May 25, 1954 A. D. SMITH 2,679,325

FURNACE CHARGING MACHINE

Filed Jan. 10, 1952 6 Sheets-Sheet 1

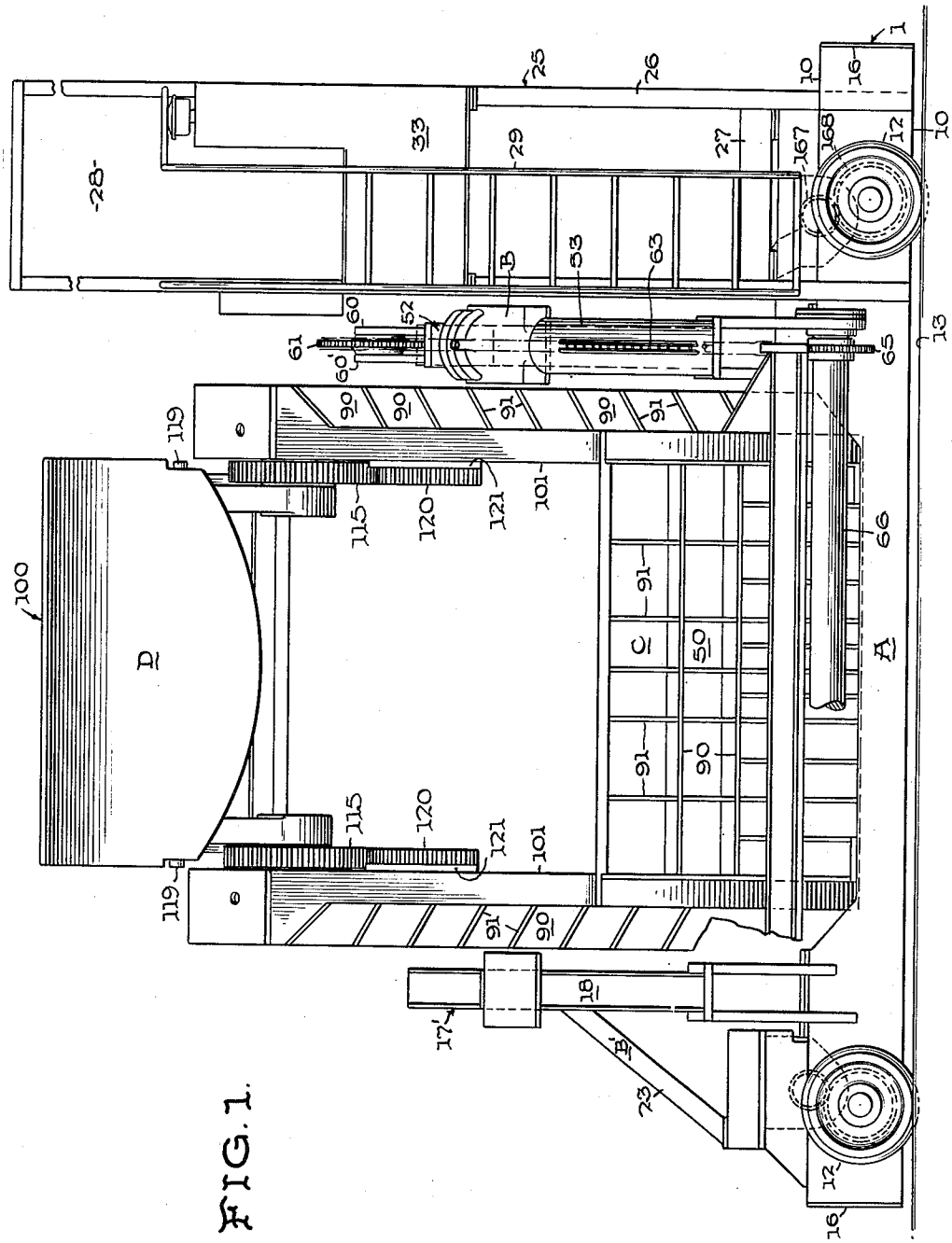


FIG. 1.

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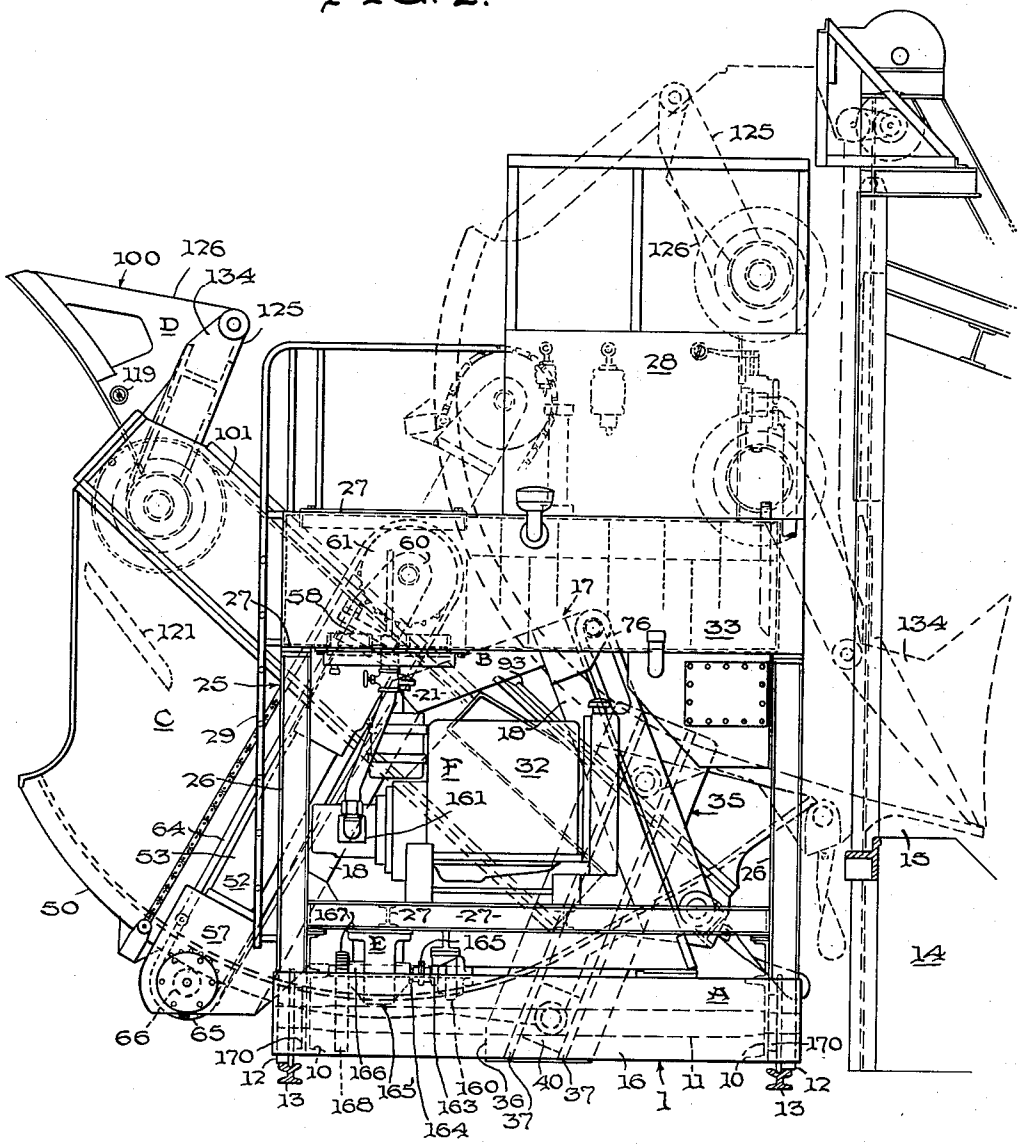
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FURNACE CHARGING MACHINE

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FIG. 2.



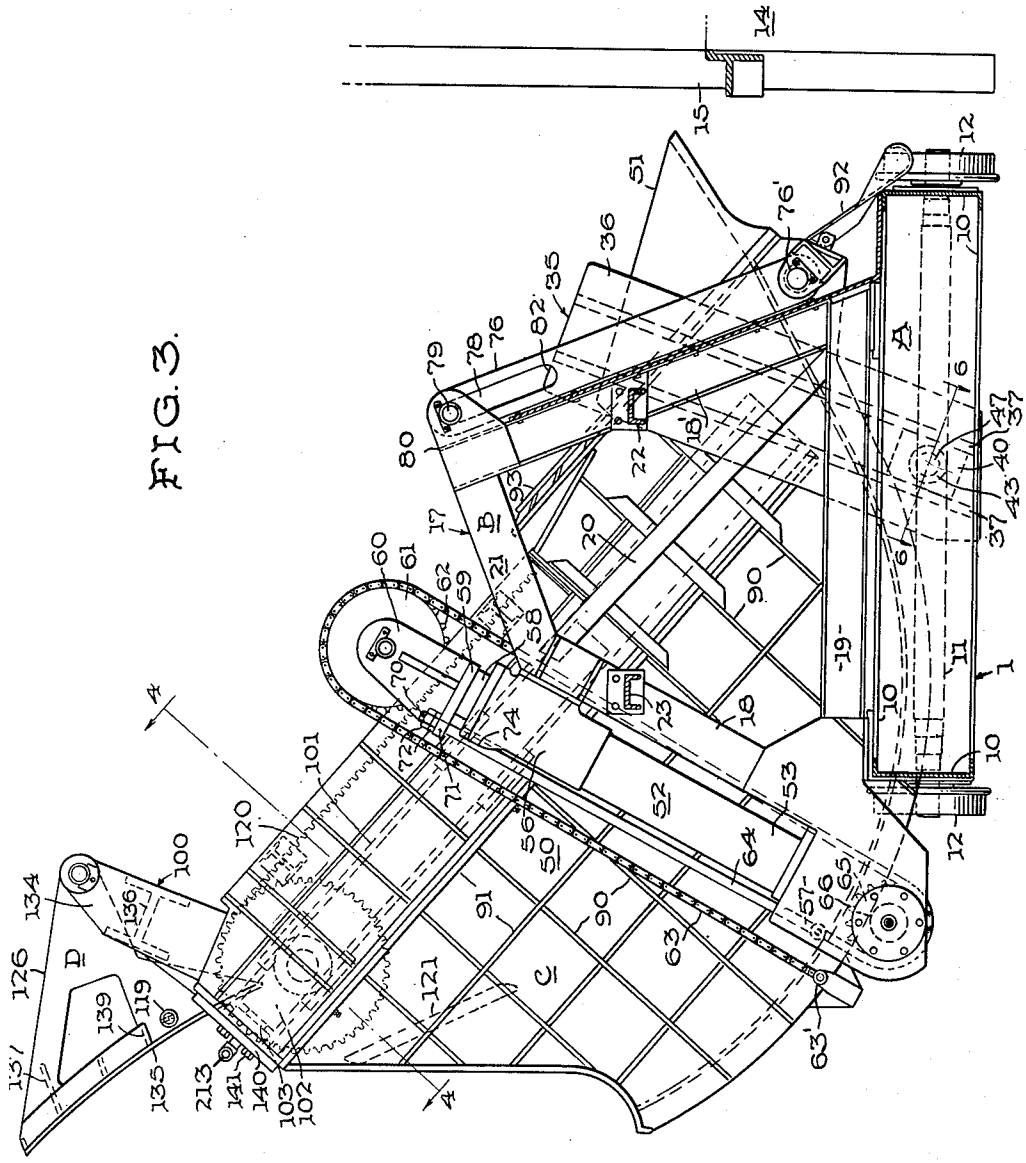
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FURNACE CHARGING MACHINE

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FIG. 3.



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FURNACE CHARGING MACHINE

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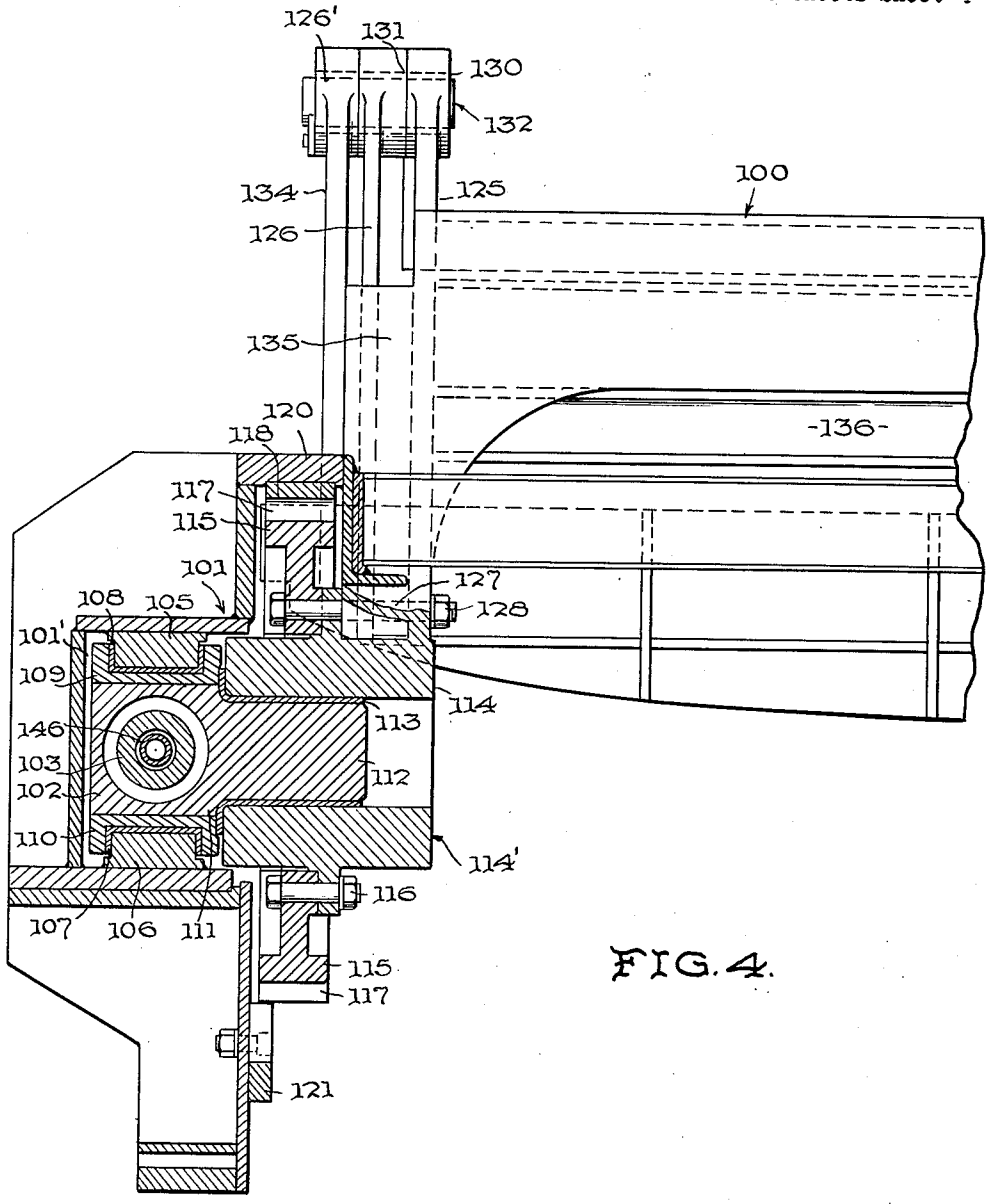


FIG. 4.

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FURNACE CHARGING MACHINE

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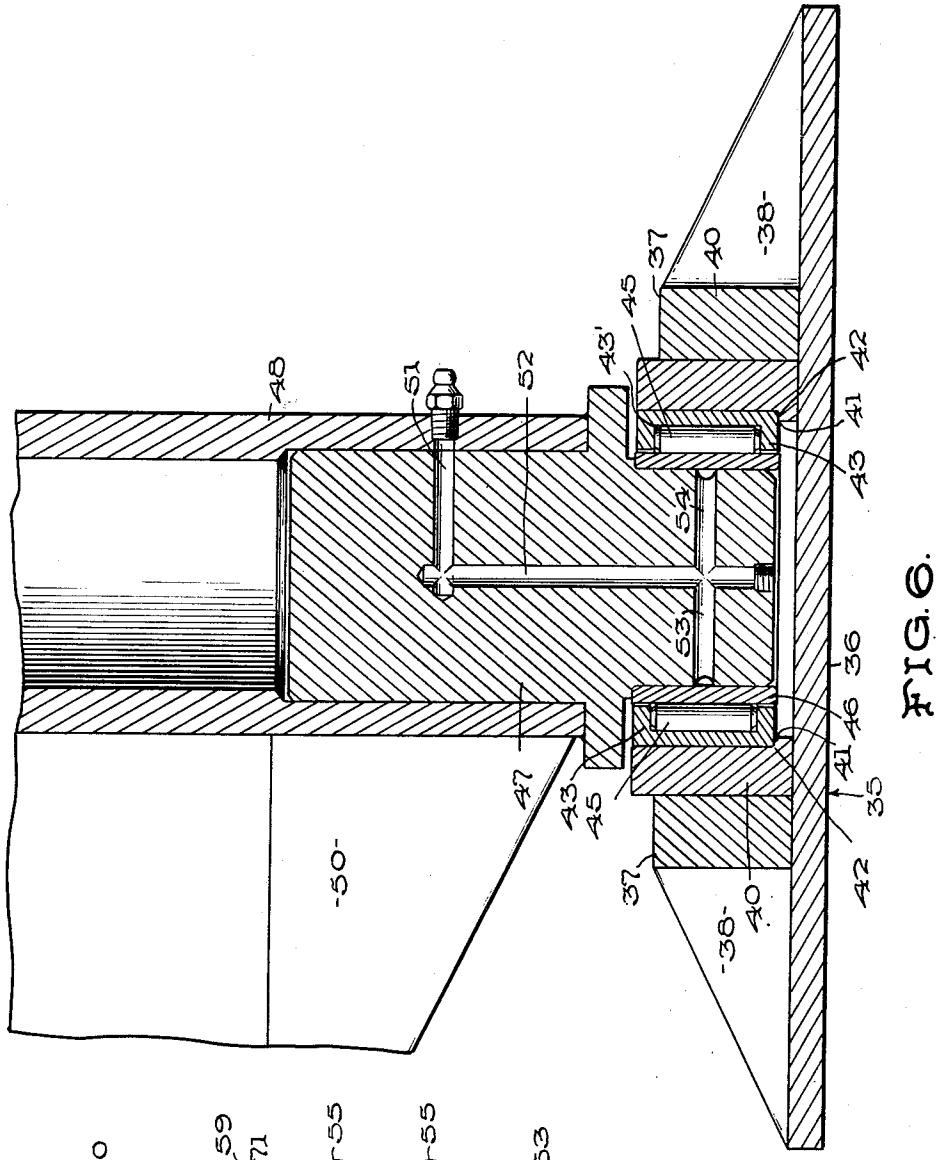


FIG. 6.

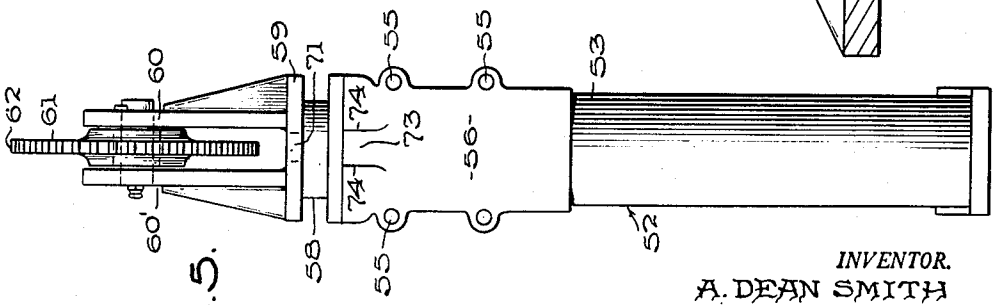


FIG. 5.

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FURNACE CHARGING MACHINE

Filed Jan. 10, 1952 6 Sheets-Sheet 6

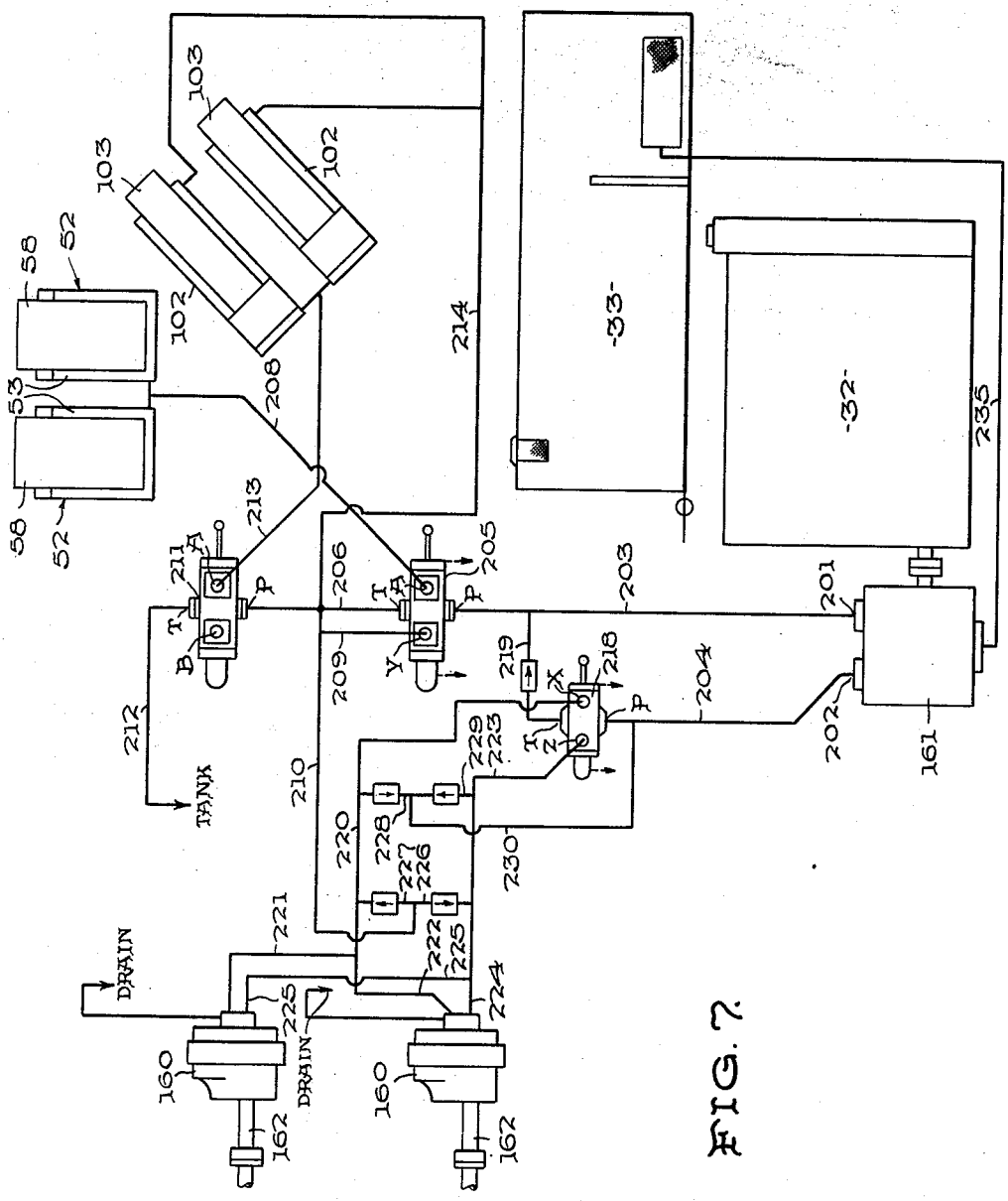


FIG. 7.

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Patented May 25, 1954

2,679,325

UNITED STATES PATENT OFFICE

2,679,325

FURNACE CHARGING MACHINE

Arthur Dean Smith, Spokane, Wash., assignor to Kaiser Aluminum & Chemical Corporation, Oakland, Calif., a corporation of Delaware

Application January 10, 1952, Serial No. 265,780

20 Claims. (Cl. 214—18)

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This invention relates to furnace charging machines. More particularly it is concerned with providing a novel charging machine which constitutes an improvement over that disclosed in U. S. Patent No. 2,576,974 wherein I am a co-inventor.

The charging machine of the instant invention as in the case of that disclosed in the aforesaid patent relates to a charging machine for supplying scrap metal and the like to melting furnaces and serves to supplant the prior operation of charging the furnace by hand.

This former charging of furnaces by hand was inefficient and hazardous and in addition, when charged by hand, the amount of the charge was ordinarily limited. By employing the charging machine of Patent 2,576,974 as well as that of the instant invention, all of the deficiencies and hazards, which attend normal hand charging, can be eliminated.

In addition, by utilizing the apparatus of the instant invention, wherein the hopper is adapted to be raised upward and toward the furnace as a unit and simultaneously therewith be rotated in an arcuate path, the front extremity or lip portion of the hopper has a line of movement through the furnace door such that any foreign material on the furnace sill is caused to be scraped or pushed into the furnace proper and thus prevent any tendency of wedging of the foreign material into the fire brick of the sill with consequent destruction of the fire brick.

Accordingly, it is a primary object of this invention to provide a novel charging machine for a melting furnace, wherein the hopper, which contains the charge, is elevated and simultaneously therewith is moved toward the furnace and rotated so as to dump its charge into the furnace.

Another object of this invention is to provide a charging machine for a melting furnace, wherein any foreign material on the furnace sill is scraped or pushed into the furnace proper.

A further object of this invention is to provide a charging machine for a melting furnace, having a novel scraper associated with the hopper containing the charge, which is adapted to eject the charge from the hopper into the furnace, when the hopper has been elevated and rotated.

Another object of this invention is to provide a novel charging device for a melting furnace, which is adapted to charge a plurality of furnaces.

Another object of this invention is to provide

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a novel charging device having common power means for elevating and lowering the hopper and for moving the scraper into and out of the hopper.

A further object of this invention is to provide a novel charging machine for a melting furnace, which is adapted to supply a relatively large charge of scrap material and the like to the melting furnace.

These and other objects are accomplished by providing a furnace charging machine mounted upon a movable carriage which is generally comprised of a pair of spaced truss-like supporting frames positioned upon the carriage. An elongated channel shaped guide member is affixed to the inner portion of each of said frames and each of these guide members projects in a vertically inclined path upwardly and outwardly toward one side of the carriage and away from the center line thereof. An elongated pivotal guide member pivotally attached at its upper end to each of said frames and extending upwardly and outwardly in a direction transverse to that of said channel shaped guide members and at an acute angle thereto cooperates with said channel shaped guide members and a bearing block is slidably mounted in each of the channel shaped guide members.

The lower portion of a hopper is pivotally mounted in the bearing blocks which are slidable in the guide members, and the lower portion of the hopper is also pivotally mounted to the lower ends of said elongated pivotal guide members. A pair of spaced hydraulic jacks connected by sprocket and chain means to the hopper are used for elevating and lowering the hopper in such a manner that upon initial actuation of the jacks the hopper is moved upward and outward as a unit along an upwardly and outwardly inclined path as defined by the channel shaped guide members and, simultaneously with this upward and outward movement, the hopper is also caused to rotate in an overhead arcuate path toward the furnace opening by the action of the pivotal guide members so as to cause the hopper to discharge its contents into the furnace. Means including a movable ejection ram or scraper are also employed for ejecting the contents of the hopper into the furnace.

Other objects, purposes and advantages of the instant invention will be more fully understood from the following detailed description when taken in conjunction with the appended drawings wherein:

Figure 1 is a front elevational view partially

broken away and with parts removed of the charging machine of the instant invention.

Figure 2 is a side elevational view of the charging machine of the present invention showing the hopper in its loading or rest position in full lines and in its discharge position in dotted lines. The upper and lower positions respectively of the scraper for the hopper are also shown in full and dotted lines.

Figure 3 is a side elevational view of a portion of the charging machine, showing how the hopper is mounted upon the movable carriage;

Figure 4 is a sectional view partly broken away when taken along lines 4—4 of Figure 3;

Figure 5 is a front elevational view of one of the two hydraulic jacks used to elevate and lower the hopper;

Figure 6 is a view taken along the lines 6—6 of Figure 3 showing the general construction of the guide members attached to the inner portion of each truss-like supporting framework, and;

Figure 7 is a schematic diagram disclosing one form of hydraulic system which might be used for operating the hopper, scraper and carriage upon which the apparatus is mounted.

In the preferred embodiment of the invention, the charging machine, which is adapted to travel along a track from one furnace to another, is generally comprised of a movable carriage A; a pair of truss-like supporting frames B and B', a charging hopper and actuating means therefor C; a scraper or ejection ram and actuating means therefor D for facilitating discharge of the contents of the hopper, and control means E for actuating the carriage A, and common power means F employed to operate the carriage A, hopper C and scraper D.

The movable carriage 1 is comprised of a plurality of beam-like frame members 10 arranged laterally and longitudinally with respect to one another and welded or otherwise secured at their ends to form a generally horizontally disposed rectangular base or frame. Axles 11 are mounted at opposite sides of the frame or base and wheels 12 are mounted on the ends of the axles 11 for travel along rails 13, which run in front of a plurality or battery of melting furnaces 14, provided with openings 15.

Guard plates 16 may also be provided at opposite sides of carriage A to reduce operating hazards during movement of the machine along tracks 13.

Mounted upon carriage A is a pair of spaced truss-type supporting frames 17 and 17'. Each of the supporting frames is generally comprised of a pair of spaced upwardly and inwardly inclined vertical members 18 and 18'; a base member 19, and diagonal bracing members 20 and 21. Additional bracing members 22 and 23 may be employed to fix the truss-like frames 17 and 17' to the carriage A.

A superstructure 25 is also advantageously located at one end of the carriage and this superstructure is comprised of a plurality of vertical beams 26 and horizontal beams 27. Mounted on these beams is a cab 28 for the operator, to which access is had by means of steps 29.

A diesel engine 32 for operating the machine and the various parts thereof is also mounted within the superstructure as well as a fluid tank 33, which serves as a reservoir for the hydraulic system employed to operate the machine, and which will be more fully described later.

Suitably affixed to the inner portion of each truss-like supporting framework 17 and 17' adjacent beam 18' is a channel shaped guide member 35, which is more fully shown in cross section in Figure 6. The lower part of each guide member may also be anchored by suitable means to the carriage A.

Each guide member in turn is comprised of a vertically inclined elongated plate 36. Affixed at a transverse angle to this plate 36 is a pair of spaced elongated members 37, which may be provided with a plurality of vertically spaced reinforcing wings 38. By affixing members 37 to plate 36 in this manner, an elongated channel shaped guide member is formed and attached to the inner side of each truss-type supporting framework, and each guide member projects in a vertically inclined path upwardly and outwardly toward one side of the carriage and away from the center line of the carriage.

Slidably mounted within each channel shaped guide 35 and between members 37 is a supporting or bearing block 40. Block 40 is provided with an inner annular recessed portion 41 and a shoulder portion 42, which is adapted to receive an annular member 43, the inner periphery of which has a channel 43' located therein which is adapted to receive a plurality of rollers 45.

These rollers bear against the contact ring 46 affixed to the flanged bearing stub 47 which is located in one end of the hollow shaft 48, to which the lower part of hopper member 50 is rigidly attached. Passages 51, 52, 53 and 54 may be formed in stub 47 for the purposes of lubricating the same during rotation thereof within slidable block 40, which rotational movement will be described more fully later.

Hopper member or trough 50 which contains the scrap metal and the like to be dumped into the melting furnace is thus pivotally mounted between the two opposing guide members 35, these guide members being located on each side of the hopper member.

It will be noted by referring to Figures 2 and 3 that the lower portion of the hopper is also pivotally mounted on each side at a point adjacent the lip portion 51 of the hopper.

At each side of the hopper is provided an elongated pivotal guide member 76 which extends upwardly and outwardly in a direction transverse to that of the cooperating channel shaped guide member 35 and at an acute angle thereto. The lower portion of each pivotal guide member is pivotally attached by suitable means to the lower portion of the hopper at the lower pivot 76' located adjacent to the lip of the hopper. The upper extremity of the guide member is pivotally attached to a short horizontal shaft or upper pivot 79, journaled between a pair of spaced fingers 80 which project outwardly from each of the beams 18 and 21 of the truss-type frames. The primary function of the guide members 76 is to modify the compound action exerted by the hydraulically operated elevating jacks and the channel shaped guide members 35 upon the hopper in order to cause the hopper to be rotated about bearing blocks 40 and pivots 76' simultaneously with the movement upward and toward the furnace caused by the action of the jacks and channel shaped guide members. By this means, the path of movement of the lip 51 of the hopper can be controlled. As shown in Figure 3, the upper extremity of the pivotal guide member 76 is provided with an elongated slot or keyway 78, the function of which will be described hereinafter

in conjunction with the operation of the charging machine.

Means are also provided for elevating the hopper or trough 50 as a unit, and simultaneously therewith rotating the hopper 50 in an overhead arcuate path so that the contents thereof may be emptied into the furnace.

These means include a pair of spaced hydraulically operated elevating jacks 52. As indicated in Figures 2, 3 and 5, each jack is similarly constructed so that a description of one will suffice for both. Each jack is comprised of a hydraulic cylinder barrel 53 rigidly affixed to the diagonal beam 18 of the truss-type supporting framework B, such as, for example, by means of suitable bolts which fit in the openings 55 in the sleeve 56, located about the upper part of the barrel 53 and in similar holes in the diagonal beam 18. The lower part of the barrel rests upon and is suitably anchored to the projecting shoulder 57 which also forms part of the framework B.

A piston 58 is adapted to reciprocate in barrel 53. Attached to the head of the piston is a base plate 59, and a pair of standards 60 and 60' are mounted on plate 59. Suitably journaled between standards 60 and 60' is a sprocket wheel 61, having teeth 62 which engage the various links of the chain 63, one end 63' of which is rigidly affixed to the bottom of the hopper as indicated in Figures 2 and 3. The other end of the chain 63 is rigidly affixed to the bottom extremity of an elongated rod 64 mounted parallel to the piston barrel 53, after the chain has been first placed about the teeth 62 of sprocket wheel 61 attached to piston 58 and a second sprocket wheel 65 journalled to the elongated horizontal shaft 66, which spans the distance between the two truss-type frames B and B', there being one sprocket wheel 65 for each hydraulic jack.

The upper part of rod 64 is rigidly affixed to the base plate 59 attached to the piston rod 58, after the threaded extremity 70 of the rod 64 has first been inserted through the opening 71 in plate 59 and the bolts 72 tightened about the threaded extremity.

The upper part of sleeve 56 is also provided with a guide or slot 73 formed by the spaced shoulders 74 and the rod 64 is adapted to slide in this slot 73.

Upon actuation of the piston rods 58, these rods will move upward along with chain rods 64 at which time because of the connection between rods 64, chains 63 and the hopper 50, the hopper will also be elevated as a unit away from the center line of the carriage. As the hopper is being elevated by means of movement upward of piston rods 58 and chain rods 64, this upward movement is modified by the vertically inclined path defined by the two channel shaped guide members 35 since the blocks 40, to which the lower portion of the hopper is attached, are freely slidable in the guide members 35. This resultant vertically inclined path which the hopper would normally be caused to take, in the absence of other forces, by the compound action of the hydraulically operated jacks 52 and the guide members 35 is simultaneously modified by the action of pivotal guide members 76. The size and position of these pivotal guide members are such, in relation to the compound force exerted by the jacks and the channel shaped guide members, that as the hopper 50 moves upward and inward toward the furnace it is caused to simultaneously rotate or pivot about bearing blocks 40 and pivots 76' in an overhead arcuate path resulting in the

movement of hopper lip 51 through the furnace opening 15 so that the contents of the trough or hopper may be discharged into the furnace 14 until the pistons 58 reach the ends of their strokes and the hopper has been elevated to its fully raised position as indicated in the dotted lines in Figure 2.

After the contents of the hopper has been discharged into the furnace, the piston rods 58 are allowed to recede into the cylinder barrels 52 upon the evacuation of fluid therefrom and the hopper is retracted to its initial position of rest, so that a further charge may be placed therein.

During the time when the hopper 50 is being elevated in order to discharge the contents into the furnace, the pivotal guide members 76 pivot toward the furnace 14 about the upper pivot 79. By means of these guide members and their resultant modification of the compound force exerted by the jacks 52 and channel shaped guide members 35, the path of travel of lip 51 of the hopper is accurately controlled. The size and position of the pivotal guide member relative to this compound force is selected such that the path of travel of the lip of the hopper as it passes through the furnace door or opening is preferably one of substantially straight line movement, the purpose of which will be hereinafter described. It has been determined that there are various combinations of settings for channel shaped members 35, pivotal guide members 76, bearing block or pivot 40, and pivot 76' that will result, upon actuation of hydraulic jacks 52, in the lip 51 of the hopper 50 moving through the furnace opening 15 in substantially a straight line path. Preferably, however, it has been found that the most desirable arrangement or setting for producing a substantially straight line of movement for the lip 51 of the hopper 50 and yet maintaining a stable and compact supporting structure, is to have fixed guide members 35 extending in a vertically inclined direction outwardly toward the furnace 14 with pivotal guide members 76 extending in a vertically inclined direction transverse to fixed guide member 35 at an acute angle thereto with pivot 76' located between bearing blocks 40 and the front extremity of lip 51 of the hopper 50. This arrangement or setting is based upon the hopper 50 being in its initial position of rest. The pivotal guide members 76 also have the additional function of acting as a primary support for the hopper when in its fully raised position.

During the normal operation of elevating the hopper in an inclined direction and simultaneously therewith rotating it, the weight of the hopper causes the pivotal guide member 76 to pivot about the shaft or upper pivot 79 with the top of slot 78 bearing down upon the shaft. Where there is any foreign material on the furnace sill, as the lip 51 of the hopper passes through the furnace door just above the furnace sill, the front extremity of lip 51 will normally push or scrape such foreign material into the furnace proper. In the event, during continued elevation of the hopper, that lip 51 of the hopper is unable to push or scrape foreign material on the furnace sill into the furnace proper, slot 78 will ride up on shaft or upper pivot 79 allowing the hopper to ride over such obstruction. Slot 78, therefore, functions as a safety device which, upon continued raising of the hopper 50, will allow the lip 51 of the hopper to ride over any obstruction on the furnace sill which it cannot push or scrape into the furnace proper thus

subjecting the fire brick of the furnace sill only to the weight of the hopper rather than to the weight of the hopper plus the force of the hydraulic jacks elevating the hopper.

An advantage gained by simultaneously elevating and rotating the hopper as a unit resides in the fact that prior to dumping, the lip portion of the hopper is projected into the furnace and well within the opening or doorway 15 so that the contents of the hopper will be correctly spilled into the furnace.

Another advantage gained by the use of the disclosed charging machine is that since the lip of the hopper passes through the furnace door or opening in substantially a straight line path closely adjacent the furnace sill, the possibility of wedging any foreign material into the fire brick of the sill is substantially eliminated.

In addition, any danger of the lip contacting the bottom of the doorway during the operation of the hydraulic jacks and thereby causing the charging machine to be lifted off of the tracks during the charging of the furnace is also avoided.

The hopper 50 may also be so constructed that it is provided with lateral and longitudinal outer reinforcing ribs 90 and 91. A deflector plate 92 may also be pivotally attached to the bottom of the hopper. The hopper or trough 50 may also be advantageously provided with an arched frame or bridging member 93 fastened to the sides of the hopper adjacent the upper edge of the lip portion 51. This bridging member serves as a guard or bumper to prevent the sides of the trough 50 from banging into the sides or walls of the furnace opening, when the trough is raised to a discharging position.

In order to expedite the flow of scrap material from the hopper into the furnace and to insure a complete emptying of the hopper, means such as an ejector ram or scraper 100 is also provided. This scraper enters the hopper after it has been raised and scrapes the last remnants of charging material from the hopper into the furnace.

Scraper 100 moves downward at the proper time along a pair of guides or ways 101, one guide or way being located in the upper inner portion of each side of the hopper, as indicated in Figures 3 and 4 of the drawing. Scraper 100 is actuated by means of a hydraulic cylinder and piston 102 and 103, located in each guide or way 101 in the following manner, and since the scraper is mounted on the upper inner surface of each side of hopper 50 in the same manner, a description of the manner, in which it is mounted on one side of the hopper, will suffice for both.

By referring to Figures 3 and 4 of the drawings it will be observed that the guide or way 101 on each upper inner side of the hopper or trough is generally comprised of an outer channel 101' having upper and lower tracks 105 and 106 located therein, which are engaged by small channel shaped members 107 and 108, which in turn are located within and connected to the large channel members 109 and 110 attached to bottom and top sides of the hydraulic cylinder 102.

The cylinder 102 is provided on the upper part of its inner face or side 111 with a trunnion like stub 112 formed integrally with the cylinder wall. A cylindrical sleeve 113 fits over the trunnion like stub 112 and the hub portion 114 of a sprocket wheel 114' fits over sleeve 113. The rim portion 115 of the wheel 114' is attached to the hub portion by means of a plurality of bolts 116.

The rim portion 115 has teeth 117, which are adapted to mesh with the teeth 118 of an elongated rack 120 affixed to the upper inner portion of each side of the hopper.

The wheel 114' may be attached to the carrier arms 125 and 134 of the scraper member 100 by any suitable means. In the preferred embodiment of the invention, carrier arms 125 and 134 may be made integral with hub 114 and a nut and bolt 127 and 128 is advantageously employed to attach the rim 115 to the hub 114 and also to the carrier arm 125. The upper parts of each carrier arm 125 and 134 are provided with suitable eyes 130 and 126', through which a suitable pivot shaft 132 may be inserted. The upper apertured part 131 of a pivot arm 126 is also keyed to shaft 132, and one side edge of a suitable scraper plate 135 is affixed to arm 126.

A suitable reinforcing and bridging member 136 may be employed to join the carrier arms 125 located in each side of the trough 50 together. Various other bridging and reinforcing members 137 and 139 may also be used.

It will also be observed by referring to Figure 3 that the upper part of each piston rod 103 is rigidly affixed to a side of the hopper 50 by means of suitable bolts and nuts 140 and 141.

The operation of the scraper as indicated in dotted lines in Figure 2 is as follows.

When the hopper 50 has been elevated and moved in an arcuate overhead path, fluid is injected into the cylinders 102 on each side of the trough through suitable conduits 213 thereby displacing the piston 103 in each cylinder 102. Since the piston is held rigidly to the frame as previously described the cylinder 102 will then move downward along tracks 105 and 106 in guides or ways 101'. As the cylinder moves downward, sprocket wheel 114' will in turn rotate because of its engagement with rack 120 and thereby cause the simultaneous rotation of carrier arms 125 and 134 which then in turn causes the pivotal movement of scraper 100, downward, so that scraper plate 135 will contact the charging material in the hopper and force or ram the same into the furnace through opening 15.

The scraper will move downward until the piston 103 reaches the end of its stroke. In addition, since the scraper plate is pivoted to shaft 132 by means of arms 126, this feature not only allows the scraper plate 135 to freely move outwardly during its downward movement until it contacts the hopper bottom so that all the charge will be contacted by the scraper plate 135, but in addition, when the piston 103 reaches the end of its stroke, the scraper is also permitted to pivot freely and enter the furnace opening so that a complete emptying of the hopper will be insured.

After the charge has been supplied to the furnace the hopper is lowered and piston and cylinder 103 and 102 actuated to raise the scraper along guides or ways 101' to its position of rest.

In certain instances where a relatively large charge of scrap metal and the like is to be placed in the hopper in its initial position of rest, it has been found advantageous to utilize scraper 100 to move the first portion of the charge to the front of the hopper in order to facilitate adding the remainder of the charge to the hopper and thus maintain proper distribution of the charge in the hopper. Due to the fact that scraper plate 135 would normally be free to move outwardly during its downward movement, it would be difficult to insure proper passage of the scraper plate into the charging end of the hopper when the

hopper is in its initial position of rest. To enable the use of the scraper when the hopper is in such position, the pivot arms 126 can be each provided with an outwardly projecting roller 119 and a suitable elongated guide bar 121 with bevelled ends can be attached to each inner side of the hopper directly below the rim portion 115 of the sprocket wheel 114' and in spaced angular relationship to rack 120. When the scraper 100 moves downward, with the hopper in its initial position of rest, the rollers 119 will contact the upper edges of guide bars 121 and ride down the length of these bars thus causing the scraper plate 135 to properly enter the hopper. The length of the guide bars 121 is such that as soon as the scraper blade has entered the end of the hopper, the rollers 119 move past the inner end of the guide bars thus again allowing free pivotal movement of the scraper plate.

It will be observed that the pivotal axis of the hopper is located on the side of the carriage, which is closest to the furnace. This permits operation of the hopper in a minimum amount of space, since the material to be charged to the furnace is picked up by the hopper on one side of the machine and is discharged into the furnace on the other side thereof by having the hopper move across the carriage.

Furthermore, by making the charging unit mobile it can be used to charge a plurality of furnaces. The preferred embodiment of the invention contemplates, therefore, that the charging machine be mobile and that it be mounted on a movable carriage, which will operate on rails laid on the floor adjacent each furnace charging door. It is to be understood, however, that it is within the contemplation of the invention that the machine can be mounted on the floor in a stationary manner.

The unit described above is mounted on a movable carriage 1, the wheels of which are driven by fluid motors 160 operatively connected to the hydraulic pump 161 driven by the diesel engine 32 as indicated in Figure 2.

Although power need be supplied to only one one set of wheels driven by a single motor 160, an advantageous embodiment of the invention contemplates that there be a fluid motor for each set of wheels. Since the fluid motor for each set is similarly constructed and drives each set of wheels in a similar manner, a description of the operation of one will suffice for both.

The fluid motor 160 is mounted in the lower part of the carriage above axle 11 to which the wheels 12 are attached. Fluid motor 160 operates to drive a shaft 163, which is operatively connected to a second shaft 164 by means of the flexible coupling 165. Shaft 164 in turn is connected to a suitable reduction gear mounted in housing 165' which latter gear (not shown) drives shaft 166 on which is mounted the spur gear pinion 167. Spur gear pinion 167 meshes with spur gear 168 mounted on axle 11 thereby causing rotation of the axle and the wheels 12 attached thereto. Axle 11 is journalled in suitable bearing members located in the bearing boxes 170 attached to the underside of the carriage.

In the preferred embodiment of the invention it is also contemplated that the diesel engine 32 serve as the common power plant for operating the hydraulic jacks 52 for raising the hopper and the hydraulic cylinders 102 for operating the scraper or ejection ram 100 as well as the fluid motors 160 which drive the wheels upon which the carriage is mounted. However, separate power means could be employed for individually operating the hydraulic jacks, scraper and fluid motors without departing from the spirit of the invention.

Accordingly, Figure 7 is a schematic diagram showing one form of piping arrangement that can be used for operatively connecting the hydraulic jacks 52, scraper 100 and fluid motors 160 to the diesel engine 32.

As shown in Figure 7 the hydraulic pump 161, which is a double pump with a common inlet and a double outlet, is driven by the engine 32 and is adapted to pump fluid from tank 33 through line 235 until it enters the suction side of the pump. Then depending on what part of the apparatus is desirable to operate, fluid can then be passed to the fluid motors 160, or hydraulic jacks 52 or cylinders 102 for the scraper 100.

Thus in the event it is desirable to drive the wheels by actuating the fluid motors 160, fluid is forced out of the pump at the two exhaust ports 201 and 202 thereof and into lines 203 and 204.

Line 203 is connected to the inlet port P of a four way hand or solenoid operated valve 205. A line 206 leads from port T of valve 205 to port P of another hand or solenoid operated four way valve 211. A line 208 leads from port A of valve 205 to the two hydraulic jacks 52 for raising the hopper 50, and line 209 leads from port Y of valve 205, to line 210 which line also is connected to line 206.

Port B of valve 211 is plugged. Exhaust port T of valve 211 is connected to line 212 which leads back to the tank 33. Port A of valve 211 is connected to line 213, which is connected to one end of the hydraulic cylinders 102 employed to operate scraper 100. The other ends of the cylinders 102 are connected to line 206 by means of line 214.

The other exhaust port 202 of the pump 161 is connected to line 204 which leads to entrance port P of a four way hand or solenoid operated valve 218. Main exhaust port T of valve 218 is connected to line 203 by means of line 219. Port X of valve 218 is connected to one side of the fluid motors 160 by means of lines 220, 221 and 222. Port Z of valve 218 is connected to the other side of fluid motors 160 by means of lines 223, 224 and 225. Auxiliary lines 226, 227, 228, 229 and 230 are also provided, the functions of which will be more fully described later.

The operation of this hydraulic circuit will now be described. When it is desirable to move the machine in one direction along the tracks, fluid is pumped from line 235, which connects tank 33 to pump 161, into the suction side of the pump after which it passes out of ports 202 and 201 of the pump into lines 203 and 204.

At this time also valves 205 and 211 are set to a neutral position, ports T and P of both valves being connected so that fluid is passed through lines 203 and 206 through valves 205 and 211 to line 212 and then back to the tank.

In the meantime, the fluid from port 202 passes through line 204 to port P of valve 218. This valve is now set so that port P is connected to port X and port Z is connected to port T. Fluid thus passes from line 204 to line 220 and into lines 221 and 222 to one side of the fluid motors thereby causing the machine to move in one direction. In the meantime also fluid is allowed to pass out of the other side of the fluid motors through lines 224 and 225 to line 223 through

valve 218 by means of ports Z and T and line 219 to line 203 and from there back to the tank.

When it is desirable to shut off power to the fluid motors so that the machine may coast while moving in the same direction, valve 218 is set to a neutral position so that port P is connected directly to port T.

Accordingly, while fluid from port 202 and line 204 passes through valve 218 and line 219 to line 203 and back to the tank, fluid from lines 224 and 225 is simultaneously fed into lines 229 and 230 and finally back to line 204. At the same time, fluid will be transmitted to the fluid motors 160 from port 201 of pump 161 and line 203 through valve 205 to line 206 and from line 206 through lines 216 and 227 and then through a check valve into lines 221 and 222, thus supplying fluid to the fluid motors circulating at no pressure and allowing them to idle.

When it is desirable to move the machine in the opposite direction, valves 205 and 211 are still maintained in their neutral position so that fluid from port 201 and line 203 is sent directly to the tank. Valve 218, however, is operated so that port P is connected to port Z and port T to port X. Fluid is then transmitted from port 202 of pump 161 and line 204 through valve 218 to line 223, and from line 223 through lines 224 and 225 to the other sides of the fluid motors, thereby causing the machine to be moved in the opposite direction.

Fluid is contemporaneously passed from the opposite sides of the fluid motors through lines 221 and 222 to line 220 to port X of valve 218 and out of valve 218 at port T to lines 219 and 203 and then to the tank in a manner previously described.

In order to allow the machine again to coast along the tracks while moving in the same direction, the auxiliary system of lines 227 to 230 is again brought into play by operation of suitable valves so that when valve 218 is again set to the neutral position, whereby ports P and T of valve 218 are connected, fluid from lines 221 and 222 which lead from the fluid motors will pass through 220, 228, 230, 204, valve 218, lines 219 and 203 back to the tank. At the same time, fluid will be transmitted to fluid motors 160 from port 201 of pump 161 and line 203 through valve 205 to line 206 and from line 206 through lines 210 and 226 and then through a check valve into lines 224 and 225, thus supplying fluid to the fluid motors circulating at no pressure and allowing them to idle.

In line 219 there is provided a check valve so that if valve 205 or valve 211 should be closed while valve 218 is open, the discharge from both ports 201 and 202 could not be applied to the fluid motors 160 and thereby giving the motors excessive speed.

When it is desirable to actuate the hopper 50 and scraper 100, as the machine is halted before a furnace, valve 218 is set to its neutral position so that fluid from port 202 of pump 161 will flow through valve 218 from port P to port T and through line 219 to line 203. Valve 205 in the meantime is set so that port P of this valve is connected to port A and port Y is connected to port T. Fluid discharged from both ports 201 and 202 of pump 161 then passes from lines 203 and 204 to line 208 and into the bottom of hydraulic cylinders 53 thereby causing simultaneous actuation of the hydraulic jacks 52 to moving the pistons 58 in cylinders 53 upward, for an equal distance, in such a manner that the hopper will be simultaneously elevated and rotated.

When the hopper has been elevated and rotated properly and it is desirable to send the scraper 100 through the hopper so as to scrape the contents of the hopper into the furnace, valve 205 is returned to its neutral position so that fluid flows through valve 205 from port P to port T. Since the flow of fluid in line 208 is blocked, the hopper will remain raised. Fluid discharged from both ports 201 and 202 of pump 161 is then transmitted to valve 211, which is then set so that port P of valve 211 is connected to port A thereof and port B which is plugged is connected to port T. Fluid thus is passed through line 213 to one end of the cylinders 102 so as to cause the displacement of pistons 103 in cylinders 102, so that the scraper will move downward in the manner previously described. In the meantime fluid is evacuated from the rod end of cylinders 102 through line 214, which leads back into line 206.

After completing the charging of the furnace and when it is desirable to lower the hopper and move the scraper back to its initial position of rest, valve 211 is then set to its neutral position so that port P is connected to port T and ports B and A are blocked. Valve 205 is actuated so that port A is connected to port T and port P is connected to port Y. Thus, as the hydraulic jacks recede under the weight of the hopper, fluid is evacuated from the cylinders 53 of the jacks back through line 208 to port A of valve 205 and out through port T thereof and line 206 to port P of valve 211 and out through port T thereof to line 212 and back to the tank. At the same time that the jacks are receding, the fluid passing out of ports 201 and 202 of pump 161 passes into port P of valve 205 and out through port Y thereof and then through lines 209 and 206 and through valve 211 back to the tank, the pump 161 being at no load under these conditions where the fluid is by-passed back to the tank. After the hopper has been lowered, valve 211 is actuated so that port A is connected to port T and port P is connected to port B. Since port B is plugged, port P is thereby blocked causing pressure to develop in line 206. This pressure build-up in line 206 causes pressure on line 214 which is connected to the rod end of cylinders 102. This pressure in line 214 causes pistons 103 to move back to their initial position and the fluid in the head end of the cylinders is transmitted by line 213 to valve 211, whence it passes through the valve from port A to port T into line 212 and back to the tank. As soon as the scraper has been returned to its initial position of rest, valves 205 and 211 are returned to their neutral position so that the pump 161 will by-pass fluid back to the tank under no load, thus completing the cycle.

The machine is now ready to be moved to a loading station so that the hopper may again be filled with charging material.

An advantageous embodiment of the invention has been herein shown and described. It is obvious that various changes may be made therein without departing from the spirit and scope thereof as defined by the appended claims.

What is claimed is:

1. In a furnace charging device of the character described for supplying a charge to a melting furnace, the combination of a carriage, a pair of spaced truss-like supporting frames mounted upon the said carriage, an elongated channel shaped guide member affixed to the inner portion

of each of said supporting frames, each of said guide members projecting in a vertically inclined path upwardly and outwardly toward one side of the said carriage, and away from the vertical center line thereof, bearing blocks slidably mounted in said guide members, a hopper member, said hopper member having the lower portion thereof freely and pivotally mounted in the said bearing blocks, an elongated pivotal guide member pivotally attached at its upper end to each of said supporting frames with the lower end of each of said guide members being pivotally connected to opposite sides of said hopper at a point closer to the discharge end of said hopper than said bearing blocks, each of said pivotal guide members projecting upwardly and outwardly in a direction transverse to that of said channel shaped guide members and at an acute angle thereto and common hydraulic jack means for moving said hopper as a whole upwardly and outwardly for a predetermined distance along an upwardly and outwardly inclined path as defined by the said channel shaped guide members and simultaneously therewith, by the action of said pivotal guide members, rotating the said hopper in an overhead arcuate path toward the melting furnace, whereby the contents of the said hopper may be discharged into the melting furnace.

2. An apparatus of the type defined in claim 1 wherein the carriage is movable.

3. In a furnace charging device of the character described for supplying a charge to a melting furnace, the combination of a carriage, a pair of spaced truss-like supporting frames mounted upon the said carriage, an elongated channel shaped guide member affixed to the inner portion of each of said supporting frames, each of said guide members projecting in a vertically inclined path upwardly and outwardly toward one side of the said carriage and away from the center line thereof, bearing blocks slidably mounted in said guide members, a hopper member, the lower portion of the said hopper member being freely and pivotally mounted in the said bearing blocks, an elongated pivotal guide member pivotally attached at its upper end to each of said supporting frames with the lower end of each of said guide members being pivotally connected to opposite sides of said hopper at a point closer to the discharge end of said hopper than said bearing blocks, each of said pivotal guide members projecting upwardly and outwardly in a direction transverse to that of said channel shaped guide members and at an acute angle thereto, common hydraulic jack means for moving said hopper as a whole upwardly and outwardly for a predetermined distance along an upwardly and outwardly inclined path as defined by the said channel shaped guide members and simultaneously therewith, by the action of said pivotal guide members, to rotate said hopper in an overhead arcuate path toward an opening in the melting furnace so as to cause said hopper to discharge the contents thereof into the furnace and means including a movable ejection ram for scraping the contents of the hopper into said melting furnace.

4. An apparatus of the type defined in claim 3 wherein the carriage is movable.

5. In a furnace charging device of the character described for supplying a charge to a melting furnace, the combination of a carriage, a pair of spaced truss-like supporting frames mounted upon the said carriage, an elongated channel shaped guide member affixed to the inner

portion of each of said supporting frames, each of said guide members projecting in a vertically inclined path upwardly and outwardly toward one side of the said carriage and away from the center line thereof, bearing blocks slidably mounted in said guide members, a hopper member, the lower portion of said hopper member being pivotally mounted in the said bearing blocks, an elongated pivotal guide member cooperating with each of said channel guide members, said elongated pivotal guide member being pivotally attached at its upper end of each of said supporting frames with the lower end of each of said guide members being pivotally connected to opposite sides of said hopper at a point closer to the discharge end of said hopper than said bearing blocks, each of said pivotal guide members projecting upwardly and outwardly in a direction transverse to that of said channel shaped guide members and at an acute angle thereto, and common hydraulic jack means for moving said hopper as a whole upwardly and outwardly for a predetermined distance along an upwardly and outwardly inclined path as defined by the said channel shaped guide members, and simultaneously therewith, by the action of said pivotal guide members, rotating said hopper in an overhead arcuate path toward said furnace whereby the front portion of said hopper will move in substantially a straight line path through the furnace door in order that the contents of said hopper may be discharged into the melting furnace.

6. An apparatus of the type defined in claim 5 wherein the carriage is movable.

7. In a furnace charging device of the character described for supplying a charge to a melting furnace, the combination of a movable carriage, a pair of spaced truss-like supporting frames mounted upon the said carriage, an elongated channel shaped guide member affixed to the inner portion of each of said supporting frames, each of said guide members projecting in a vertically inclined path upwardly and outwardly toward one side of the said carriage and away from the center line thereof, bearing blocks slidably mounted in said guide members, a hopper, the lower portion of said hopper being pivotally mounted in the blocks in said guide members, an elongated pivotal guide member pivotally attached at its upper end to each of said supporting frames with the lower end of each of said guide members being pivotally connected to opposite sides of said hopper at a point closer to the discharge end of said hopper than said bearing blocks, each of said pivotal guide members projecting upwardly and outwardly in a direction transverse to that of said channel shaped guide members and at an acute angle thereto, common hydraulic means for moving said hopper as a whole upwardly and outwardly for a predetermined distance, along an upwardly and outwardly inclined path as defined by the said channel shaped guide members, and simultaneously therewith, by the action of said pivotal guide members, rotating said hopper in an overhead arcuate path toward said furnace, so as to cause the front portion of said hopper to move through the furnace door in substantially a straight line path closely adjacent the furnace door sill to push any foreign material on the furnace sill into the furnace proper and to discharge the contents of said hopper into the furnace and means including a movable ejection

ram for scraping the contents of the hopper into said melting furnace.

8. In a furnace charging machine comprised of a movable carriage, a hopper pivotally mounted upon the carriage and hydraulic jack means for moving said hopper in an overhead arcuate path whereby the contents of said hopper may be discharged into the said furnace, the improvement comprising fixed linearly straight guide members for the said hopper and pivotal guide members cooperating therewith, said linearly straight guide members projecting in a vertically inclined path upwardly and outwardly toward one side of said carriage and away from the center line thereof, and said pivotal guide members projecting in a vertically inclined path upwardly and outwardly in a direction transverse to said linearly straight guide members whereby upon the actuation of said hydraulic jack means said hopper as a whole will be moved upwardly and outwardly along an inclined linearly straight path as defined by the said fixed linearly straight guide members and simultaneously therewith, by the action of said pivotal guide members, said hopper will be rotated in an overhead arcuate path toward the furnace so that the contents thereof may be discharged into the said furnace and wherein the front portion of said hopper is adapted to pass through a furnace opening in substantially a straight line path and closely adjacent to the furnace sill.

9. In a furnace charging machine of the character described for supplying a charge to a melting furnace, the combination of a movable carriage, a pair of spaced truss-like supporting frames mounted upon the said carriage, an elongated channel shaped guide member affixed to the inner portion of each of said supporting frames, each of said guide members projecting in a vertically inclined path upwardly and outwardly toward one side of said carriage and away from the center line thereof, bearing blocks slidably mounted in said guide members, a hopper, the lower portion of said hopper being pivotally mounted in the said bearing blocks, an elongated pivotal guide member cooperating with each of said channel guide members, said elongated pivotal guide member being pivotally attached at its upper end to each of said supporting frames with the lower end of each of said guide members being pivotally connected to opposite sides of said hopper at a point closer to the discharge end of said hopper than said bearing blocks, each of said pivotal guide members projecting upwardly and outwardly in a direction transverse to that of said channel shaped guide members and at an acute angle thereto, common hydraulic means for moving said hopper as a unit upwardly and outwardly for a predetermined distance along an upwardly and outwardly inclined path as defined by the said channel shaped guide members and simultaneously therewith, by the action of said pivotal guide members, rotating said hopper in an overhead arcuate path toward said furnace so as to cause the said hopper to discharge the contents thereof into the furnace, means including a movable ejection ram for scraping the contents of the hopper into the said melting furnace, and common power means for operating said hydraulic jack means and said movable movable ejection ram.

10. In a furnace charging machine of the type described, the combination of a movable carriage, a pair of spaced truss-like supporting frames mounted upon the said carriage, an elongated channel shaped guide member affixed to the inner portion of each of said supporting frames, each of said guide members projecting in a vertically inclined path upwardly and outwardly toward one side of the said carriage and away from the center line thereof, bearing blocks slidably mounted in each of said guide members, a hopper, the lower portion of said hopper member being pivotally mounted in the said bearing blocks, an elongated pivotal guide member pivotally attached at its upper end to each of said supporting frames with the lower end of each of said guide members being pivotally connected to opposite sides of said hopper at a point closer to the discharge end of said hopper than said bearing blocks, each of said pivotal guide members projecting upwardly and outwardly in a direction transverse to that of said channel shaped guide members and at an acute angle thereto, common hydraulic jack means for moving said hopper as a unit upwardly and outwardly for a predetermined distance along an upwardly and outwardly inclined path as defined by the said channel shaped guide members and simultaneously therewith by the action of said pivotal guide members rotating said hopper in an overhead arcuate path toward the furnace, so as to cause the said hopper to discharge the contents thereof into the furnace, means including a movable ejector ram for scraping the contents of the hopper into the said furnace, and common power means for operating said hydraulic jack means and said ejector ram.

11. An apparatus of the type defined in claim 10 wherein the upper end of each of said elongated pivotal guide members is provided with a slot, the top of which bears down upon the pivot, said slot adapted to allow said pivotal guide member to ride upwardly on said pivot in the event that the normal path of movement of said hopper is altered by an obstruction on the furnace sill.

12. In a furnace charging device of the character described for supplying a charge to a melting furnace, the combination of a movable carriage, a pair of spaced truss-like supporting frames mounted upon the said carriage, an elongated channel shaped guide member affixed to the inner portion of each of said frames, each of said guide members projecting in a vertically inclined path upwardly and outwardly toward one side of said carriage and away from the center line thereof, bearing blocks slidably mounted in each of said guide members, a hopper, the lower portion of said hopper being pivotally mounted in said bearing blocks, an elongated pivotal guide member cooperating with each of said channel guide members, said elongated pivotal guide member being pivotally attached at its upper end to each of said supporting frames with the lower end of each of said guide members being pivotally connected to opposite sides of said hopper at a point closer to the discharge end of said hopper than said bearing blocks, each of said pivotal guide members projecting upwardly and outwardly in a direction transverse to that of said channel shaped guide members and at an acute angle thereto, a plurality of oppositely disposed hydraulic jacks, chain and sprocket means for connecting said jacks to said hopper whereby upon actuation of said hydraulic jacks said hopper may be moved upwardly and outwardly along an upwardly and outwardly inclined path defined by the said channel shaped

guide members and simultaneously therewith, by the action of said pivotal guide members, be rotated in an overhead arcuate path toward said furnace so as to cause the said hopper to discharge the contents thereof into the furnace and wherein the front extremity of said hopper moves through the furnace opening in substantially a straight line path closely adjacent the furnace sill.

13. A furnace charging device of the type defined in claim 12, including means for scraping the contents of the hopper into the furnace, said means including a guideway for each upper, inner side of the said hopper, a scraper member, means for pivotally and slidably mounting said scraper member in said guideways whereby upon rotation of said hopper in an overhead arcuate path said scraper will be moved down into said hopper so as to eject the contents thereof into the said furnace.

14. In a furnace charging device of the character described for supplying a charge to a melting furnace, the combination of a movable carriage, a pair of spaced truss-like supporting frames mounted upon the said carriage, an elongated channel shaped guide member affixed to the inner, upper portion of each of said frames, each of said guide members projecting in a vertically inclined path upwardly and outwardly toward one side of the said carriage and away from the center line thereof, a bearing block slidably mounted in each of said guide members, a hopper, the lower portion of said hopper being pivotally mounted in the said bearing blocks, an elongated pivotal guide member cooperating with each of said channel guide members, said elongated pivotal guide member being pivotally attached at its upper end to each of said supporting frames with the lower end of each of said guide members being pivotally connected to opposite sides of said hopper at a point closer to the discharge end of said hopper than said bearing blocks, each of said pivotal guide members projecting upwardly and outwardly in a direction transverse to that of said channel shaped guide members and at an acute angle thereto, hydraulic means for moving said hopper as a unit upwardly and outwardly for a predetermined distance along an upwardly and outwardly inclined path as defined by the said channel shaped guide members and simultaneously therewith, by the action of said pivotal guide members, rotating said hopper in an overhead arcuate path toward the said furnace wherein the front extremity of said hopper moves through the furnace in substantially a straight line path closely adjacent the furnace sill, and means for scraping the contents of the hopper into the furnace, said means including a guideway for each upper, inner side of the said hopper, a scraper member, means for pivotally and slidably mounting said scraper in said guideways whereby upon rotation of the said hopper in an overhead arcuate path said scraper will be moved down into the said hopper so as to eject the contents thereof into the furnace.

15. An apparatus of the type defined in claim 14 wherein the upper end of each of said elongated pivotal guide members is provided with a longitudinally extending slot, the top of which bears down upon the pivot, said slot adapted, upon continued raising of said hopper, to allow said pivotal guide members to ride upwardly on said pivot in the event that an obstruction alters the normal path of travel of the front extremity of said hopper while moving into the furnace.

16. In a furnace charging device of the character described for supplying a charge to a melting furnace, the combination of a carriage, a pair of spaced truss-like supporting frames mounted upon the said carriage, an elongated channel shaped guide member affixed to the inner portion of each of said supporting frames, each of said guide members projecting in a vertically inclined path upwardly and outwardly toward one side of the said carriage, and away from the vertical center line thereof, bearing blocks slidably mounted in said guide members, a hopper member, said hopper member having the lower portion thereof freely and pivotally mounted in the said bearing block, an elongated pivotal guide member pivotally attached at its upper end to each of said supporting frames with the lower end of each of said guide members being pivotally connected to opposite sides of said hopper at a point closer to the discharge end of said hopper than said bearing blocks, each of said pivotal guide members projecting upwardly and outwardly in a direction transverse to that of said channel shaped guide members and at an acute angle thereto, and common hydraulic jack means for moving said hopper as a whole upwardly and outwardly for a predetermined distance along an upwardly and outwardly inclined path as defined by the said channel shaped guide members and simultaneously therewith, by the action of said pivotal guide members, rotating the said hopper in an overhead arcuate path toward the melting furnace, whereby the contents of the said hopper may be discharged into the melting furnace and wherein the path of movement of the front extremity of said hopper through the furnace opening is substantially a straight line, and common power means for operating said hydraulic jack means and for moving said carriage.

17. In a furnace charging device of the character described for supplying a charge to a melting furnace, the combination of a carriage, a pair of spaced truss-like supporting frames mounted upon the said carriage, an elongated channel shaped guide member affixed to the inner portion of each of said supporting frames, each of said guide members projecting in a vertically inclined path upwardly and outwardly toward one side of the said carriage and away from the center line thereof, bearing blocks slidably mounted in said guide members, a hopper member, the lower portion of said hopper member being pivotally mounted in the said bearing blocks, an elongated pivotal guide member cooperating with each of said channel guide members, said elongated pivotal guide member being pivotally attached at its upper end to each of said supporting frames with the lower end of each of said guide members being pivotally connected to opposite sides of said hopper at a point closer to the discharge end of said hopper than said bearing blocks, each of said pivotal guide members projecting upwardly and outwardly in a direction transverse to that of said channel shaped guide members and at an acute angle thereto, and common hydraulic jack means for moving said hopper as a whole upwardly and outwardly for a predetermined distance along an upwardly and outwardly inclined path as defined by the said channel shaped guide members and simultaneously therewith, by the action of said pivotal guide members, for rotating said hopper

in an overhead arcuate path toward said furnace, whereby the contents of said hopper may be discharged into the melting furnace and wherein the path of travel of the front extremity of said hopper through the furnace opening is substantially a straight line movement closely adjacent the furnace sill, and common power means for operating said hydraulic jack means, said ejection ram and for moving said carriage.

18. In a furnace charging machine comprised of a movable carriage, a hopper pivotally mounted upon the carriage and hydraulic jack means for moving said hopper in an overhead arcuate path whereby the contents of said hopper may be discharged into the said furnace, the improvement comprising an upwardly projecting guide member affixed to each side of said carrige and an upwardly projecting pivotal guide member cooperating with each of said first mentioned guide members whereby upon the actuation of said hydraulic jack means said hopper as a whole will be moved upwardly along a path as defined by the said fixed guide members and simultaneously therewith, by the action of said pivotal guide members, said hopper will be rotated in an overhead arcuate path toward the furnace so that the contents thereof may be discharged into the said furnace and wherein the discharge end of said hopper is adapted to pass through the furnace opening in substantially a straght line path and closely adjacent to the furnace sill.

19. The combination defined in claim 18 including means for scraping the contents of the hopper into the furnace upon the rotation and raising of the hopper.

20. In a furnace charging machine comprised of a movable carriage, a hopper pivotally mounted upon the carriage and hydraulic jack means for moving said hopper in an overhead arcuate path whereby the contents of said hopper may be discharged into said furnace, the improvement comprising fixed linearly straight guide members for said hopper and pivotal guide members cooperating therewith, said linearly straight guide members projecting in a vertically inclined path upwardly and outwardly toward one side of the carriage and away from the center line thereof and said pivotal guide members projecting in a vertically inclined path upwardly and outwardly in a direction transverse to said linearly straight guide members whereby upon the actuation of said hydraulic jack means said hopper as a whole will be moved upwardly and outwardly along an inclined linearly straight path as defined by the said fixed linearly straight guide members and simultaneously therewith by the action of said pivotal guide members said hopper will be rotated in an overhead arcuate path toward the furnace so that the contents thereof may be discharged into the furnace, and means including a movable ejection ram for scraping the contents of the hopper into said furnace upon the rotation and raising of said hopper.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,478,055	Redington	Aug. 2, 1949
2,576,974	Smith et al.	Dec. 4, 1951