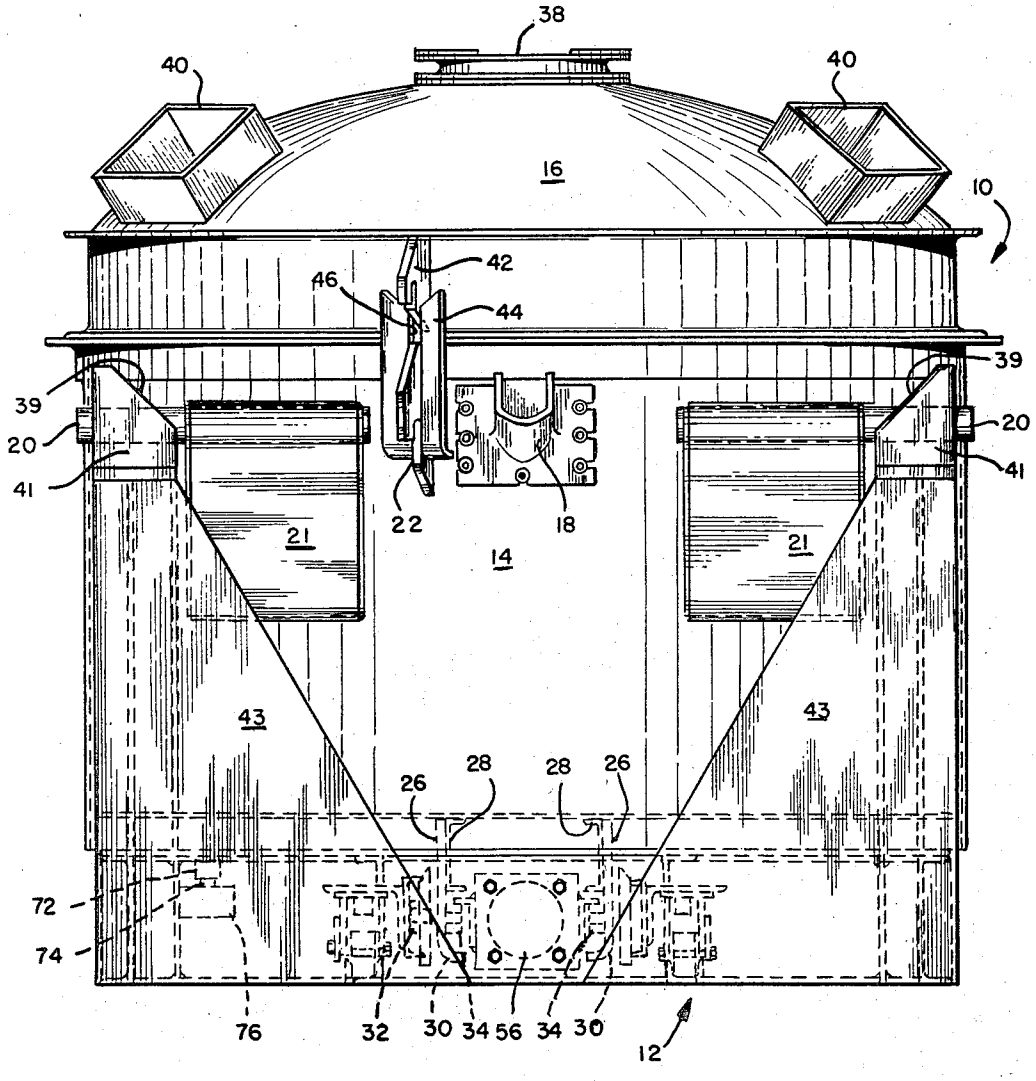
Dec. 17, 1968 A. B. BRADLEY 3,416,781

FURNACE AND APPARATUS FOR TILTING SAME

Filed Jan. 6, 1964 4 Sheets-Sheet 1

FIG. 1



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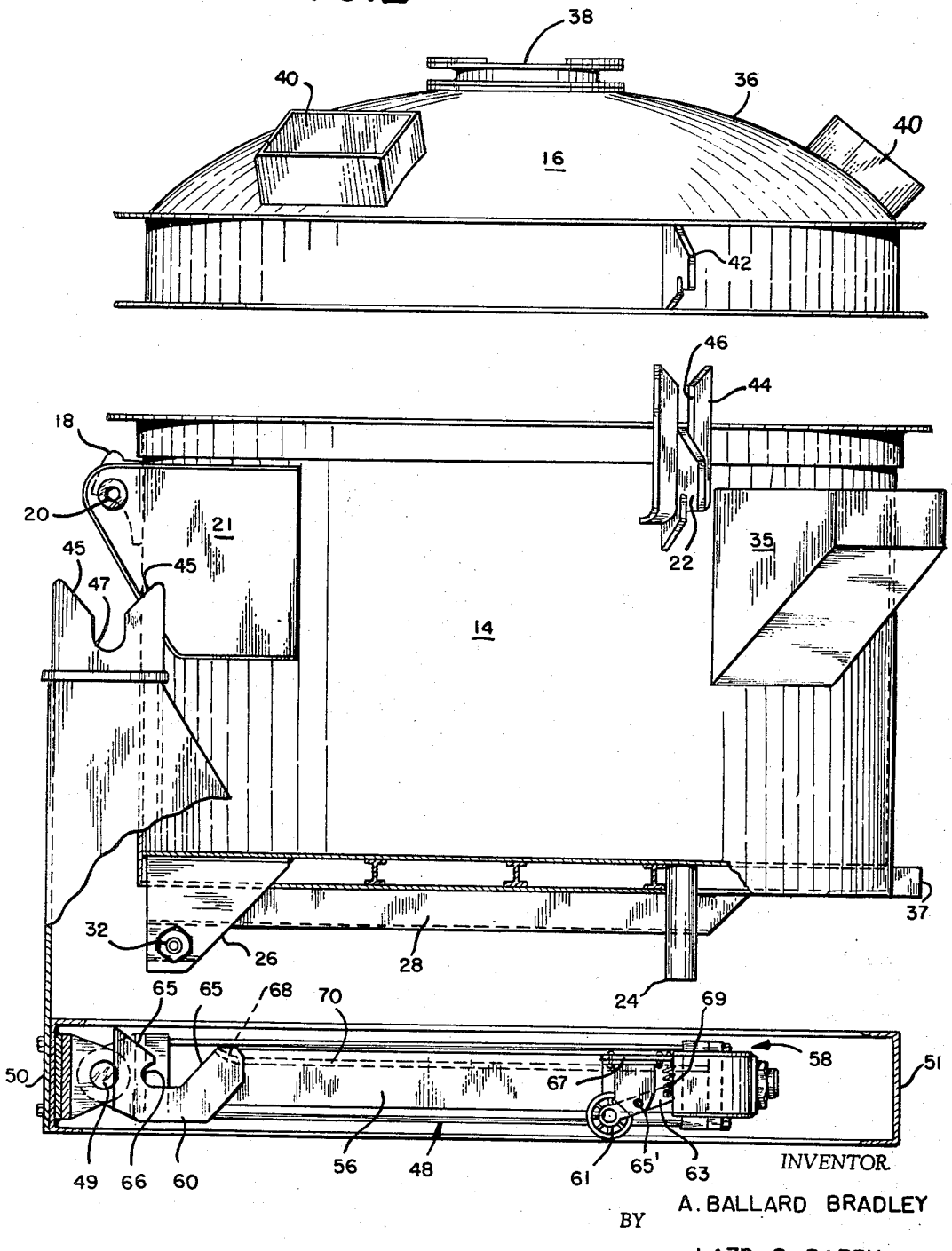
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FURNACE AND APPARATUS FOR TILTING SAME

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FIG.2



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FURNACE AND APPARATUS FOR TILTING SAME

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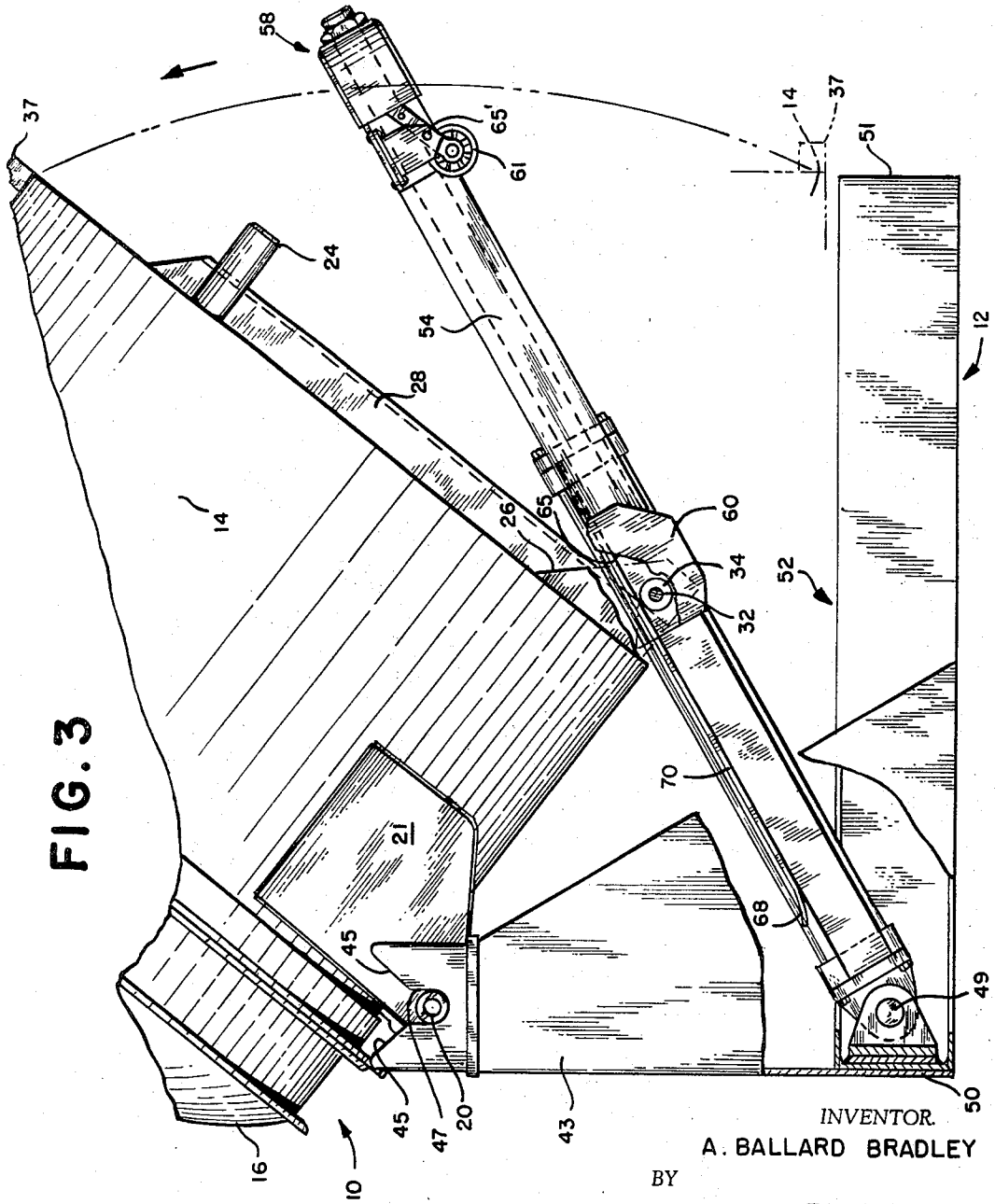


FIG. 3

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FURNACE AND APPARATUS FOR TILTING SAME

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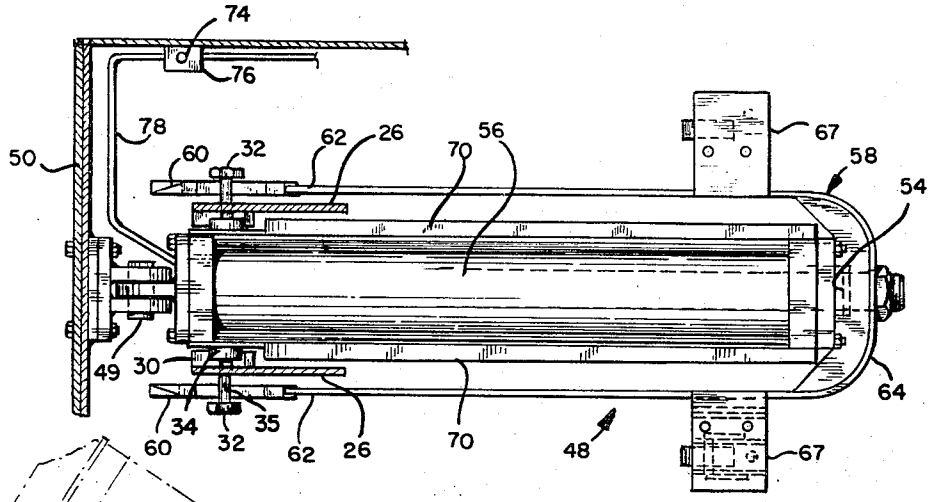


FIG. 4

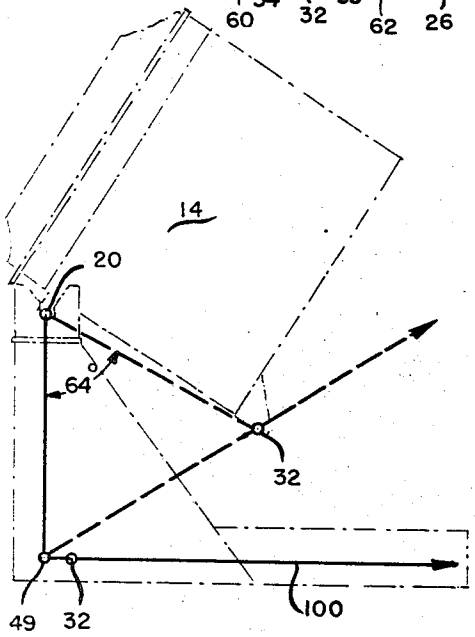


FIG. 6

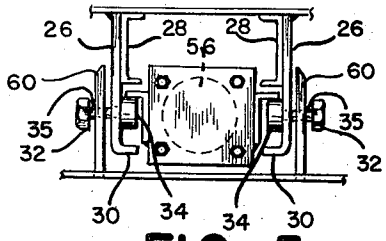


FIG. 5

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United States Patent Office 3,416,781
Patented Dec. 17, 1968

3,416,781

FURNACE AND APPARATUS FOR TILTING SAME

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Filed Jan. 6, 1964, Ser. No. 335,976
6 Claims. (Cl. 266—39)

ABSTRACT OF THE DISCLOSURE

Disclosed herein is a tilting furnace arrangement including a portable ladle tilting device for tilting a combined ladle and holding furnace for molten materials which is removeably mounted on said tilting device. The tilting device includes a tilting mechanism which is disengaged from the furnace and is moveable into engagement with the lower part of the furnace to tilt the furnace.

This invention relates to holding and melting furnaces and more particularly to a furnace which can be used interchangeably as a holding, melting or transfer furnace and to the means for supporting and tilting such furnaces.

In the normal handling of molten metal, the metal is first melted in a permanently located melting furnace. A transfer ladle is used to carry the molten metal from the melting furnace to a holding furnace where the molten metal is maintained in the molten state until used under efficient operating conditions. The ladles used for any of the above purposes are generally designed for one purpose only.

One of the principal objects of this invention is to provide a universal type furnace ladle which can be used as a melting or holding furnace or a transfer ladle.

Another object of the present invention is to provide a tilting furnace which is portable and has interchangeable component parts.

Another object of this invention is to provide a universal type of holding furnace which can be readily mounted on a portable tilting mechanism.

Another object of the present invention is to provide a tilting furnace arrangement in which the component parts are interchangeable with other parts.

Another object of the present invention is to provide a tilting device for a furnace ladle which utilizes a horizontal force.

Another object of the present invention is to provide a tilting mechanism for a holding furnace which has the tilting means contained within the limits of the tilting mechanism.

Another object of the present invention is to provide a holding furnace which can be removed from a tilting mechanism without the necessity of making any mechanical disconnections.

Another object of the present invention is to provide a tilting mechanism for a holding furnace in which the tilting moment which is applied to the furnace remains substantially constant.

Another object of the present invention is to provide a holding furnace for a portable tilt mechanism having separate lift means for the cover and ladle which interact to provide an aligning and holding function between the cover and ladle.

A further object of the present invention is to provide a combined holding furnace and tilting arrangment in which the length of the stroke of the tilting mechanism is substantially reduced.

Another object of the present invention is to provide a holding furnace and tilting mechanism in which the holding furnace is automatically locked to the tilting mechanism whenever the holding furnace is tilted from its horizontal position.

These objects are accomplished by providing a portable cradle which has the tilting mechanism located within the limits of the base of the cradle. Upright members are provided on one side of the base to releaseably support trunnions on the ladle of the furnace to allow for the removal of the holding furnace without any mechanical disconnect. The furnace can then be used as a transfer ladle or it can be positioned on another cradle for use as a holding furnace. An engaging member is provided on the bottom of the ladle of the holding furnace and is positioned to be engaged by a force applying member on the tilting mechanism whenever the furnace is properly positioned on the base of the cradle. Whenever the tilting mechanism is actuated, the force applying member will move into engagement with the engaging member on the bottom of the holding furnace, tilting the bottom of the furnace away from the upright members. Since the furnace is pivotally mounted on the support member, it will rotate about the pivot axis of the trunnions. The furnace is mechanically interlocked with the tilt mechanism so that the rotary motion of the furnace pivots the tilt mechanism about a pivot point on the same end of the base as the upright members. The force of the tilt mechanism will remain substantially constant throughout the full motion of the furnace.

Other objects and advantages will become more readily apparent from the following detailed description when read in connection with the accompanying drawings, in which:

FIG. 1 is a front view of the holding furnace positioned on a tilting cradle.

FIG. 2 is a side view of the tilting furnace with the cover separated from the ladle and the ladle separated from the cradle.

FIG. 3 is a side view of the tilt mechanism showing the furnace in its full tilted position.

FIG. 4 is a top view of the tilt mechanism.

FIG. 5 is an enlarged view of the automatic interlock arrangement between the ladle and the tilt mechanism.

FIG. 6 is a force diagram for the furnace shown in FIGS. 1–5.

Referring more particularly to the drawings, a holding furnace **10** is shown positioned on a tilting cradle **12**. The holding furnace includes a ladle **14** and a cover **16** which are interlocked by the lifting lugs **22** and **42**, respectively, as described below. It should be apparent that each component of the furnace can be independently removed from the cradle and interchanged with corresponding units as shown in FIG. 2.

The ladle has a nose pouring spout **18** located intermediate and on the axis of a pair of trunnions **20** which are mounted in quadrants **21** on one side of the ladle. With this arrangement, when the ladle is tilted, the pouring spout will always be in the same location and the molten metal receiver can be positioned immediately below the pouring spout.

A number of lifting lugs **22** are located on the upper periphery of the ladle for transporting the ladle by an overhead crane. Three lugs are normally used, but more can be added if desired. A pair of legs **24** (one showing) are provided on the bottom of the ladle which form a tripod base with a pair of plates **26** (FIG. 5) secured to the main beams **28** of the ladle for supporting the ladle when it is placed on the floor. Each of these plates has a roller **34** on the inside surface mounted on a stud **35** which extends through the plate and is secured thereto by a lock nut **32**. The ladle is cylindrical and has one or more filling blisters **35** located on the opposite side of the ladle from the quadrants for the trunnions. The

ladle is filled with molten metal from a melting furnace and the metal is kept in the molten state by an overhead burner located in cover **16**.

The cover is of conventional design having an upper dome **36** with a central opening **38** which is adapted to be connected to and support an overhead fuel burner (not shown). Any other type of overhead burner or burners can be used with the furnace. Three flues **40** are located near the outer periphery of the dome for the release of combustion products from the burner. Lifting lugs **42** are located on the outer surface of the sides of the cover in corresponding positions to lifting lugs **22** on the ladle. Each of the lifting lugs on the ladle has a positioner **44** secured thereto which extends upward above the top of the ladle. When the cover is placed on the ladle, the cover lifting lugs will be aligned in slots **46** in the positioners. It should be apparent that an overhead crane can be used to lift the cover from the ladle independently or to lift the ladle and cover as a unit from the cradle. If the cover is to be left on the ladle, a mechanical disconnection may have to be made for the fuel and air lines to the overhead burner if the unit is to be moved any distance.

The ladle is supported on the tilting cradle by the trunnions which rest in pillow blocks **41** secured to the top of upright members **43** and support block **37** which engages the rear beam **51** of the base frame **52**. When the ladle is lowered onto the cradle, the trunnions will engage the sloped sides **45** of the pillow blocks which guide the trunnions into pivot slots **47**. Sloped surfaces **39** on the inside surface of the pillow blocks aid in aligning the ladle on the cradle by engaging one or the other of quadrants **21** if they are not centered between the upright members. With the trunnions on the ladle resting in the pillow blocks and the support block on the rear beam of the base frame, plates **26** will depend from the bottom of the ladle with the lock nuts in position to be engaged by the tilting mechanism **48**.

The ladle is tilted by means of the tilting mechanism which is pivotally connected by pin **49** to the front beam **50** of the base frame **52**. When hydraulic cylinder **56** is pressurized, ram **54** will be forced outward axially from the hydraulic cylinder moving U-shaped pitman assembly **58** away from the front beam. A pair of rollers **61** are provided to support the pitman assembly and are mounted on the ends of lever arms **63** which are pivotally mounted on pins **65'** on brackets **67**. Springs **69** connected between the ends of the lever arms and the bracket provide sufficient cushioning force to hold the pitman assembly off the floor.

A pair of hooks **60** are located on the ends **62** of the U-shaped frame **64** of the pitman assembly, have angularly disposed surfaces **65** which engage and guide the lock nuts **32** on the plates **26** into slot **66** in the hooks when the ladle is positioned in the cradle. The lower curled edge **30** of the plates will aid in guiding the plates between the hooks if the ladle is not properly aligned when it is lowered in the cradle. When the pitman assembly is moved by ram **54**, the lock nuts will seat in slots **66** and the bottom of the furnace ladle will be tilted away from the front beam by the action of the pitman assembly. Cam rollers **34** will clear the upturned ends **68** of the cam roller guides **70** as the ladle is positioned on the cradle and will engage the upturned ends **68** of the guides **70** on the sides of the hydraulic cylinder when the lock nuts move away from the front beam of the base frame. Since the rollers will move in an arc about the axis of the trunnions as the ladle is tilted, they will exert an upward force on the guides which will rotate the hydraulic cylinder about the pivot pin **49** keeping a substantially straight line of force from the pivot point of the hydraulic cylinder through the end of the pitman assembly. The tilting moment will therefore remain substantially constant even though the angular relation of the tilting mechanism to the furnace will change to a certain extent.

The applicant's tilt mechanism is designed to provide approximately 64° of motion in the furnace ladle. This provides a greater capacity within the furnace since the angle of refractory material within the furnace can be made smaller and still assure that all of the melt will be poured out.

Whenever the pressure is reversed in the double acting hydraulic cylinder, the weight of the ladle will aid the return of the ram into the cylinder so that it returns to its normal position with considerable speed. To prevent the ladle from dropping at too fast a rate, in its downward motion, a cam **72** is located on the bottom of the ladle which engages a cam follower **74** on a deceleration mechanism **76** in the fluid return line **78** from the hydraulic cylinder. The cam is positioned to actuate the deceleration mechanism approximately 6 inches before the ram reaches the end of its stroke to cushion the downward motion of the furnace. The downward motion of the furnace should be stopped before the ram reaches the end of its stroke so that the hooks can clear the lock nuts, a three-inch override is sufficient to clear the hooks from the lock nut and the rollers from the cam roller guides. Once the furnace comes to rest on the frame, it will be released from all mechanical interlocks so that it can be raised off the cradle without the necessity of manually disengaging any locking mechanism. This is important in this particular industry since the ladle can then be used as a trasfer ladle and one ladle can be removed from the cradle and another immediately set in its place without any appreciable shut down of the system.

A hydraulic system is shown by way of example only since any known force system could be used to accomplish the same result. The source of the hydraulic pressure is not shown since it is of conventional design and the operation of hydraulic systems is well known. Although only one embodiment of the invention is shown and described, it should be apparent that various changes and modifications can be made without departing from the scope of the appended claims.

I claim:

1. A tilting furnace arrangement for pouring fluids comprising:

a portable tilting frame having a horizontal base portion and

a pair of spaced upright members at one end of said base,

tilting means pivotally connected to said one end of said base between said upright members, and being moveable toward and away from said one end of said base, and

a combined ladle and holding furnace having a pouring spout and a pair of pivot trunnions aligned on each side of the spout on one side of the furnace, said furnace being positioned on said frame with the trunnions removably engaged with said upright members,

connecting means on the bottom of said furnace substantially below said spout and in close proximity to said one end of said base,

said tilting means including hook means for engaging said connecting means when the tilting means is actuated to rotate said container about said pivot means.

2. A tilting device according to claim **1** wherein said tilting means includes:

a first member pivotally connected to said frame and

a linearly moveable member operatively connected to said first member, said linearly movable member being connected to said hook means, said connecting means includes roller means for engaging said first member upon rotation of said furnace to pivot said first member about one end of said base when the furnace is rotated,

whereby motion of said movable member controls the position of said device.

3. A tilting furnace arrangement for pouring fluids comprising:

a portable tilting frame having a horizontal base portion and

a pair of spaced upright members at one end of said base,

tilting means pivotally connected to said one end of said base between said upright members, and being moveable toward and away from said one end of said base, and

a combined ladle and holding furnace having a pouring spout and a pair of pivot trunnions aligned on each side of the spout on one side of the furnace, said furnace being positioned on said frame with the trunnions removeably engaged with said upright members,

connecting means on the bottom of said furnace substantially below said spout and in close proximity to said one end of said base,

said tilting means including hook means for engaging said connecting means when the tilting means is actuated to rotate said container about said pivot means.

4. A tilting furnace for pouring molten materials comprising a portable cradle having a base and a pair of upright members,

a furnace including a ladle for holding molten material having pivot means positioned to engage said upright members when the ladle is placed in the cradle,

a pouring spout located on said pivot means and a cover adapted to be positioned on said ladle and having a heating means for maintaining said material molten within said ladle, said cover having a number of lift means located on its outer periphery, said ladle having:

a number of lift means located on its outer periphery in positions corresponding to the positions of said lift means on said cover, and

aligning and holding means for interengaging said lift means when the cover is placed on the ladle,

a tilting mechanism having one end connected to said base between said upright members, the other end of said tilting mechanism including means for engaging the lower portion of the furnace beneath the pouring spout when the tilting mechanism is actuated to rotate said furnace about said pivot members, and

means for actuating said tilting mechanism to rotate said furnace and pour said molten material from said spout.

5. A tilting furnace for pouring molten materials comprising a portable cradle having a base and a pair of upright members,

a furnace including a ladle for holding molten material having pivot means positioned to engage said upright members when the ladle is placed in the cradle, a pouring spout located on said pivot means, a support means on the bottom of said ladle beneath said spout, and including first engaging means extending therefrom,

a cover adapted to be positioned on said ladle and having a heating means for maintaining said material molten within said ladle,

a tilting mechanism having one end connected to said base between said upright members, the other end of said tilting mechanism including means for engaging the lower portion of the furnace beneath the pouring spout when the tilting mechanism is actuated to rotate said furnace about said pivot members,

said tilting mechanism including a first member pivotally connected to said base,

a second member axially movable with respect to said first member,

said second member including second means for engaging said first engaging means, roller means mounted on said ladle, and guide means mounted on said first member for engaging said roller means when the second member is moved axially with respect to the first member, said roller means rotating said first member about its pivotal connection with the base and said second means for engaging engages said first engaging means to rotate said ladle about said pivot on axial motion of said second member, and

means for actuating said tilting mechanism to rotate said furnace and pour said molten material from said spout.

6. A tilting furnace arrangement comprising:

a holding furnace having a pair of trunnions coaxially aligned and secured to its outer surface and a pouring spout located between said trunnions,

and a tilting device having a base and

a pair of upright members for receiving said trunnions and supporting said holding furnace on said base,

tilting means pivotally connected to said base between said upright members and including:

connecting means movable with said tilting means, said connecting means including engaging means normally disengaged from said furnace and moveable with said connecting means to engage said furnace below said pouring spout when the tilting means is actuated, said furnace includes:

cam roller means for engaging said actuating means, whereby on movement of said connecting means, said actuating means will be rotated on its pivot connection.

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U.S. Cl. X.R.

298—20; 266—36