This invention relates to a drum type induction furnace, and more particularly to a drum type induction furnace having a novel discharge conduit.

It is another conventional heretofore to provide a drum type induction furnace with a discharge conduit having its longitudinal axis coincident with the axis of rotation of the drum. For example, FIGURE 1 in each of Patents 2,369,272 and 2,474,443. In order to make efficient use of the floor space where an induction furnace is located, it is often desirable to discharge the molten metal into a holding furnace, vessel, or the like which is disposed alongside of the drum furnace. Accordingly, the conventional type of discharge conduit cannot be efficiently utilized.

The discharge conduits proposed heretofore suffer from a disadvantage in that they are difficult to maintain since they are not designed with maintenance in mind. Such conduits are not readily removable as a unit. Accordingly, when metal freezes within such conduits, the launder must be relined. This requires the insulation to be torn apart and the entire furnace will be nonproductive during this period. As a result thereof, it often requires two to three days before the furnace is operating again. The discharge conduit of the present invention reduces the "down time" to approximately one-half hour which is insufficient for the furnace to cool down. Thus, production is not seriously affected.

I have discovered that a rotary drum type induction furnace can be provided with a novel discharge conduit which is rotatably secured to the drum adjacent the periphery thereof and which extends transversely across the drum. As the drum is rotated to a discharge position, the communication port between the drum and the discharge conduit is positioned below the level of the molten metal within the drum thereby effecting a discharge of said metal. As the drum rotates to a discharge position, the end of the discharge conduit remote from the drum reciprocates on the holding furnace, vessel, or the like.

It is an object of the present invention to provide a rotary drum with a novel type discharge conduit.

It is another object of the present invention to provide a drum type induction furnace with a novel discharge conduit which extends transversely with respect thereto.

It is another object of the present invention to provide a drum type induction furnace with a discharge conduit which extends transversely with respect thereto.

It is still another object of the present invention to provide a rotary drum type induction furnace with a discharge conduit which enables the same to discharge molten metal into a vessel positioned alongside of or offset with respect to said furnace.

It is still another object of the present invention to provide a novel readily replaceable discharge conduit for an induction furnace.

Other objects will appear hereinafter.

For the purpose of illustrating the invention there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentality shown.

FIGURE 1 is an end view of a drum type induction furnace in accordance with the present invention.

FIGURE 2 is an end view of the furnace shown in FIGURE 1 with the discharge conduit shown in section and disposed in the manner in which it will be utilized. FIGURE 3 is a transverse sectional view taken along the lines 3—3 in FIGURE 2.

FIGURE 4 is a transverse sectional view taken along the lines 4—4 in FIGURE 2.

FIGURE 5 is an end elevational view of the furnace of the present invention, showing the end opposite from the end illustrated in FIGURE 1. Referring to the drawings in detail, wherein like numerals indicate like elements, there is shown in FIGURE 1 a drum type induction furnace designated generally as 10. The furnace 10 comprises a cylindrical drum 12 which is rotatably mounted about the axis of a crescent-shaped track 14. The track 14 is supported by adjustable positioning rollers 16. The rollers 16 are adjustably mounted on a base 18.

A pair of induction units 20 and 21 are provided on the drum 12. Cooling fans 22 and 23 and a charging chute 24 are provided in a manner well known in the art. A clevis 25 is pivotally secured to a pin on an end wall of the drum 12. One end of a piston rod 26 is connected to the clevis 25. The other end of the piston rod 26 is disposed within a power cylinder 28. A clevis 30 on one end of the power cylinder 28 is rotatably connected to a mount on the base 18.

The internal structure of the drum 12, induction units, fans and power cylinder per se, form no part of the present invention. For purposes of illustration, as shown more clearly in FIGURE 4, the drum 12 is provided with a refractory lining 32. The portion of the drum 12 illustrated in FIGURE 4 is an end wall thereof. The end wall of the drum 12 is provided with an outlet port 34 adjacent the periphery thereof. A refractory lining 36 extends through the port 34 and the lining 32. The refractory lining 36 is provided with an outlet pipe 38. The outlet pipe 38 and the refractory lining 36 are fixedly secured with respect to the end wall of the drum 12.

The pipe 38 is provided with an outlet port 39.

A pair of annular plates 40 are fixedly secured to the end wall of the drum 12. A short cylindrical housing 42 is fixedly secured to one end of the plates 40 and surrounds the refractory lining 36. A short cylinder 44 is fixedly secured to the end wall of the drum 12 surrounding the cylindrical housing 42. An annular ring is fixedly secured to the outer periphery of the cylinder 44 at the end thereof remote from the end wall of the drum 12. The ring 46 extends in a radial direction with respect to the cylinder 44.

A faceplate 48 is juxtaposed to the ring 46 and the end of the cylinder 44. The faceplate 48 is recessed so that the faceplate 48 is provided with a shoulder on which is juxtaposed to the outer peripheral surface of the ring 46. A backup plate 50 surrounds the cylinder 44 and is provided with an inner peripheral diameter which is smaller than the outer peripheral diameter of the ring 46. The ring 46 is disposed intermediate the faceplate 48 and the backup plate 50.

The faceplate 48 and the backup plate 50 are held in assembled relationship by means of a plurality of bolts 52 extending therethrough. Accordingly, the ring 46 provides a mount for rotatably supporting the faceplate 48. A conduit housing 54 is fixedly secured to the faceplate 48 in any convenient manner such as by welding. The housing 54 is provided with a removable top plate 55 adjacent the faceplate 48.

Refractory material 56 is disposed between a launder 58 and the walls of the housing 54. An access port is provided along the longitudinal axis of the pipe 38 by means of the removable plug 60 which extends through
3,291,472

the housing 54, refractory 56, and the launder 58. Silicon carbide resistor heater bars 57 are disposed above the launder 58.

As shown more clearly in FIGURE 2, the end of the housing 54 of the discharge conduit remote from the port 39 is connected to a cylindrical portion 62. The cylindrical portion 62 and the launder 58 are provided with heater bars similar to bars 57. The launder 58 is provided with a discharge port 64.

The cylindrical portion 62 is rotatably mounted and supported by an annular support 66. The support 66 is provided with a flat base 68. The flat base 68 is reciprocally supported on the upper surface of the vessel walls 57 by a ball bearing and is provided with an inlet port 72. The annular support 66 is lined with refractory or insulation material.

The operation of the present invention is as follows:

The metal to be melted by the furnace 10 of the present invention is inserted in the drum 12 through chute 24. The metal is liquefied by the high frequency current in a manner well known to those skilled in the art. When it is desired to discharge the molten metal from the drum 12, the drum 12 is rotated by actuation of the power cylinder 28. The admission of a fluid into one end of the power cylinder 28, causes the piston rod 26 to rotate the drum 12 about the axis of the crescent-shaped track 14.

The drum 12 is rotated as set forth in the next preceding paragraph until the port 39 is below the level of liquid metal within the drum 12. At this point, the molten metal freely flows through the pipe 38 into the launder 58, through the port 64, into the vessel 70. The port 39 is disposed in the launder 58 so as to prevent leaks. As the drum 12 rotates, the port 39 will move from the solid line position shown in FIGURE 2 to the phantom position. As the port 39 moves to the phantom position shown in FIGURE 2, the point 75 within the cylindrical portion 62 moves to the point 76. The reciprocatory mounting for the base 68 on the annular support 66 accommodates the movement of the point 75 to the position of the point 76.

It will be noted that discharge of molten metal from the drum 12 into the vessel 70 is accomplished merely by rotating the drum 12. No valves are utilized for this purpose at any time, and leaks are avoided in many places without using seals. I have found it desirable to provide guide tracks for the base 68, however, the same are not necessary.

It will be noted that the rotatable mounting for the discharge conduit enables the same to be readily removable with respect to the drum 12 merely by loosening the bolts 57. The plate 60 and the top plate 55 are readily removable for purposes of inspection, cleaning and repair of the portion of the launder 58 adjacent the port 39.

The mating relationship between the cylindrical portion 62 and the annular support 66 readily accommodates the movement of the discharge conduit as the drum 12 is rotated by the mechanism 20 and prevents leaks therebetween. It will be appreciated by those skilled in the art, that other types of means may be provided for rotating the drum 12 in place of the power cylinder 28 and the lever 20. For example, the drum 12 may be rotated by means of a rack and pinion as illustrated in FIGURE 5 of Patent 2,369,272.

While the discharge conduit is illustrated in FIGURE 2 as extending transversely across the end of the drum 12, it will be appreciated by those skilled in the art that the discharge conduit could extend from the plate 48 to either side of the drum 12. That is, the discharge conduit could extend to the right in FIGURE 2 instead of to the left as illustrated.

It is customary in some applications to make the furnace and all metal conveying ducts associated therewith as tight as possible and then apply an inert atmosphere to the system. If a few small leaks occur, the effect is minor if the atmosphere inside the furnace is maintained slightly above atmospheric pressure. All of the moving joints in the furnace of the present invention are remote from the molten metal, are reasonably cool, and hence will not warp out of shape. Accordingly, the furnace of the present invention is readily adaptable for use with the provision of an inert atmosphere over the molten metal and leaks, if any, will be small.

Thus, it will be seen that I have provided a novel discharge conduit having one end removably and rotatably connected to a drum type induction furnace with its other end reciprocally supported on a vessel or the like adapted to receive the molten metal from the furnace. While the discharge conduit is preferably in communication with the drum 12 adjacent the peripheral surface thereof, it will be appreciated that the discharge conduit may have communication with the drum 12 at any point intermediate the longitudinal axis of the drum and the inner peripheral surface thereof. For practical reasons, the discharge conduit is preferably in communication with the drum adjacent the inner peripheral surface thereof.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. A drum type induction furnace comprising a drum, means supporting said drum for rotation about a substantially horizontal axis, means associated with said drum for melting metals within said drum, a discharge conduit having first and second ends, means rotatably connecting said first end of said conduit to an upright end wall of said drum at a point spaced from the axis of rotation of said drum, means providing communication between the interior of said drum and said first end of said conduit, the longitudinal axis of said conduit extending at an angle with respect to the longitudinal axis of said drum, the second end of said conduit being disposed below said first end of said conduit in all rotative dispositions of said drum, means slidably supporting said second end of said conduit, and means for rotating said drum so that said first end of said conduit may be disposed below the level of molten metal in said drum to effect a discharge of molten metal from said drum through said conduit to a vessel disposed to one side of said drum.

2. A drum type induction furnace comprising a drum having its longitudinal axis substantially horizontally disposed, means supporting said drum for rotation about a horizontal axis, means for remodeling said drum for melting metals, a vessel for receiving molten metal from said drum, said vessel being positioned to one side of said drum, a discharge conduit for conveying molten metal from said drum to said vessel, said discharge conduit having first and second ends, means rotatably coupling said first end of said conduit to an end of said drum at a point spaced from the axis of rotation of said drum, means providing communication between said one end of said conduit and the interior of said drum adjacent the inner peripheral surface of said drum, the second end of said conduit being lower than the first end of said conduit in all rotative positions of said drum and means for rotatably and reciprocally supporting said second end of said conduit on said vessel so that molten metal may be transferred to said vessel without being exposed to the surrounding atmosphere, whereby rotation of said drum enables the contents of said drum to be discharged through said conduit into said vessel without the use of valves or the like.

3. A furnace in accordance with claim 1 wherein said means rotatably supporting said one end of said discharge conduit comprises an annular ring fixedly secured with respect to said drum, a backup plate on one side of said ring, a faceplate on the other side of said ring, a shoulder on said faceplate extending around said ring, bolts extend-
ing through said plates, and said conduit being fixedly secured with respect to said faceplate.

4. Apparatus comprising a cylindrical drum, the longitudinal axis of said drum being horizontally disposed, means for supporting and rotating said drum about a horizontal axis, a discharge conduit for said drum, means rotatably connecting one end of said conduit to said drum adjacent the inner periphery of said drum, means providing communication between said drum and said one end of said conduit, the other end of said conduit being lower than said one end in all rotative positions of said drum, and the longitudinal axis of said conduit being substantially perpendicular to the longitudinal axis of said drum, whereby the contents of said drum may be discharged by rotating said drum about said axis to place said one end of said conduit below the liquid level.

5. In a furnace comprising a drum, the longitudinal axis of said drum being substantially horizontally disposed, means for selectively rotating said drum about an axis spaced from and substantially parallel to the longitudinal axis of said drum, a heated discharge conduit for said drum, said conduit having a refractory lining, means rotatably and removably connecting one end in all rotative positions of said drum of said conduit to an upright end wall of said drum at a point spaced from the axis of rotation of said drum, means providing communication between said drum and said conduit at a location lying along a radius of said drum between the longitudinal axis of said drum and the inner peripheral surface of said drum, the other end of said conduit being lower than said one end in all rotative positions of said drum, and the longitudinal axis of said conduit being substantially perpendicular to the longitudinal axis of said drum.

6. In a furnace in accordance with claim 5 including means rotatably and reciprocably supporting said other end of said conduit.

7. A furnace in accordance with claim 6 wherein said means for rotatably and reciprocably supporting said other end of said conduit includes a curved portion on said other end of said conduit rotatably supported by an annular support having a mating curved portion, and a base on said annular support slidably mounted on a vessel into which said discharge conduit empties.

8. A furnace in accordance with claim 1 wherein said means providing communication between said first end of said conduit and said drum includes a second conduit, said second conduit having one end projecting into said discharge conduit so that molten metal may be discharged directly into said discharge conduit without crossing any joint between said conduits.

9. A furnace in accordance with claim 1 including means providing an access opening in said discharge conduit at said first end to facilitate inspection, maintenance and repair at said first end of said discharge conduit.

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