** and the track F, which is of the same gauge as the track E, comprises the paired rails **34**, **35** and **36**, **37**. The foundation or support for the tracks E and F is designated G and may be of any desired character. The track E, as previously suggested, may extend to the blowing position, etc., and the track F may extend to a service area. The furnace unit A includes four trucks H, I, J and K connected to the frame C adajacent to the corners thereof for movably supporting it on one or the other of the tracks E or F. The trucks are connected to the frame C for rotation about generally vertical axes. To transfer the furnace unit from one track to the other the frame C is raised so as to lift the wheels of the trucks H, I, J and K clear of the rails of the track upon which it is supported, the trucks rotated until the wheels thereof overlie the rails of the other track and the frame C lowered to position the furnace unit upon the second track. The furnace unit A is raised and lowered by hydraulic actuated jack means L, M, N and P, located concentric with the axis of rotation of the trucks H, I, J and K, respectively.

The trucks H to K and the jack means associated therewith are alike and only the truck I and the jack means M, associated with it, will be described in detail. The duplicate parts of the other trucks and jack means when designated by reference characters will be done so by using the same reference characters with prime, double prime and triple prime marks employed therewith when applied to trucks H, J and K, and their associated jack means, respectively.

The jack means M, associated with the truck I, comprises a fluid pressure actuated motor comprising a vertically extending cylinder **50** fixedly secured in the frame C and having a reciprocable piston rod or ram **51** projecting from its lower end. The lower end of the piston or ram **51** is provided with a circular foot member **52** adapted to engage the rails of the track upon which the wheels of the truck I rest. In the normal operation of the apparatus the foot member **50** when lowered engages both tracks at their intersection. The foot member, however, may be of any desired construction and may be adapted to engage between the rails of the tracks or to span the rails as desired.

The fluid pressure actuated motor is preferably of the double acting-type so that the piston or ram **51** can be moved by fluid pressure, preferably hydraulic, in a downwardly direction to raise the frame C and the truck I when the direction of movement of the furnace unit is to be changed, and in the opposite direction to maintain the foot member **52** clear of the rails when the furnace unit is being moved along one of the tracks.

Fluid pressure may be supplied for operating the piston or ram **51** in any convenient manner. It is preferably supplied by a self-contained power unit carried by the furnace unit and operated by an internal combustion engine. If operated by an electric driven motor, power can be supplied by a trolley distribution system of the third rail type.

The truck I comprises a frame **60** connected to the frame C for rotation about the cylinder member or cylinder **50** of the jack means M. Suitable annular bronze ring-like members **61** and **62** are interposed between opposite sides of a plate **63** of the truck frame **60** and the adjacent plate-like member **64** of the frame C, and a ring member **65** welded to the cylinder **50**. The truck I, as shown, comprises two pairs of wheels **70**, **71** and **72**, **73**, supported on suitable axles **74**, **75**, respectively, connected to the frame. The wheels **70**, **71** are keyed to the axle **74** and are adapted to be driven by a motor **76** supported on the frame **60** and operatively connected to the axle **74** by a suitable train of gears, enclosed in a housing **77** forming part of the frame **60**. The motor provides means for moving the furnace unit A along the track upon which it is supported, and suitable brake mechanism **78** is associated with the motor shaft so that the furnace unit can be held in any position to which it is moved along one or the other of the tracks.

Attention is called to the fact that the ram **51** and its foot member **52** are centrally located with respect to the wheels of the truck I and the construction is such that they do not interfere with the operation of the wheels.

As shown, the tracks E and F cross one another at right angles, therefore the trucks H to K are pivoted through 90° in transferring a furnace unit from one track to the other. In the embodiment shown this is accomplished by double-acting fluid-pressure reciprocating-type motors **80**, **81**, **82** and **83**, located at the front and rear of the furnace unit, as viewed in FIGS. 1 and 2, and having their pistons operatively connected with the trucks H to K, respectively. The cylinders of the motors are pivotally connected to the front and rear members **26**, **27** of the frame C. As will be obvious from FIG. 2, the two front trucks and the two rear trucks are rotated in opposite directions with respect to one another in transferring the furnace unit from one track to the other. The motors **80** to **83** may be supplied with fluid pressure in a conventional manner, preferably from a power source such as the one previously discussed located on the furnace frame C and movable with the furnace unit.

From the foregoing it will be apparent that the objects heretofore enumerated and others have been accomplished and that there has been provided a novel and improved process of making steel by the basic oxygen lance process wherein the furnace vessel is supported at all times on wheels so that it can be readily movable from its normal operating or blowing position for other operations including, charging, preheating, pouring, etc., and for servicing, including relining, etc.

Having thus described our invention, what we claim is:

1. The method of operating a steelmaking furnace installation of the oxygen lance type which comprises: providing a trackway including first and second intersecting tracks, a movable steelmaking furnace unit operable on the trackway and comprising a generally horizontal frame having a steelmaking vessel pivoted thereon, a plurality of wheeled trucks each individually pivotally connected to the frame for movement about a different generally vertical axis, and vertically extensible hydraulic jack means for lifting the frame and for raising the trucks; moving the furnace unit towards an operating and/or service location while supported on one of the tracks to a position where the tracks intersect; actuating the hydraulic jack means to lift the frame and to raise the trucks from one track; rotating the trucks to position the trucks above the other of the tracks; actuating the jack means to lower the trucks onto the other track; and moving the furnace unit along the other track to an operating and/or service location.

2. The method of operating a steelmaking furnace installation of the basic oxygen lance type which comprises: providing a trackway including first and second intersecting tracks, a movable steelmaking furnace unit operable on the trackway and comprising a generally horizontal frame having a steelmaking vessel pivoted thereon, a plurality of wheeled trucks each individually pivotally connected to the frame for movement about a different generally vertical axis, vertically extensible hydraulic jack

means for lifting the frame and for raising the trucks, and means connected to the frame for rotating the trucks; moving the furnace unit towards an operating and/or service location while supported on one of the tracks to a position where the tracks intersect; actuating the hydraulic jack means to lift the frame and to raise the trucks from one track; actuating the means for rotating the trucks to position the trucks above the other of the tracks; actuating the jack means to lower the trucks onto the other track; and moving the furnace unit along the other track to an operating and/or service location.

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ROBERT G. SHERIDAN, Primary Examiner

U.S. Cl. X.R.

105—177; 214—18