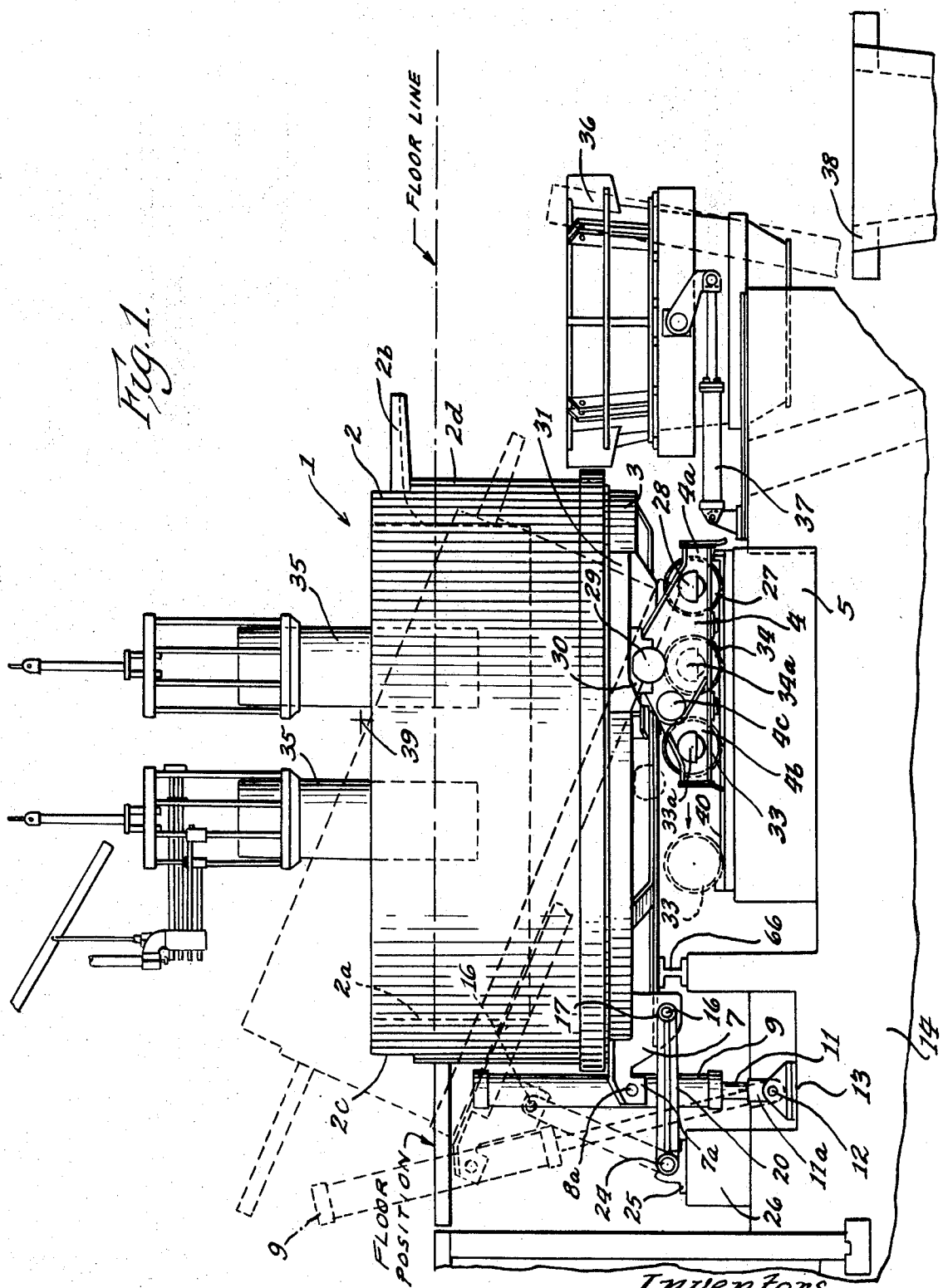
March 2, 1971 F. K. ARMOUR ET AL 3,567,205

TILTING MECHANISM FOR MOLTEN METAL RECEPTACLE

Filed May 22, 1968 2 Sheets-Sheet 1

Fig. 1.



Inventors
Frank K. Armour and
Arthur J. Benke
By William P. Porcelli Atty.

March 2, 1971 F. K. ARMOUR ET AL 3,567,205

TILTING MECHANISM FOR MOLTEN METAL RECEPTACLE

Filed May 22, 1968 2 Sheets-Sheet 2

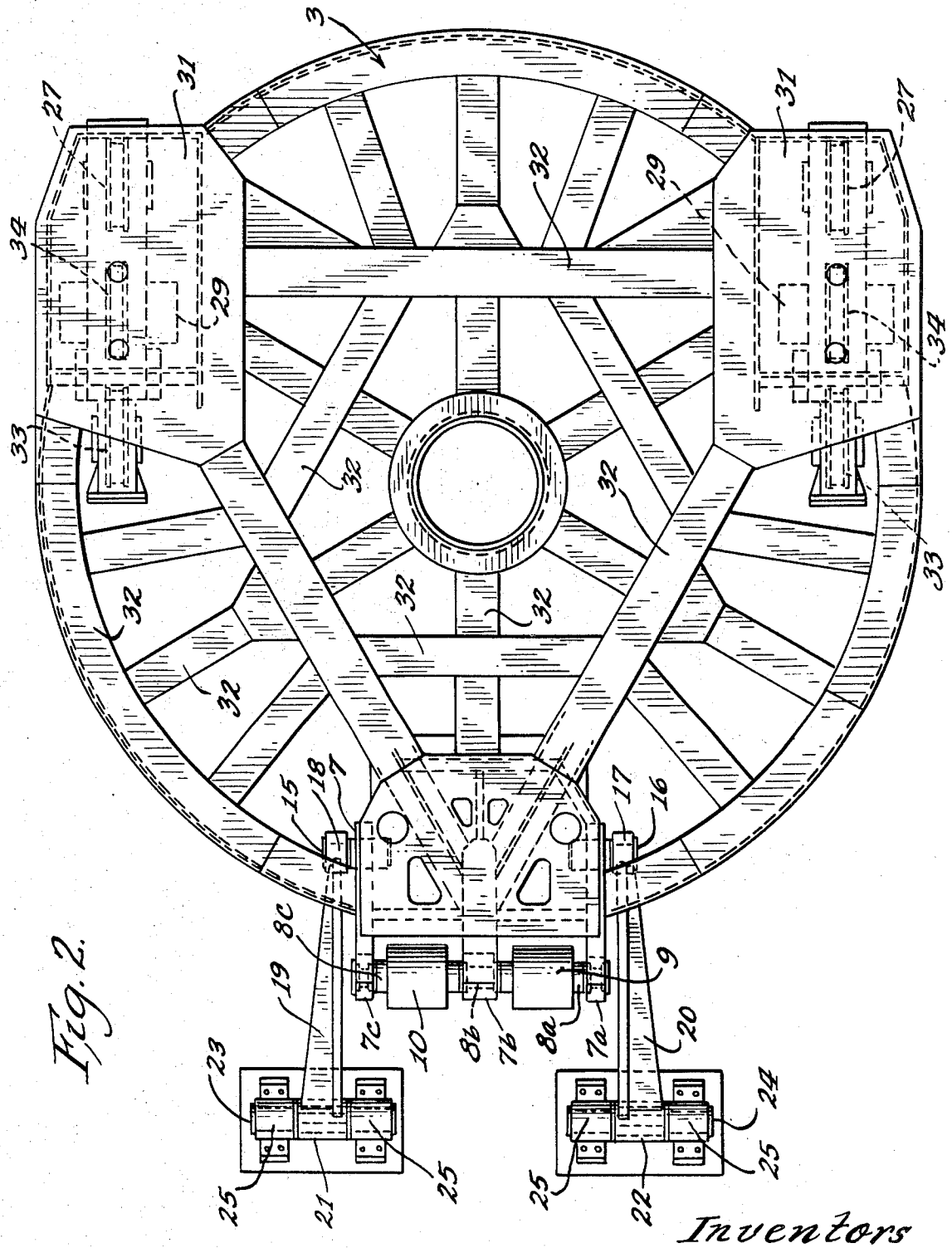


Fig. 2.

Inventors
Frank K. Armour and
Arthur J. Benke
By William P. Porcelli
Atty.

United States Patent Office 3,567,205 Patented Mar. 2, 1971

3,567,205

TILTING MECHANISM FOR MOLTEN METAL RECEPTACLE

Frank K. Armour, Flossmoor, and Arthur J. Benke, Willow Springs, Ill., assignors to Interlake Steel Corporation, Chicago, Ill.

Filed May 22, 1968, Ser. No. 731,088
Int. Cl. C21c 5/50
U.S. Cl. 266—36 8 Claims

ABSTRACT OF THE DISCLOSURE

A receptacle for containing molten metal having use as a furnace for heating the metal. The receptacle has improved mechanism for tilting the receptacle for pouring to discharge the molten metal from it. The tilting mechanism combines a rolling carriage supporting the receptacle at one end and a power cylinder supporting it at the other end. Actuation of the power cylinder combines rolling movement of the carriage with tilting of the receptacle.

This invention relates to the art of receptacles for containing molten metal and particularly to improved tilting means for causing the receptacle to be tilted for pouring to discharge the molten metal from it.

It is common to provide a furnace for treating metal by heating it to a molten state to desirable temperature levels and for particular periods of time until treatment is completed, the furnace being a receptacle for containing the molten metal. After treatment, it is necessary to pour the molten metal from the furnace. This is often done by tilting the furnace and allowing the molten metal to pour over a pouring lip which may be located in the region of the upper edge of the furnace or the lower portion of an opening through the furnace wall. A typical technique for mounting the furnace for tilting is to provide trunnions or journals projecting from opposite sides of the furnace which are pivoted in suitable bearings securely mounted in fixed positions. With this arrangement, the trunnions and bearings and the entire structure relating thereto are positioned high on the outside of the furnace in the work regions around the furnace where the furnace attendants and workers operate. This is objectionable because it interferes with their activity. Furthermore, the size of the trunnions and bearings are objectionably large because of the weight which must be supported by them when supporting a furnace filled with heavy metal. It is, therefore, the principal object of this invention to provide an improved tilting mechanism which is located substantially beneath the working floor level of the furnace attendants so that there is minimum interference with the attendants' activities due to the tilting mechanism when the furnace is being tilted.

In order to accomplish this objective, improved tilting mechanism is provided in the form of trunnions and bearings located beneath the normal floor level of the furnace attendants' activity and on carriages having means rolling along a supporting platform as the furnace is tilted. The trunnion and bearing portions are located adjacent one end of the furnace, while the opposite end of the furnace is connected to a piston means which controls and powers the tilting movement of the furnace.

It is another object of the invention to provide a tilting mechanism, as described, by the use of a rolling carriage and a powered actuator which causes tilting of the furnace around a substantially fixed axis of rotation. An advantage of employing this type of rotation around a fixed axis is that it lends itself to use with an electric furnace, whereby the heating electrodes extend substantially vertically

downwardly into the furnace through the top opening and into holes in the top crust surface of the furnace charge. Without a fixed axis of rotation properly located with respect to the position of the electrodes, the electrodes would be urged to shift with their holes through the hardened crust on the top of the charge in the furnace as the furnace is tilted, to result in possible breakage of the electrodes, unless they are removed before furnace tilting. By maintaining the fixed axis during tilting, the holes for the electrodes do not shift and, so it is unnecessary to remove the electrodes while pouring, to thereby minimize down time on the furnace.

Another object of the invention is to provide improved carriage mechanism for the purpose stated which has articulated construction of a design which provides even load support distribution between a plurality of rolling means on the carriage.

Another object of the invention is to provide such an articulated carriage having a first carriage portion connected by a journal to a second carriage portion with the first carriage portion having one wheel and also carrying the trunnion and bearing means for supporting the furnace, and the second carriage portion provided with two other wheels, the three wheels mentioned being the rolling means referred to above.

It is another object of the invention to provide an articulated carriage as described having the three wheels in substantially equally spaced alignment with each other in a row in a plane perpendicular to the axes of rotation of the wheels, with the trunnion and bearing means supporting the furnace being in vertical alignment with the middle positioned of the three wheels, and the journal connection between the first and second carriage portions being in vertical alignment midway between the middle positioned wheel and one of the other of the three wheels to thereby provide equal load support distribution to the three wheels.

Another object of the invention is to provide tilting mechanism as described which is adaptable more generally for use with a molten metal receptacle which is not necessarily a furnace, but merely a container for molten metal which must be tilted for pouring.

Other objects and advantages of the invention should be apparent upon reference to the accompanying drawings in which:

FIG. 1 shows a side elevation of an electric furnace embodying the principal features of the invention and

FIG. 2 shows a top plan view of the furnace support for the furnace shown in FIG. 1.

As indicated in FIG. 1, an electric furnace **1** embodying the principal features of this invention is mounted on a fixed main support frame **14** and consists of a furnace body **2** which may be circular in cross-section and which rests upon a furnace support **3** positioned below it. The furnace support **3** is, in turn, supported on two articulated carriages **4** which roll along a supporting platform **5** positioned below the carriages **4**.

In a region opposite the location of the carriages, the furnace support **3** rests on a fixed stanchion **66**. Even further remote from the location of the stanchion **66** the furnace support **3** is provided with a bracket **7** journaled to two cylinders **9** and **10** which are employed to cause tilting of the furnace.

In more detail, the bracket **7** has three arms **7***a*, **7***b*, and **7***c* which are journaled on trunnions **8***a*, **8***b*, and **8***c* to the sides of the two cylinders **9** and **10** which are each provided with piston rods **11** having their lower ends **11***a* journaled on pins **12** to fixed brackets **13** on the main support frame **14**. On opposite sides of the bracket **7** are projecting trunnions **15** and **16** journaled to the inner ends **17** and **18** of two stabilizing arms **19** and **20** which have

their inner ends 21 and 22 journaled on shafts 23 and 24 in four pillow blocks 25 which are securely fastened to another support stanchion 26 on the main support frame 14.

Each of the articulated carriages 4 is provided with a first carriage portion 4*a* and second carriage portion 4*b* journaled together by means of a connecting shaft 4*c*. Each first carriage portion 4*a* is provided with a single wheel 27 journaled therein on a journal 28. The first carriage portion is also provided with a trunnion 29 which directly supports a yoke 30 which is secured directly to a pad 31 above it. The pad 31 is one of two similar pads mounted on opposite sides of the furnace support 3. The furnace support 3 is substantially circular in shape, as shown in FIG. 2, to correspond to the circular cross-section of the furnace body and consists of a maze of interconnected structural members 32 which are welded or otherwise connected together into a reticulated frame. In order to keep the furnace 2 secured in place on the furnace support 3, the base of the furnace 2 is also welded or otherwise secured to the furnace support 3.

The second carriage portion 4*b* is provided with two wheels 33 and 34 which are suitably journaled on journals 33*a* and 34*a* to the second carriage portion and are spaced from each other. The three wheels 27, 33 and 34 are spaced equally from each other in a single row in alignment with each other in a plane perpendicular to the axes of rotation of the wheels. The trunnion 29 is in vertical alignment with the middle positioned wheel 34. The connecting shaft 4*c* between the first and second carriage portions is in vertical alignment midway between the two wheels 33 and 34. In this way, the spacing of the connecting shaft 4*c* from the trunnion 29 is one-half the distance between the trunnion 29 and the journal 28 of the wheel 27. With this arrangement, the support distribution is equal on all three wheels 27, 33 and 34. Further, the articulated connection between the two carriage portions 4*a* and 4*b* insures that the wheels are self-leveling and adjust to irregularities in the support surfaces for the wheels so that the equal load support distribution occurs.

The furnace 2 is provided with a central top opening 2*a* into which the metal to be melted and treated can be added. Also, this top opening 2*a* is provided as clearance for the reception of the heating electrodes 35 of conventional design for use as part of an electric furnace. The forward end of the furnace 2 is provided with a pouring lip 2*b* which communicates between the outside of the furnace body and the internal compartment of the furnace.

In operation, when the metal has been fully heated and treated, it is necessary to tilt the furnace body 2 and pour the molten metal over the pouring lip 2*b* and into a holding ladle 36 of conventional design. After pouring into the holding ladle 36 suitable means 37 is provided for causing the holding ladle 36 to be tilted for pouring off the molten metal into molds 38, as desired.

When tilting the furnace body 2, it tilts on the trunnions 29 supported on both of the carriages 4. The tilting movement occurs as the cylinders 9 and 10 are filled with fluid under pressure from a suitable pressure source to cause the cylinders 9 and 10 to extend away from the piston rods 11 contained therein. As the cylinders 9 and 10 extend, they cause bracket 7 to be elevated which, in turn, causes the entire furnace body 2 to tilt as the rear portion 2*c* elevates relative to the forward portion 2*d*. As this elevation occurs, the stabilizing arms 19 and 20 also rotate on their shafts 23 and 24 and the linkage arrangement between these control arms 19 and 20 and the connections of the cylinders 9 and 10 with the furnace body 2 cause a relative shifting of the forward portion 2*d* of the furnace body 2 which is translated into rolling motion of the wheels 27, 33 and 34 of the two carriages 4. This rolling motion is from the right to the left, as viewed in FIG. 1 until wheel 33 reaches the position shown in phantom outline in FIG. 1. In this position of wheel 33, the cylinders 9 and 10 are elevated to the position as indicated in phantom outline in FIG. 1 and the furnace body 2 is also elevated to a position shown in phantom line in FIG. 1. It should be emphasized that the axis of rotation 39 of the furnace body 2 is shown as substantially fixed through the location of the top opening of the furnace body 2 so that the electrodes 35 are not obstructed by the top crust of the furnace charge at any time during the full range of tilt of the furnace body 2. With this arrangement, there is no need to remove the electrodes 35 from the furnace body 2 with the result that the operation of heating and treating metal can continue, even though some of the molten metal is poured from the furnace body 2.

For improved location control of the furnace body 2 while tilting, the wheels 27, 33 and 34 can be supported on tracks 40 secured to the supporting platform 5. The tracks 40 are raised at their ends to act as stops for the rolling movement of the carriages 4.

For return tilting movement from the position as indicated in phantom outline to the position indicated in bold outline in FIG. 1, flow of fluid under pressure is reversed to the cylinders 9 and 10 and return movement continues until the furnace body 2 again rests on stanchion 66.

It should also be evident from FIG. 1 that the floor level at which the furnace attendants operate is well above substantially all of the mechanism required for tilting the furnace and in a location where it does not materially interfere with the attendants' duties around the furnace.

Although the embodiment shown in FIGS. 1 and 2 is for an electric furnace, the same principles can be applied to any type of furnace or metal containing receptacle which requires tilting. Further, even though the embodiment shown is for rotation about a fixed axis 39, by variation of the lengths and pivots of the linkage arrangement involving the cylinders 9 and 10, the control arms 19 and 20, the bracket 7 and the associated connections, the rotation can be arranged about a shifting axis of rotation in order to meet a particular requirement other than related to concern over electrode breakage. Therefore, it should be clearly understood that, although the invention has been shown and described with respect to only a single embodiment, it is apparent that the invention can be employed in other embodiments without departing from the true scope of the invention as defined by the appended claims in which:

We claim:

1. A furnace comprising, a furnace body having an internal compartment for holding metal to be heated, a pouring lip in the furnace body communicating between the outside of the furnace body and the compartment over which molten metal can be poured from the compartment, and a top opening in the furnace body for the reception of at least one heating electrode extending substantially vertically downward into the compartment, mounting means for mounting the furnace body to tilt in a path for allowing metal to be poured over the pouring lip from the compartment as the furnace body is tilted, a fixed suporting platform, said mounting means having furnace body supporting free wheeling rotatable means rolling and travelling in a path along the supporting platform, and actuating means for causing the furnace body to tilt relative to the rolling means and relative to the heating electrode as the rotatable means rolls and travels in a path along the supporting platform in response to the tilting movement, said rotatable means having trunnion means on which the furnace body rests and pivots as it is tilted.

2. A furnace as defined by claim 1 characterized by, said rotatable means being in the form of at least one wheel rolling and guided on a track.

3. A furnace as defined by claim 1 characterized by, said rotatable means being in the form of a plurality of wheels mounted below the trunnion means and rolling and guided on track means.

4. A furnace as defined by claim 1 characterized by, said rotatable means being in the form of an articulated carriage having a first carriage portion connected by a journal to a second carriage portion, the first carriage portion carrying the trunnion means and one wheel, and the second carriage portion carrying two wheels.

5. A furnace as defined by claim 4 characterized by, all three wheels being in substantially equally spaced alignment with each other in a row in a plane perpendicular to the axes of rotation of the wheels, said trunnion means being in vertical alignment with the middle positioned of the three wheels, and said journal connecting the first and second carriage portions being in vertical alignment midway between the middle positioned wheel and one of the other of the three wheels, thereby causing equal weight support distribution to the three wheels.

6. A molten metal container comprising, a container shell having an internal compartment for holding metal, a pouring lip in the shell communicating between the outside of the shell and the compartment over which molten metal can be poured from the compartment, mounting means for mounting said container shell to tilt in a path for allowing metal to be poured over the pouring lip from the compartment as the container shell is tilted, a fixed supporting platform below the container shell, said container shell being supported on free wheeling rolling means along the supporting platform and actuating means for causing the container shell to tilt relative to the rolling means as the rolling means rolls and travels in a path along the supporting platform in response to the tilting movement, said rolling means having trunnion means on which the container shell rests and pivots as it is tilted, said rolling means being in the form of a plurality of wheels mounted below the trunnion means and rolling and guided on track means.

7. A molten metal container comprising, a container shell having an internal compartment for holding metal, a pouring lip in the shell communicating between the outside of the shell and the compartment over which molten metal can be poured from the compartment, mounting means for mounting said container shell to tilt in a path for allowing metal to be poured over the pouring lip from the compartment as the container shell is tilted, a fixed supporting platform below the container shell, said container shell being supported on free wheeling rolling means along the supporting platform, and actuating means for causing the container shell to tilt relative to the rolling means as the rolling means rolls and travels in a path along the supporting platform in response to the tilting movement, said rolling means having trunnion means on which the container shell rests and pivots as it is tilted, said rolling means being in the form of an articulated carriage having a first carriage portion connected by a journal to a second carriage portion, the first carriage portion carrying the trunnion means and one wheel, and the second carriage portion carrying two wheels, all three wheels being in substantially equally spaced alignment with each other in a row in a plane perpendicular to the axes of rotation of the wheels, said trunnion means being in vertical alignment with the middle positioned of the three wheels, and said journal connecting the first and second carriage portions being in vertical alignment midway between the middle positioned wheel and one of the other of the three wheels, thereby causing equal weight distribution to the three wheels.

8. A molten metal container comprising, a container shell having an internal compartment for holding metal, a pouring lip in the shell communicating between the outside of the shell and the compartment over which molten metal can be poured from the compartment, mounting means for mounting said container shell to tilt in a path for allowing metal to be poured over the pouring lip from the compartment as the container shell is tilted, a fixed supporting platform below the container shell, said container shell being supported on free wheeling rolling means along the supporting platform, and actuating means for causing the container shell to tilt relative to the rolling means as the rolling means rolls and travels in a path along the supporting platform in response to the tilting movement, said actuating means comprising a fluid operated ram pivotally connected to the container shell, said mounting means for mounting said container shell including a stabilizing link pivotally connected between the container shell and the supporting platform, said stabilizing link and the rolling means arranged to guide the container shell through its path about said substantially fixed axis of rotation.

References Cited

UNITED STATES PATENTS

623,073	4/1899	Burt	266—36X
2,334,019	11/1943	McFeaters	266—39
2,481,699	9/1949	Stroman	266—36X
2,528,571	11/1950	Babcock et al.	266—36X
3,416,781	12/1968	Bradley	266—36X
2,481,433	9/1949	McBroom	13—10
3,035,106	5/1962	Mercier	13—10

CHARLES W. LANHAM, Primary Examiner

J. S. BROWN, Assistant Examiner