Aug. 27, 1963 R. C. RENTON 3,102,154

ELECTRIC ARC FURNACES

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Fig. 1.

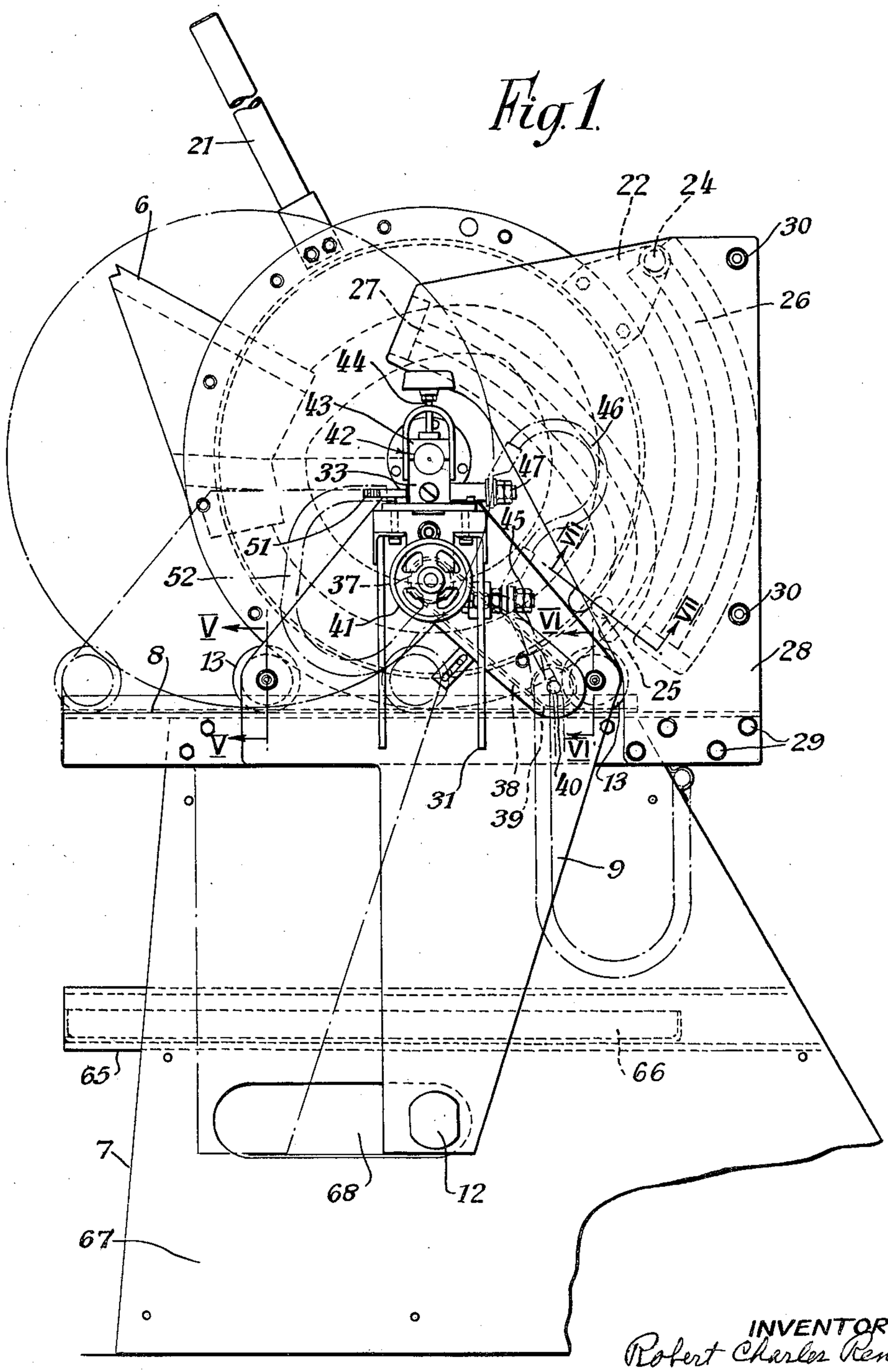

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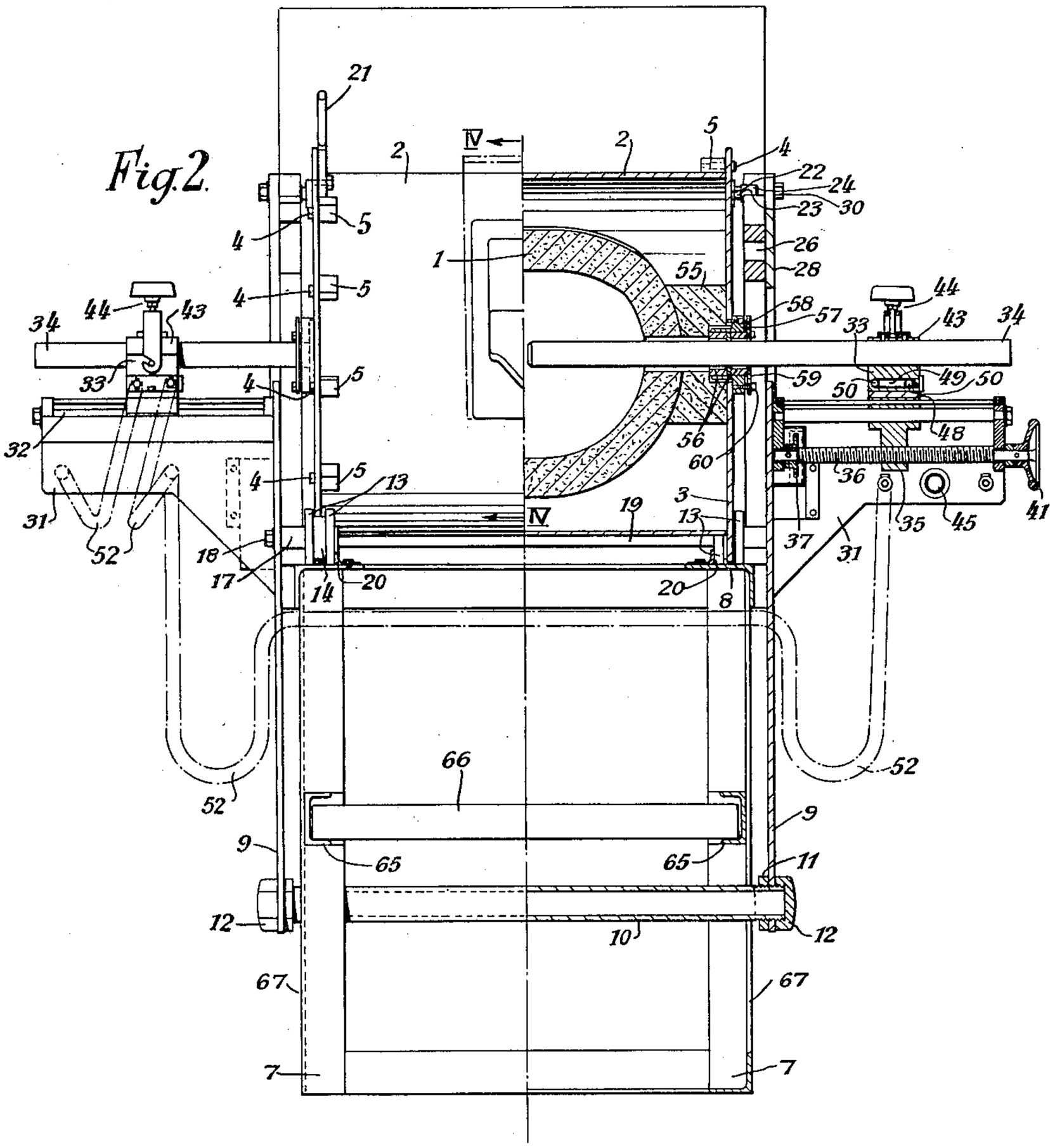
Fig.2.



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ELECTRIC ARC FURNACES

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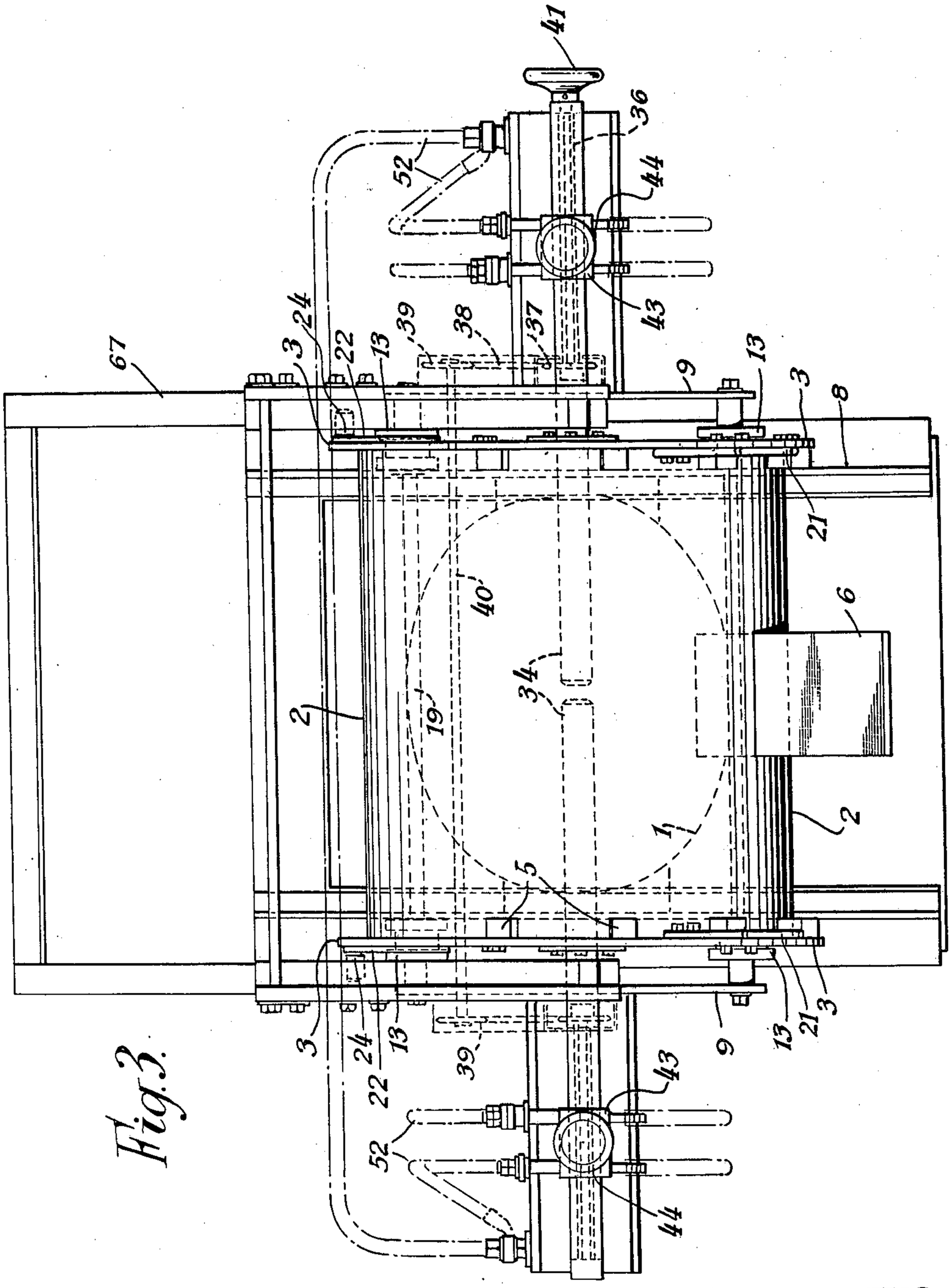

Fig. 3.

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ELECTRIC ARC FURNACES

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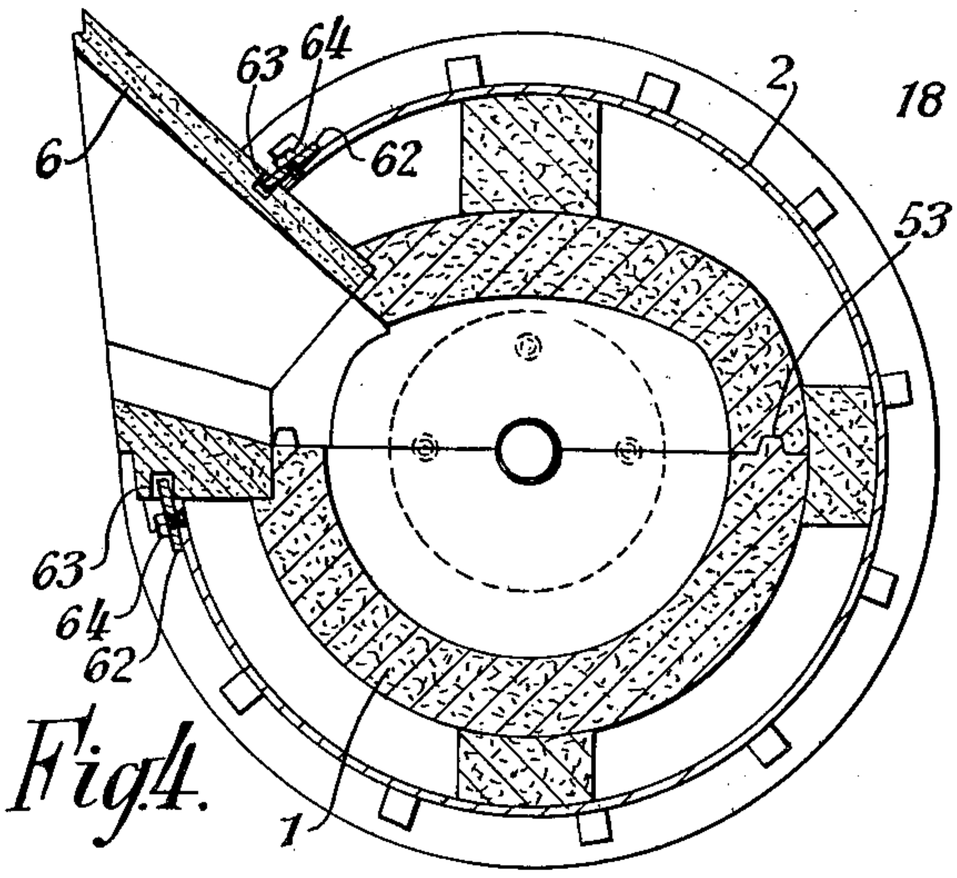

Fig.4.

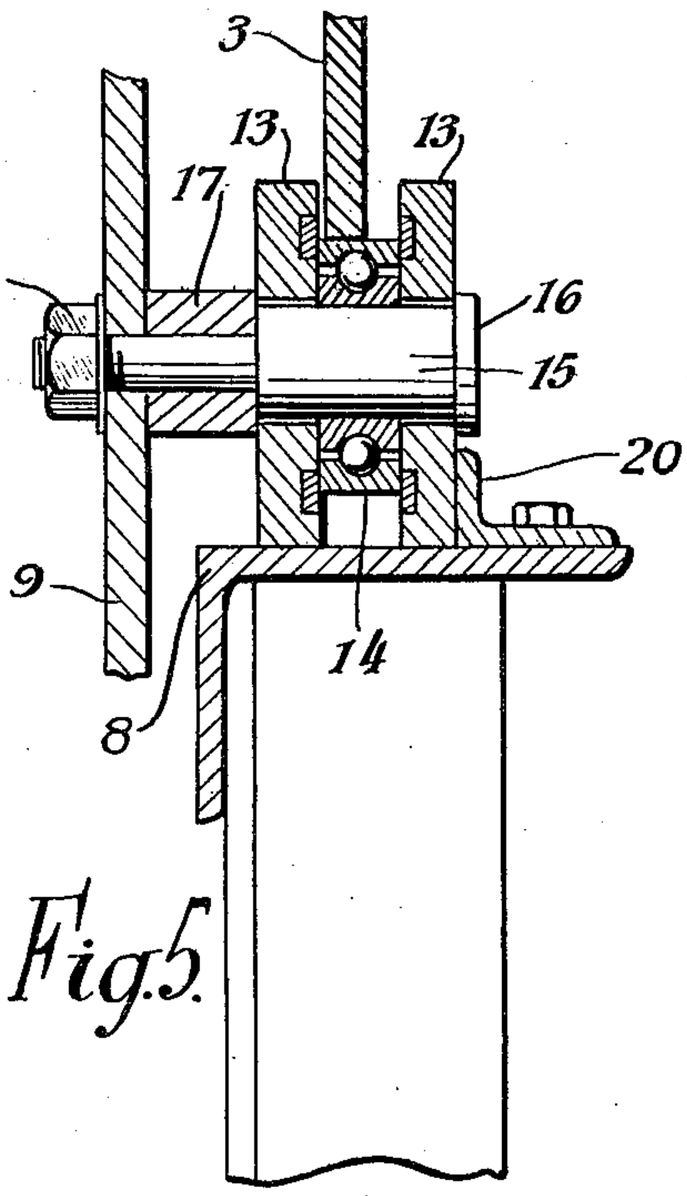

Fig.5.

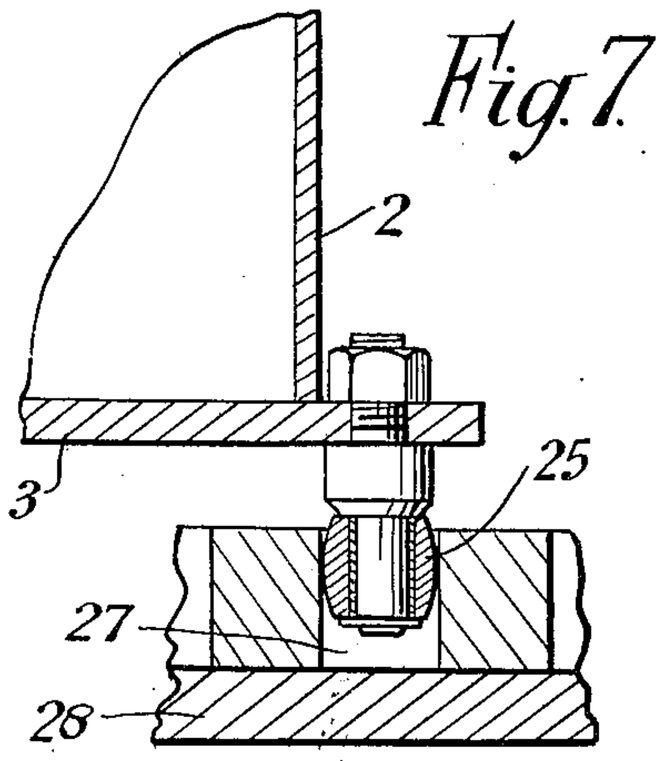

Fig.7.

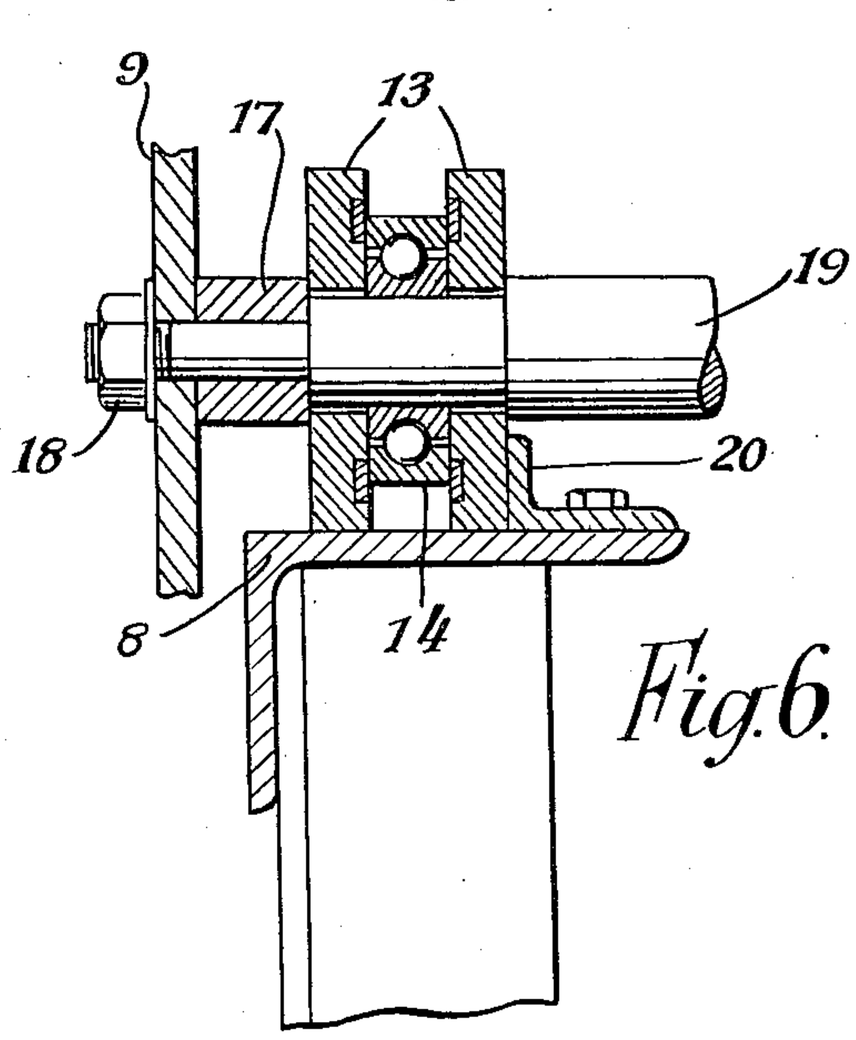

Fig.6.

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ELECTRIC ARC FURNACES

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10 Claims. (Cl. 13—10)

This invention relates to electric arc furnaces for melting metals preparatory to casting. Such furnaces have to be tiltable to enable the melted metal to be poured into moulds, and it is desirable that the pour point shall remain in a fixed vertical line. This result has hitherto been achieved by tilting the furnace about a fixed axis close to the pour point, but, to perform such tilting, the whole weight of the furnace must be lifted, and the tilting gear must therefore be massive, and calls for considerable power to operate it.

The object of the present invention is to provide an improved mounting and tilting gear for a furnace of the kind referred to.

According to the present invention, an electric arc furnace is rotatably mounted to turn about an axis adjacent to its centre of gravity on a carriage which is itself movable in a horizontal direction, and is so constrained during tilting for pouring, about the said axis that the lip of the pouring orifice travels in a vertical line, the resulting horizontal movement of the tilting axis being accommodated by movement of the carriage.

The furnace conveniently carries a pair of discs or arcuate track members co-axial with the tilting axis, said discs or arcuate track members resting on rollers on the carriage, and the carriage being provided with rollers engaging fixed horizontal tracks.

The movement of the furnace during tilting may be controlled by projections engaging in fixed guide tracks, for example slots, in a fixed frame supporting the furnace. The projections may be located adjacent the pour point and co-operate with vertical guide tracks, or may be positioned remote from the pour point, the guide tracks being so shaped that the pour point is constrained to follow a straight vertical path.

The carbon rods between which the electric arc is struck in the furnace may be mounted on the axis about which the furnace turns relative to the carriage, and may be moved longitudinally by means mounted on the carriage. Conveniently, the carbon rods are mounted in slide members movable along tracks on the carriage and embodying nuts engaging screw-threaded shafts rotated by chain-and-sprocket gearing from a common shaft also mounted on the carriage, conveniently below the furnace.

The accompanying drawings show by way of example, a construction of electric arc furnace according to one embodiment of the invention.

In the drawings:

FIGURE 1 is an end view of the furnace;

FIGURE 2 is a front elevation partly in section;

FIGURE 3 is a plan view;

FIGURE 4 is a section on the line IV—IV of FIGURE 3;

FIGURE 5 is a scrap section on the line V—V of FIGURE 1;

FIGURE 6 is a scrap section on the line VI—VI of FIGURE 1; and

FIGURE 7 is a scrap section on the line VII—VII of FIGURE 1.

Referring to the drawings the crucible 1 of the furnace is housed in a cylindrical casing 2 the opposite ends of which are closed by end plates 3 each of which is secured

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in position by bolts 4 screwed into lugs 5 disposed in spaced relationship around the periphery of the cylindrical casing 2, the said casing having a pouring spout 6 for the discharge of molten metal from the crucible.

The casing 2 is mounted with its axis horizontal on a supporting framework shown generally at 7. The supporting framework 7 is provided at its upper end with horizontal running rails 8 on which rests a wheeled carriage movable along the said rails. The carriage comprises two side plates 9 spaced apart from one another so as to be located one at either end of the cylindrical casing 2, the side plates 9 being secured to each other by a tie rod 10 the opposite ends of which extend through holes in the downwardly extending portions of the side plates 9, each side plate 9 being clamped between a stop nut 11 and cap nut 12 screwed onto the threaded ends of the tie rod 10. Each side plate 9 carries two running wheels the construction of which is shown particularly in FIGURES 5 and 6. Each running wheel consists of a pair of discs 13 located one on either side of a ball bearing 14. As shown in FIGURE 5, the running wheels at the front of the carriage are each mounted on the plain bearing portion of a stub shaft 15 the discs and ball bearing being located axially between a flange 16 on one end of the stub shaft and a sleeve 17, each front wheel assembly so formed being secured to the side plate 9 by a nut 18 screwed onto the threaded end of each stub shaft. The use of stub shafts for supporting the front wheels provides a gap permitting the cylindrical casing to be rotated by an amount sufficient to move the pouring spout to a downwardly projecting position beneath the carriage and beyond the normal pouring position. The running wheels at the rear of the carriage are mounted on the opposite ends of a cross shaft 19 extending between the side plates 9 of the carriage the axial location of the running wheels being similar to that used for the front running wheels as shown in FIGURE 6. The peripheral edges of the discs 13 rest on the running rails 8 to support the carriage which is guided along the rails by engagement of the inner discs with the guide flanges 20. The cylindrical casing 2 is mounted on the carriage by locating the peripheral edge of each end plate 3 on the outer race of each ball bearing 14. Thus the cylindrical casing can be freely rotated about its axis on the carriage, a hand lever 21 being provided to facilitate this operation by an operator, and is also movable bodily in a horizontal direction perpendicular to its axis by movement of the carriage along the rails 8.

Each end plate 3 of the cylindrical casing 2 has a radially extending bracket 22 secured thereto each bracket carrying a laterally extending roller shaft 23 on each of which is mounted a guide roller 24. Each said end plate 3 also carries a further guide roller 25 the latter being angularly spaced from the guide rollers 24 and located radially inwards in relation thereto. The guide rollers 24 are engageable in arcuate tracks 26 and the guide rollers 25 in arcuate tracks 27, the said tracks being carried by support plates 28 located one at either end of the cylindrical casing 2 and secured to the sides of the supporting frame 7 adjacent the rear thereof by bolts 29, the support plates 28 being rigidly coupled together by tie rods 30. As can best be seen in FIG. 1, tracks 26 and 27 are disposed at different radial distances from the tilting axis of the casing. Track 26 is concentric and track 27 eccentric with reference to said axis. The arrangement of the guide tracks and guide rollers is such that, as the cylindrical casing 2 is rotated, one pair of rollers enter their guide tracks before the other pair leave the other guide tracks, so that the casing is guided to follow a predetermined path when turned about its axis. During the part of such turning movement when the pouring spout is moving downwardly from a position substantially in the horizontal plane containing the axis

of the crucible, the latter is constrained by the engagement of the guide rollers 25 in the tracks 27 so that the lip of the pouring spout moves in a vertical line during pouring, the movement of the axis of the crucible which must take place due to the straight-line movement of the pouring spout being accommodated by movement of the carriage on its rails. During movement of the pouring spout upwardly to a top position for charging purposes, the cylindrical casing turns about its centre and the carriage does not move.

Projecting outwardly from each side plate of the carriage is a cantilever bracket 31 supporting a horizontal rod 32 on which is mounted a slide member 33 for supporting one of the two carbon rods 34 between which the furnace arc is struck, the slide members supporting the carbon rods 34 co-axial with the crucible into which they extend through suitable glands hereinafter described. Each slide member 33 embodies a nut 35 engaging the screw-thread on a screw-threaded shaft 36 mounted in the corresponding cantilever bracket so as to lie parallel to the guide rod 32, the two screw-threaded shafts each having fixed thereon a sprocket wheel 37 coupled by a chain 38 to a further sprocket wheel 39 on a cross shaft 40 extending, between the downward extensions of the carriage end plates 9 and to the rear thereof. A handwheel 41 is provided on one of the screw-threaded shafts 36 by means of which it can be rotated to cause relative longitudinal movement of the two carbon rods.

The carbon rods are secured in the slide members 33 by clamping each rod between a curved seating 42 and removable cover 43 held in position by a screw down quick release fastening 44. Each cantilever bracket carries an electrical terminal 45 for the connection of the electrodes to the power supply, each said electrical terminal being in turn connected by a lead 46 to a further electrical terminal 47 carried by the corresponding slide member 33 each said terminal 47 being secured to an upper part of the slide member 33 which is electrically insulated from the lower part thereof by the interposition of a block 48 of insulating material. Each slide member 33 is also adapted to be cooled by circulating water or other coolant through a chamber 49 formed therein, inlet and outlet openings 50 having nipples 51 for the connection of hoses 52 being provided.

The crucible 1 is made in two halves meeting in a diametral plane, interengaging spigots and grooves 53 being provided to locate the two halves. The crucible is assembled in the cylindrical casing 2 and is located radially by blocks 54 of refractory material arranged around it the remainder of the space inside the casing being filled with discrete refractory material. The crucible is located axially by end blocks 55 also of refractory material which surround the inner end of stuffing boxes, extending inwardly through the end wall thereof, each said stuffing box including a winding of asbestos string clamped between bushes 56 of refractory material through which the carbon rods 34 extend, the bushes being surrounded by a flanged sleeve 57 secured to the adjacent end plate 3 by socket head screws 58, the bushes 56 being secured axially by retaining plates 59 held in position by socket head screws 60 secrewed into the flange of the sleeve 57. The crucible 1 has an orifice 61 in the peripheral wall thereof the surrounding edge of which is shouldered to receive the inner end of the pouring spout which is mounted on the cylindrical casing so as to be removable the spout when assembled being retained in position by brackets 62 longitudinal edges of which engage in slots 63 in the spout, the brackets being secured to the cylindrical casing by bolts 64.

The parts forming the crucible are preferably made of pure recrystallised alumina, the end blocks of sillimanite or like high quality refractory material, and bushes and locating blocks of refractory material such as mullite or molochite. The discrete filling material is also a refractory material.

The supporting frame 7 is provided with runners 65 for the slidable support of a removable mould supporting tray 66 the sides of the frame 7 being provided with closure plates 67, the tie rod 10 passing through slots 68 in the said closure plates which slots permit the free movement of the carriage.

It will be understood that the particular embodiment above described is given by way of example only and the construction can be modified in many ways. For example other guiding means can be adopted to achieve the vertical movement of the pouring spout during pouring. For example, a single pair of rollers on the cylindrical casing, offset angularly from the opening, may engage in guide slots so shaped that, during the part of the turning movement of the crucible when pouring takes place, the said opening moves vertically. In a still further alternative construction the crucible may comprise a central cylindrical portion made in two halves meeting in a diametral plane and two frusto-conical end portions abutting one against each end of the cylindrical portion. The parts are assembled in the casing, the cylindrical part being located by means of refractory blocks, for example three in number, arranged around it, and the remainder of the space inside the casing being filled with discrete refractory material. The frusto-conical end portions are located in recesses in end blocks also mounted inside the casing on stuffing boxes extending inwardly through the end walls thereof and constructed as hereinabove described.

I claim:

1. An electric arc furnace installation comprising a furnace including a pouring orifice defining a lip, a carriage supporting said furnace rotatable about a horizontal axis, guide rails guiding said carriage along a horizontal path transverse of said turning axis, and carriage control means displacing said carriage on said guide rails so that the lip of the pouring orifice during tilting of the furnace for pouring moves along a path perpendicular in reference to said guide rails.

2. An electric arc furnace installation according to claim 1, wherein said carriage control means comprise projections carried by the furnace and guide tracks fixedly mounted adjacent to the furnace so as to be engaged by the projections as the furnace is turned about its axis of rotation.

3. An electric arc furnace installation according to claim 1, wherein the furnace is mounted on the carriage rotatable in reference thereto through an angle to move the pouring orifice to an upper position to permit charging the furnace and to a lower limit position beyond the normal pouring position.

4. An electric arc furnace installation according to claim 1, wherein said carriage control means comprise guide means for guiding the furnace during its rotary movement between an upper and lower limit position in reference to the carriage.

5. An electric arc furnace installation according to claim 4, wherein said furnace guiding means comprise guide rollers and arcuate guide tracks, said tracks being disposed concentric to the axis of rotation of the furnace, each of said guide rollers being engageable with one of said guide tracks to guide the lip of the pouring orifice through said perpendicular path.

6. An electric arc furnace installation according to claim 1, wherein said furnace comprises carbon rods between which the electric arc is struck in the furnace, said rods being mounted on the axis about which the furnace turns relative to the carriage, and means mounted on the carriage for longitudinally displacing said rods.

7. An electric arc furnace installation according to claim 1, wherein the furnace comprises a casing enclosing a crucible of refractory material said casing having a pouring spout communicating with said pouring orifice in the furnace.

8. An electric arc furnace installation according to

claim 7, wherein the crucible comprises at least two parts which are radially and axially located in the casing by blocks of refractory material.

9. An electric arc furnace installation according to claim 1 wherein said carriage control means comprise first guide means supported by the furnace for movement in unison therewith, and second guide means stationarily mounted adjacent to the furnace, said first guide means being engageable with said second guide means for guiding the lip of the pouring orifice along said perpendicular path.

10. An electric arc furnace installation according to claim 1 wherein said furnace mounts a pair of guide rollers and a pair of arcuate guide tracks is stationarily mounted adjacent to the furnace, each of said tracks being engageable with one of said rollers, said guide tracks being disposed at different radial distances from said tilting axis

and one of the tracks being concentric and the other eccentric in reference to said tilting axis whereby said concentric track guides the furnace for tilting about said axis and said eccentric track constrains movement of the furnace in reference to the carrier movement on said guide rails to effect said movement of the lip of the pouring orifice along said perpendicular path.

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