Sept. 13, 1949. J. L. STROMAN 2,481,699

METAL MELTING FURNACE

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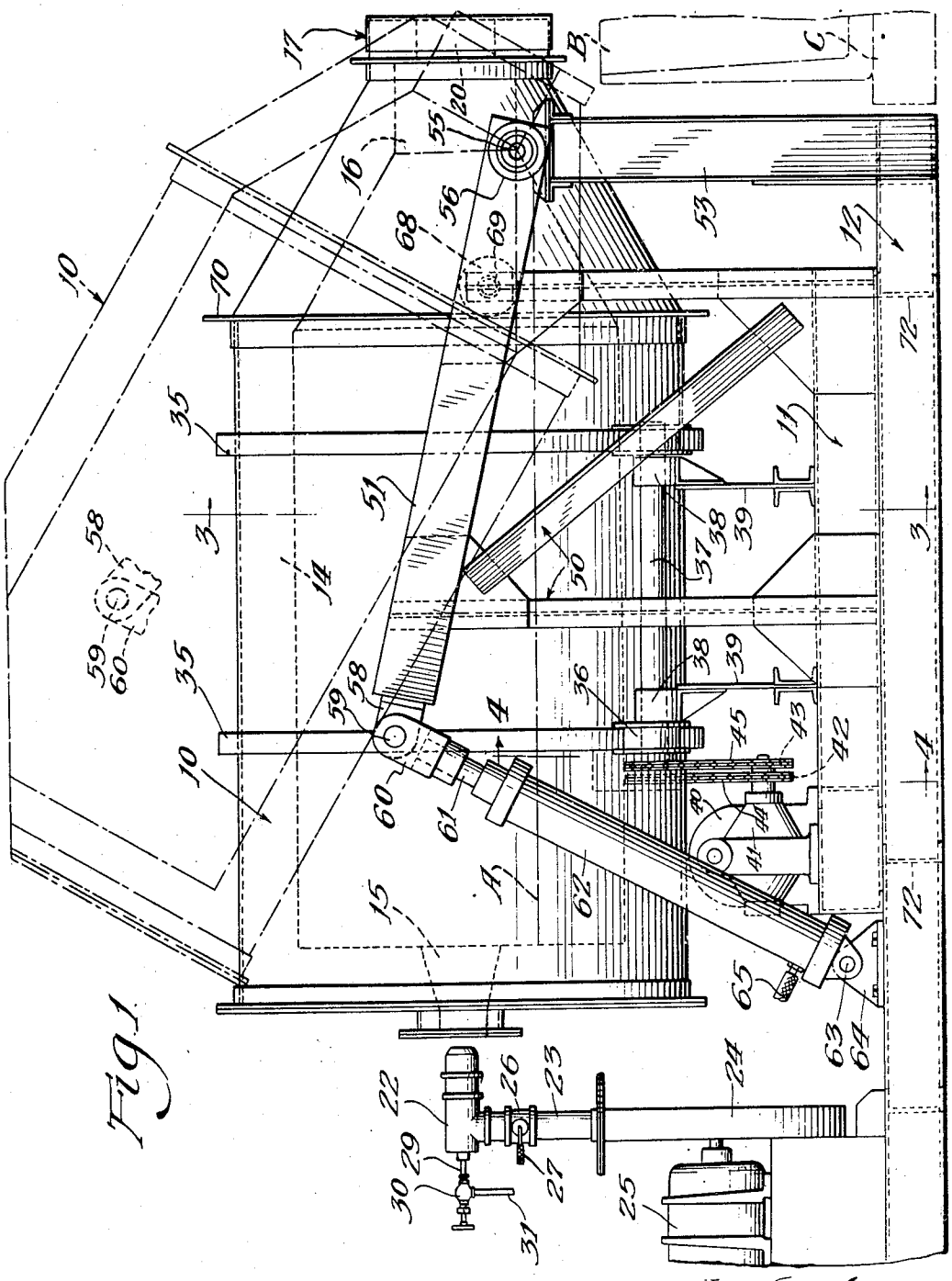


Fig. 1.

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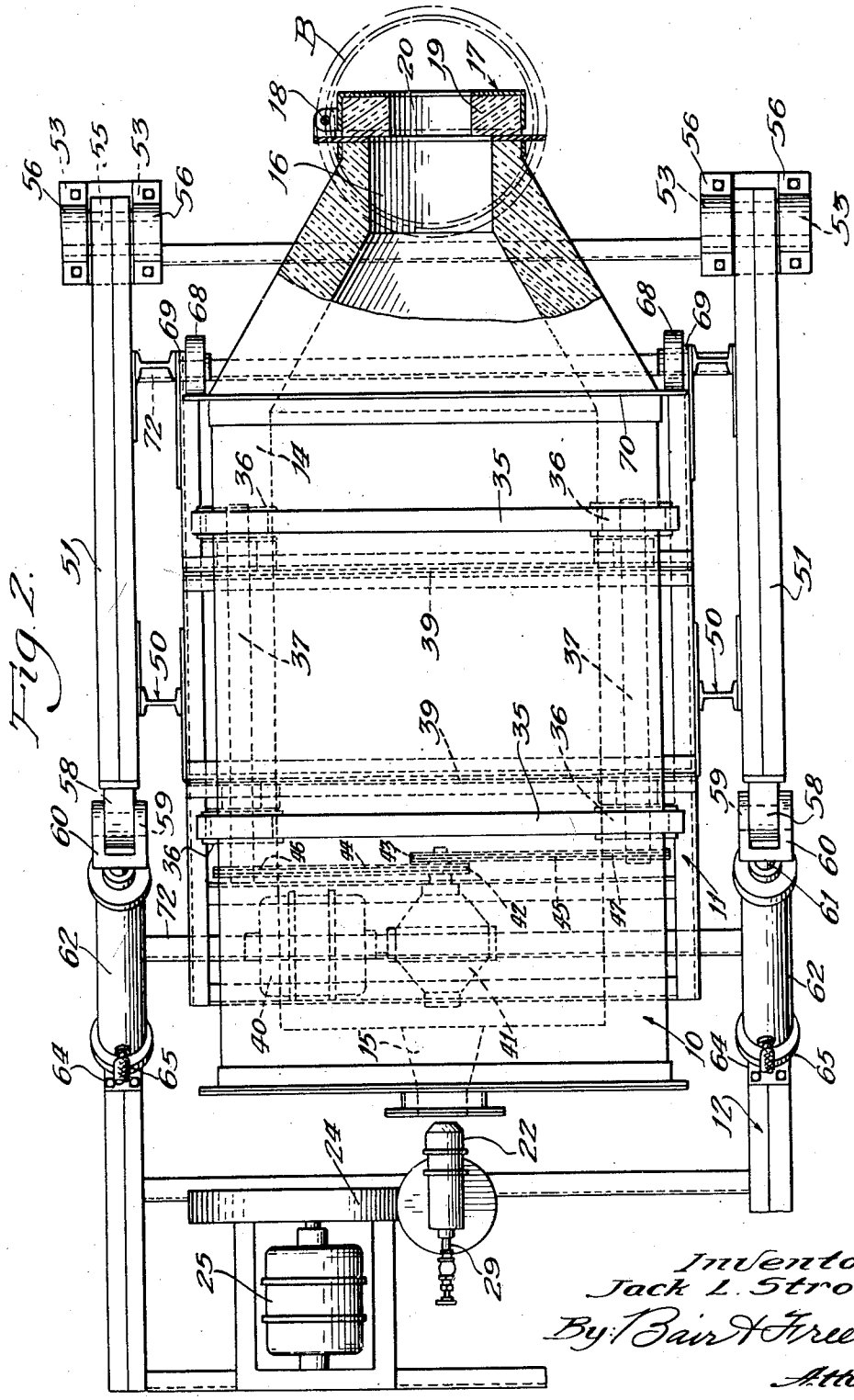


Fig. 2.

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Fig. 3.

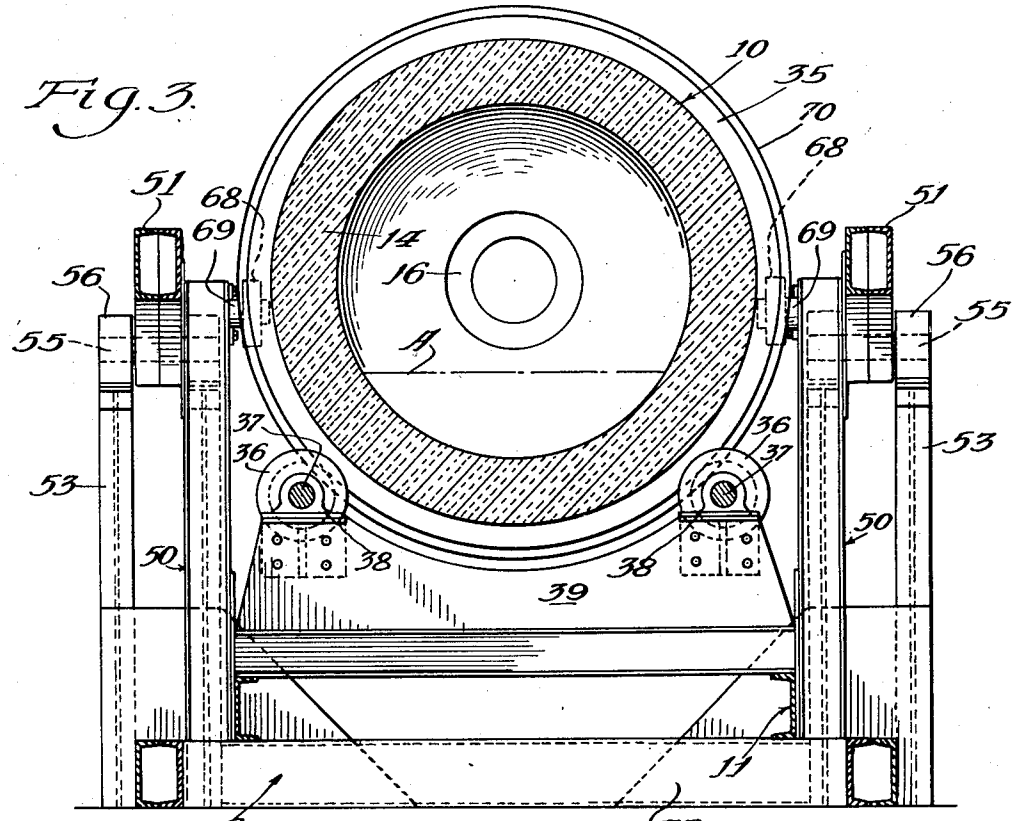
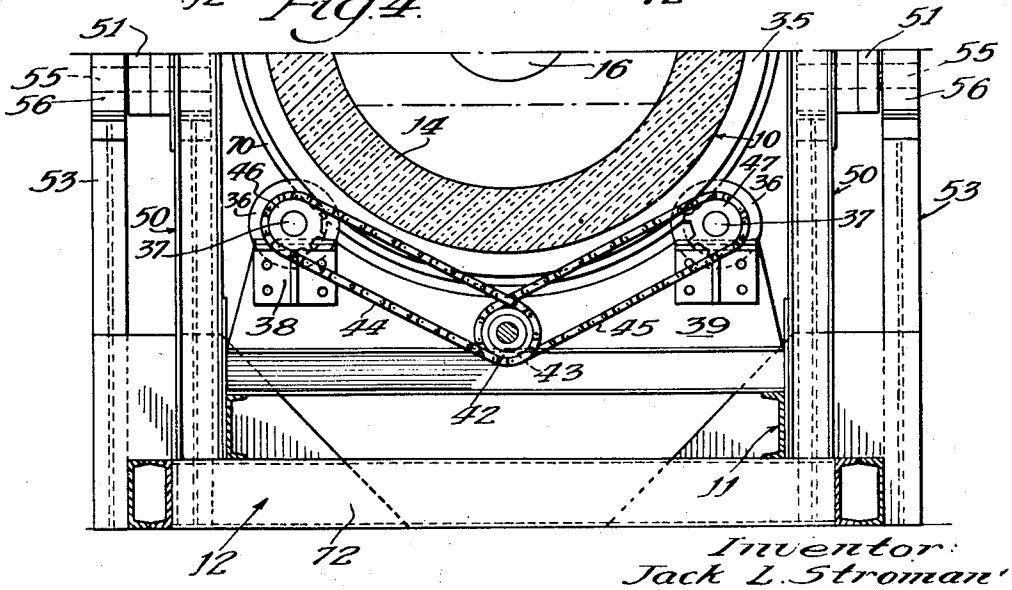


Fig. 4.



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UNITED STATES PATENT OFFICE

2,481,699

METAL MELTING FURNACE

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Application October 6, 1944, Serial No. 557,454

2 Claims. (Cl. 266—33)

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The present invention pertains to metal melting furnaces of the type including a rotary melting chamber. Furnaces of this general class, as heretofore produced, have been provided with various means and arrangements for effecting discharge of the molten metal. Such prior furnace constructions generally require the services of two or more persons during the pouring operation, and normally require two persons to support, readjust and position the ladle while the metal is being poured. Due to the peculiarities of construction of prior furnaces, the pouring stream of molten metal is always of substantial length, resulting in substantial oxidization and loss of metal. In one type of furnace heretofore employed, the tapping port or discharge opening is provided in the side wall of the furnace, necessitating plugging and sealing of the port during the melting operation, and unplugging or opening of the port to permit pouring of the molten metal. The operation of sealing and opening the tapping port in such furnace constructions, results in substantial loss in time.

One of the objects of the present invention is to provide a novel and improved furnace construction of the character indicated which eliminates the foregoing disadvantages and which results in a substantial saving in time.

Another object is to provide an improved furnace construction of the character indicated comprising a rotary chamber having a discharge port at one end thereof, together with suitable mounting means by virtue of which the chamber may be tilted about a transverse horizontal axis, located adjacent the bottom and outer end of the discharge port, to effect discharge of the molten metal.

A further object is to provide an improved furnace of the character indicated, provided with novel mounting means which permits pouring of molten metal into a ladle disposed in a stationary position on a platform or floor, and wherein the pouring stream is of relatively short length.

Still another object is to provide a novel mounting and force applying means for a rotary chamber type of furnace, for effecting tilting of the furnace about an axis disposed in close proximity to the pouring lip of the discharge port.

Other objects and advantages of this invention will be apparent from the following description, taken in connection with the accompanying drawings, in which:

Figure 1 is a side elevational view of the furnace embodying the present invention.

Figure 2 is a top plan view of the furnace, with parts shown in section to illustrate details of construction.

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Figures 3 and 4 are transverse, vertical sectional views through the furnace, taken substantially as indicated at lines 3—3 and 4—4 respectively on Figure 1.

The furnace embodying the present invention includes a rotary chamber or drum 10, supported upon a movable auxiliary frame 11, which in turn is supported upon a main frame 12. The chamber is of generally cylindrical form and is normally supported with its axis disposed in a substantially horizontal plane. The interior of the chamber is lined with a suitable refractory as indicated at 14, and its rear end is provided with an inwardly flaring firing port opening 15. The forward end of the chamber is provided with a centrally located port opening 16, through which the furnace is charged with metal and through which the molten metal is discharged from the chamber. Provided at the outer end of said opening 16, is a door 17, suitably hinged as shown at 18. The door is adapted to be latched in a closed position (by means not shown) during the metal melting operation, and is adapted to be swung laterally to open position when the molten metal is being discharged through the port opening 16. It is to be understood that the hinge pivot 18 for the door, is so arranged that when the door is swung to open position it tends to remain in such position without the necessity of latching the same. The door 17 includes a panel of ceramic material 19, having a central opening 20, disposed in central axial alignment with the port opening 16, and the firing port 15. The opening 20, in the ceramic panel of the door, serves as a discharge exit for the exhaust gases from the chamber.

The rotary chamber of the furnace is adapted to be charged with metal through the port opening 16 and when the metal is melted it assumes a liquid level, as indicated at A, which is slightly below the bottom of the discharge port opening 16, as may be clearly seen in Figure 1 of the drawings.

Mounted on the rear end of the main frame 12 is suitable apparatus for firing the chamber, which includes a nozzle 22, disposed in central relation to the firing port 15. The nozzle is connected to a source of forced air through a pipe 23, which in turn is connected to a blower 24 of usual construction, having a fan therein, driven by an electric motor 25, mounted on the main frame. A valve 26 is interposed in the pipe 23 and is adapted to be controlled by a handle 27

for regulating the volume of air entering the nozzle for admixture with fluid fuel. Connected to the rear end of the nozzle is a fluid fuel supply pipe 29, the outer end of which is connected to a hand control valve 30, which in turn is connected to a fuel supply pipe 31. Thus the two valves may be so adjusted that the fuel and air may be admixed in such proportion so as to obtain a desired combustible mixture.

Surrounding the chamber is a pair of axially spaced apart annular tracks 35, which serve to support the chamber in a cradle comprising two sets of transversely spaced apart flanged rollers 36, engaging the respective tracks 35. The two sets of rollers on opposite sides of the chamber, are rigidly connected to longitudinal extending shafts 37, journalled in bearing brackets 38, which in turn are connected to upright bracing structures 39, attached to the auxiliary frame 11. The auxiliary frame is made up of structural members, and is of generally rectangular form, as may be seen in Figure 2 of the drawings, and has mounted at the rear end thereof, beneath the chamber 10, an electric motor 40, operably connected to a speed reducer 41. Mounted on the take off shaft of the reducer is a pair of sprocket wheels 42 and 43, around which are trained oppositely and transversely extending drive chains 44 and 45, which chains are trained at their opposite ends around sprocket wheels 46 and 47 respectively, mounted on the rear ends of said roller shafts 37, as clearly seen in the drawings. Thus by virtue of the drive described, the rollers 36 are positively driven in the same direction for frictionally driving the rotary chamber 10, and rotating it about its longitudinal, substantially horizontal axis, while the chamber is being fired for melting the metal.

Connected to each side of the forward portion of the auxiliary frame is an upright, relatively rigid, framing structure 50, composed of beams, gusset plates and reenforcing members. The upper end of each upright frame is rigidly connected to a longitudinally extending beam member 51, which serves as a lever arm. The beam members 51, by reason of the upright framing structures 50, are an integral part of the auxiliary frame, and because of the substantial load imposed thereupon, including the rotary chamber and drive therefor, said beam members are formed as reinforced relatively heavy structures each including a pair of channel members welded together, as seen in Figure 3 of the drawings. The beam members normally extend at a slightly oblique angle to horizontal as seen in Figure 1 of the drawings, and their forward ends are trunnioned or pivoted on the upper ends of a pair of transversely spaced apart upright standards 53. The standards are rigidly attached to and form a part of the main frame 12, and are disposed at opposite sides of the forward end of the rotary chamber 10. The forward ends of the beams 51 are rigidly connected to trunnions or stub shafts 55, the ends of which are journalled in bearing brackets 56, connected to the top of the standards 53. The rear ends of the beams are provided with fittings 58, mounted on pivot pins 59 carried in clevis fittings 60. The clevis fittings 60, are connected to the upper ends of ram rods 61, of a pair of hydraulic rams 62, the lower ends of which are pivoted at 63, in brackets 64, attached by bolts directly on the side members of the main frame 12. The ram cylinders are connected by hoses 65 to a suitable source of fluid under pressure. Suitable control mechanism, (not shown) may be provided for controlling the operation of the rams in a manner well understood in the art.

It will be seen from Figure 1 of the drawings that the forward pivot axis of the beams 51, is disposed in close proximity to the bottom and outer end of the discharge port 16. When the rams 62 are operated, force is applied in an upward direction to the rear ends of the beams 51, thereby raising the auxiliary frame 11 together with the rotary chamber 10 as a unit for tilting the same about the pivot axis of the trunnion 55, so as to dispose the chamber in a tilted position as indicated in dot and dash outline in Figure 1 of the drawings.

To take up the forward end thrust of the chamber when disposed in a tilted position, I provide on each of the upright framing structures 50 of the auxiliary frame, adjacent the forward end, a pair of thrust rollers 68, supported by bearings 69, connected to the upright frames 50. The thrust rollers are disposed in engagement with an annular flange 70, surrounding the forward end of the chamber 10, so that at any tilted position of adjustment of the chamber, the forward end thrust is imparted directly to the rollers 68 so as to assist the flanged rollers 36 in maintaining the chamber in proper position on the auxiliary frame 11.

As may be noted from Figure 1 of the drawings, the location of the trunnion axis about which the chamber 10 tilts, is such that the pouring lip or outer lower edge of the discharge opening 16, does not move through any appreciable distance during the pouring of the molten metal; hence it is possible to support a ladle, as indicated in dot and dash outline at B, on a platform C, in a stationary position during the time that the chamber is tilted and during the time that the metal is being poured. This arrangement eliminates the necessity of manually supporting the ladle during the pouring operation, and dispenses with the necessity of repositioning the ladle incident to the tilting of the chamber while pouring the molten metal.

It will also be observed that by virtue of this construction the length of the pouring stream of the molten metal is reduced to a practical minimum, thereby reducing oxidization of the metal as it is being poured, and thus effecting a reduction in metal loss which results from such oxidization. It will also be noted that the chamber is so designed and dimensioned that when disposed in the tilted position as seen in Figure 1 of the drawings, it is possible to effect complete discharge of all molten metal from the chamber.

While the hydraulic rams 62 may be so constructed as to support the auxiliary frame and rotary chamber in their lowered position as seen in Figure 1 of the drawings, it is preferred, however, that the auxiliary frame be permitted to also rest upon a pair of longitudinally spaced apart, transversely extending supports 72, herein shown in the form of channel members connected at opposite ends to the sides of the main frame 12.

It will be apparent that any suitable force applying means may be substituted for the hydraulic rams for effecting the tilting movement of the chamber. It will also be apparent that my novel tilting arrangement for a rotary chamber type of furnace is readily adaptable to furnaces of other types than that herein disclosed, for example, a furnace wherein a single port opening is provided for firing and charging the chamber,

and through which exhaust gases are caused to be discharged, and through which the molten metal may be discharged, and is also applicable to furnaces of the rotary type wherein the chamber is disposed for rotation about an axis inclined slightly to horizontal such as disclosed in my copending application Serial No. 557,453, filed October 6, 1944, now Patent No. 2,455,531, issued December 7, 1948.

Although I have therein shown and described a preferred embodiment of my invention, manifestly it is capable of modification and rearrangement of parts without departing from the spirit and scope thereof. I do not, therefore, wish to be understood as limiting this invention to the precise form herein disclosed, except as I may be so limited by the appended claims.

I claim as my invention:

1. A melting furnace comprising a stationary main frame having a lower horizontal base portion and an upright standard at one end, a movable auxiliary frame having a lower base portion supported on the base portion of the main frame, said auxiliary frame having an upright portion, a metal melting chamber mounted on and movable with said auxiliary frame, said chamber being mounted with its longitudinal axis normally horizontal and being rotatable on its horizontal axis, means mounted on and carried by said auxiliary frame for rotating said chamber, the forward end of said chamber having a central reduced dimension discharge port at one end, said auxiliary frame being pivoted on a horizontal axis on the upper end of said upright standard on the main frame, said chamber being so mounted that said horizontal axis is adjacent the lower part of said discharge port, and means reacting between said main frame and auxiliary frame for tilting said auxiliary frame and thereby the chamber about said horizontal axis, whereby the movement of said discharge port in the tilting operation is held at a minimum.

2. A metal melting furnace comprising, a stationary main frame having a lower horizontal base portion and an upright standard at one end, a movable auxiliary frame having a lower base portion supported on the base portion of the main frame, said auxiliary frame having an upright portion, a longitudinally extending lever arm mounted on the upper part of the upright portion of said auxiliary frame, a metal melting chamber mounted on and movable with said auxiliary frame, said chamber being mounted with its longitudinal axis normally horizontal and being rotatable on its horizontal axis, means mounted on and carried by said auxiliary frame for rotating said chamber, the forward end of said chamber having a central reduced dimension discharge port at one end, the forward end of said lever arm, and thereby said auxiliary frame, being pivoted on a horizontal axis on the upper end of the upright standard on said main frame, said chamber being so mounted that said horizontal axis is adjacent the lower part of said discharge port, means reacting between said main frame and the rear end of said lever arm for tilting said auxiliary frame and thereby the chamber about said horizontal axis, whereby the movement of said discharge port in the tilting operation is held at a minimum, an end thrust flange surrounding the chamber, and thrust rollers carried on the auxiliary frame and engaging said flange to take up end thrust of the chamber in a tilted position.

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