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3,279,628

FURNACE CHARGER

Filed Dec. 15, 1964

3 Sheets-Sheet 1

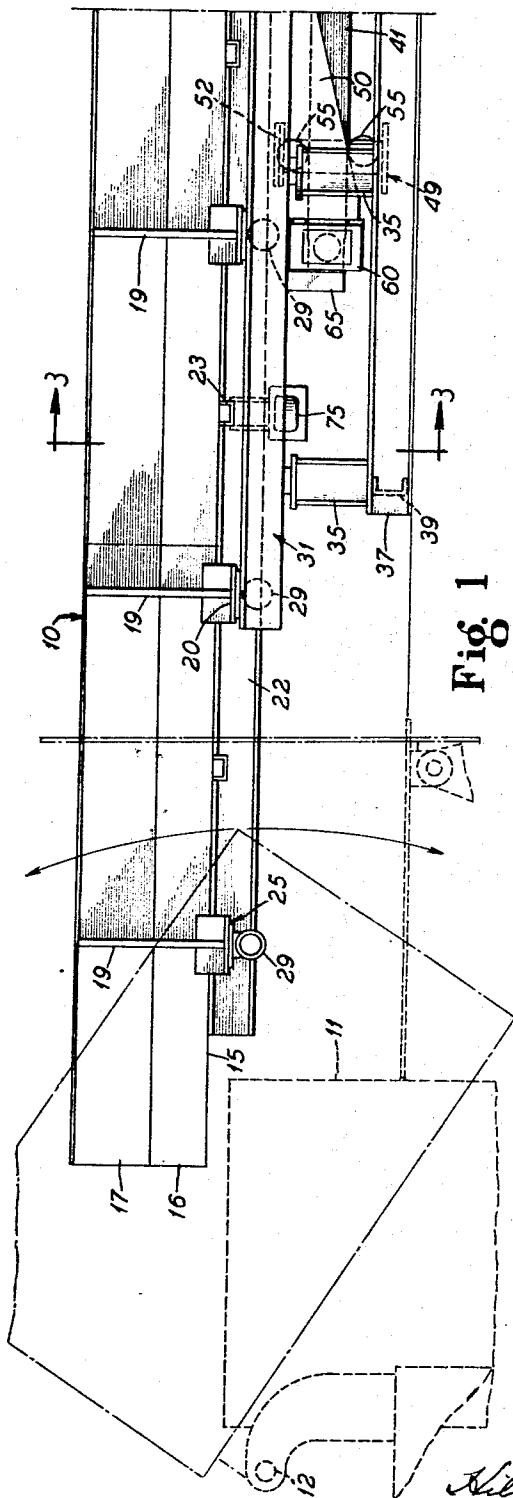


Fig. 1

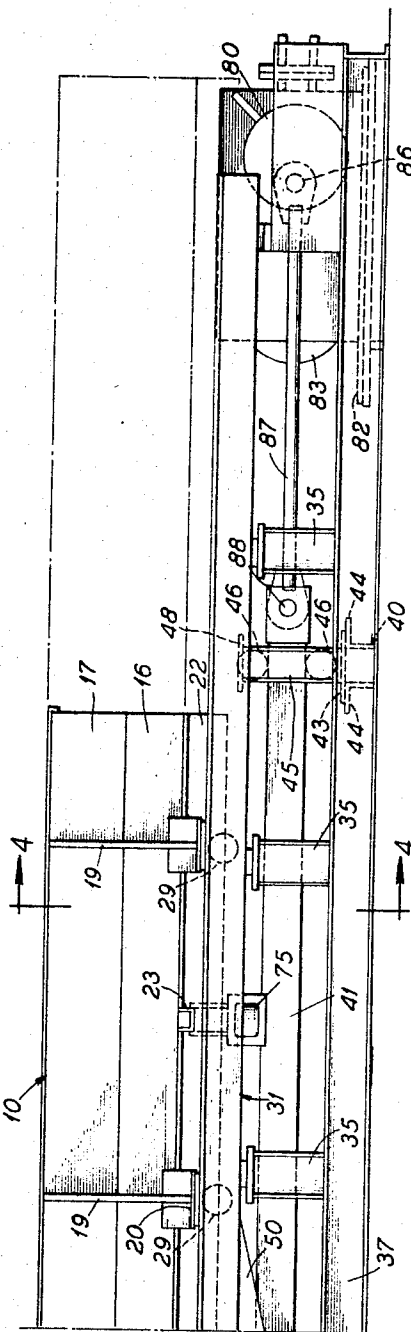


Fig. 2

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3 Sheets-Sheet 2

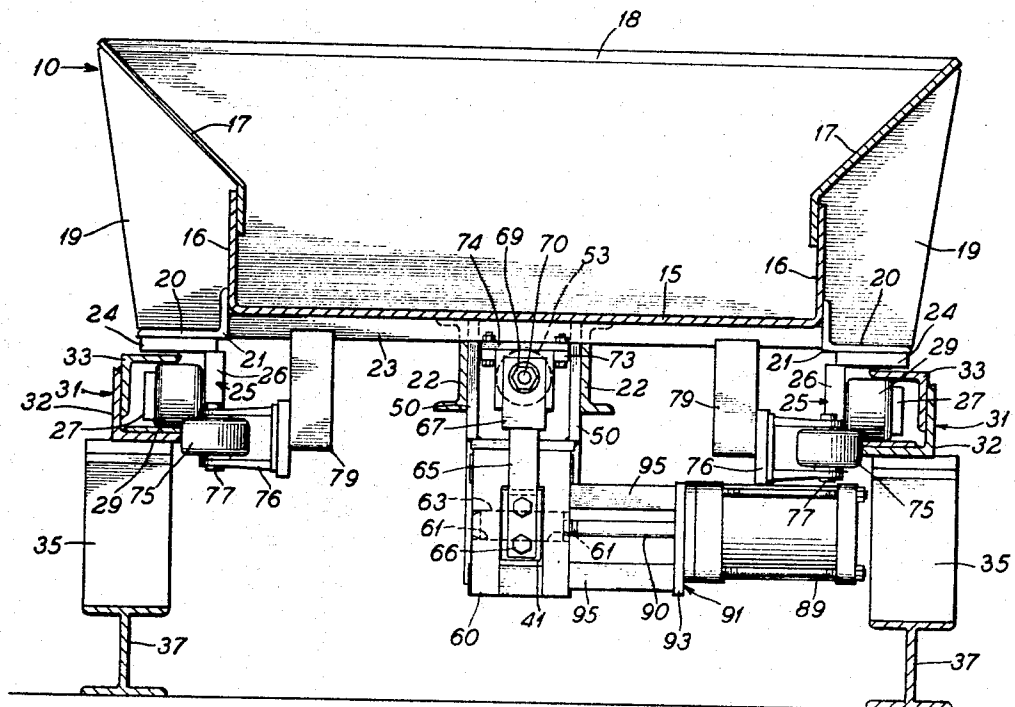


Fig. 3

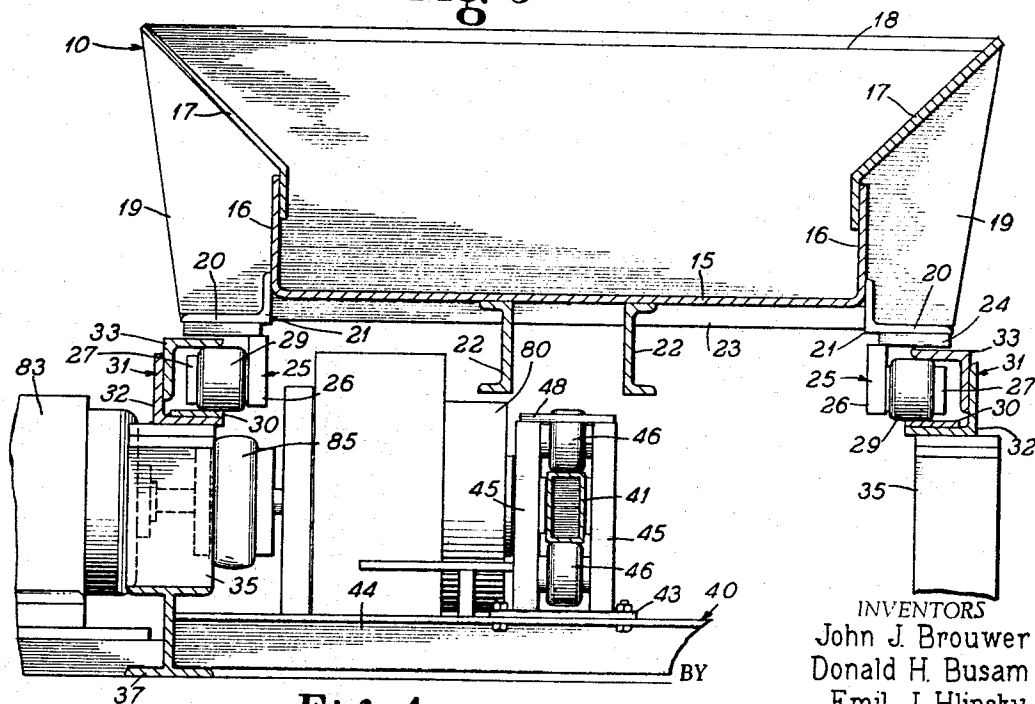


Fig. 4

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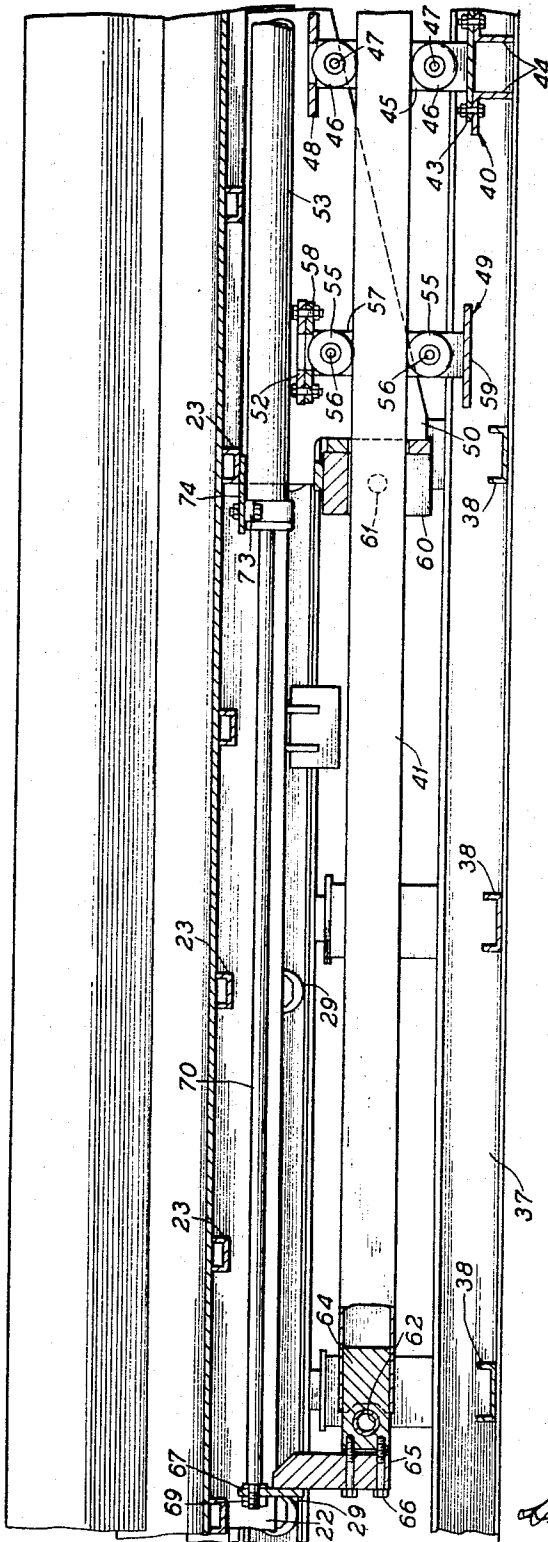


Fig. 5

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3,279,628

FURNACE CHARGER

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11 Claims. (Cl. 214—26)

This invention relates to improvements in furnace chargers and more particularly relates to an improved form of furnace charger for charging electric melting furnaces and the like.

A principal object of the present invention is to provide a novel and improved form of apparatus for charging melting furnaces, arranged with a view toward minimum manual effort in loading the furnace and utmost simplicity and efficiency in construction and operation.

Another object of the invention is to provide a novel shaker loader for charging electric furnaces and the like in which a shaker trough is used for storage of the charge such as scrap and the like, and provides a uniform feed of the charge to the furnace upon reciprocable operation thereof.

A still further object of the invention is to provide a shaker conveyor loading apparatus for charging electric melting furnaces in which the loading apparatus is retractible to receive a charge of scrap and the like and is extensible into a charging position over the receiving end of the furnace, and is reciprocally driven when in its extended position to deliver its load into the furnace at a uniform rate.

Still another object of the invention is to provide an extensibly and retractibly movable shaker conveyor trough extensible into charging relation with respect to a melting furnace in which the trough is reciprocally driven with a shaker conveying action when in its extended position, and in which the shaker conveyor drive and extensible and retractible movement thereof is controlled from a position remote from the furnace.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

FIGURE 1 is a view in side elevation of the delivery end portion of a furnace charging apparatus constructed in accordance with the principles of the present invention, showing the apparatus in charge delivery relation with respect to an electric melting furnace;

FIGURE 2 is a rear continuation of the apparatus shown in FIGURE 1;

FIGURE 3 is a fragmentary transverse sectional view taken substantially along line 3—3 of FIGURE 1;

FIGURE 4 is a fragmentary transverse sectional view taken substantially along line 4—4 of FIGURE 2; and

FIGURE 5 is a fragmentary longitudinal sectional view of the charging apparatus, showing the apparatus in a retracted position with the front and rear end portions of the charging apparatus broken away.

In FIGURES 1 and 2 of the drawings we have shown a shaker conveyor trough 10 in an extended furnace charging position with its delivery end extending over an electric melting vessel of furnace 11, diagrammatically shown in its charge receiving and melting position by dashed lines and movable about trunnion supports 12 to a pouring position, and shown as moving toward a pouring position by dash dot lines.

The trough 10 is shown in FIGURES 3 and 4 as comprising an upwardly facing channel 15 having a flat bottom and having parallel upright walls 16 and an outwardly flaring hopper-like portion 17 extending along and upwardly from the insides of the side walls 16 and flaring

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outwardly from the upper end portions thereof. The flaring side walls of the outwardly flaring hopper-like portion 17 are closed at the receiving end of the trough line by an end closure wall 18.

The side walls 16 and hopper-like portion 17 of the trough 10 are braced at a plurality of points along said trough by gusset plates 19 depending from the bottom of the side walls 16 and abutting at their end portions the horizontal legs 20 of angle irons 21. The vertical legs of the angle irons 21 extend upwardly along the outer sides of the walls 16 for a short portion of the height thereof and along the inner sides of the plates 19. Laterally spaced outwardly facing channels 22 extend longitudinally along the bottom of the trough 15. Upwardly opening channels 23 extend across the bottom of the channel-like trough 15 intermediate the gusset plates 19 and at said gusset plates and are recessed in the channels 22 and welded at the ends of their flanges or legs to the bottom of the trough 10, to transversely reinforce the bottom of said trough.

The bottoms of the horizontal legs 20 of the angle irons 21 have horizontal plates 24 of brackets 25 welded or otherwise secured thereto. The brackets 25 include vertical plates 26 depending from said horizontal plates and welded or otherwise secured to said horizontal plates and forming mountings for shafts 27 for rollers 29, forming rolling supports for the trough 10. The rollers 29 may be journaled on the shafts 27 on ball bearings (not shown), and ride along tracks or bearing plates 30 extending along the top side of the lower flange of a channeled guide 31. The channeled guide 31 is shown in FIGURES 3 and 4 as being in the form of upper and lower angle irons 32 and 33 respectively, welded or otherwise secured together, with the horizontal legs thereof facing inwardly to provide a channeled retaining guide for the rollers 29, supporting the trough 10 for extensible and retractible movement toward and from the furnace 11, and for reciprocable movement when driven with a shaker conveyor action, to progress a charge on the receiving end of said trough to the delivery end thereof, for charging a furnace.

The channeled guide 31 is supported on a plurality of spaced posts 35 supported at their bottoms on the top flanges of beams 37, shown as being I-beams and a extending substantially the length of the trough when in its retracted position. The I-beams 37 are connected together at intervals by cross frame members 38 in the form of channels having their webs facing upwardly and extending along the insides of the lower flanges of the I-beams (FIGURE 5), and at their forward ends by a vertically extending channel 39 (FIGURE 1).

A cross frame structure 40 is also provided to form a support for vertically spaced rollers 46, 46 supporting and guiding a drive bar 41 for the shaker conveyor trough line 10. The drive bar 41 is shown as being a rectangular hollow bar, but may be solid or of any desired form. As shown in FIGURES 4 and 5 the cross frame structure 40 includes a horizontal plate 43 extending along the top flanges of angle irons 44, 44 connected between the I-beams 37. The plate 43 is bolted or otherwise secured to top horizontal flanges of the angle irons 44, 44. Parallel spaced upright bars 45 are suitably mounted on the plate 43 and extend upwardly therefrom and have the rollers 46, 46 mounted therebetween on transverse shafts 47, 47. The rollers 46, 46 may be journaled on the shafts 47, 47 on ball bearings and form a support and guide for the drive bar 41 adjacent the rear end thereof. The bars 45 may be connected together at their upper ends by a plate 48.

A roller support 49 is suspended from the bottom of the trough 10 and moves with said trough and is disposed between parallel spaced plates 50, 50. The plates 50, 50

extend longitudinally of the trough 10 along the insides of the channels 22, 22 and depend from said channels and have the reinforcing channels 23 recessed therein. As shown in FIGURE 5, the roller support 49 is suspended from a plate 52 mounted between the plates 50, 50 beneath a cylinder 53. The roller support 49 includes rollers 55, 55 extending along the upper and lower sides of the drive bar 41 and mounted on shafts 56, 56 mounted at their ends in parallel spaced bars 57, 57 depending from a plate 58, abutting the bottom of the plate 52, and bolted or otherwise secured thereto. The lower ends of the bars 57 are connected together by a plate 59. The drive bar 41 also extends through a saddle 60 mounted between the plates 50, 50, and having aligned apertures 61 therein, registrable with the hollow interior of a hardened bushing 62 extending through a bar 64 suitably mounted in the forward end of the hollow drive bar 41, and extending forwardly therefrom. A drive pin 63 slidably carried in an aperture 61 of the saddle 60 is adapted to register with the hollow interior of the bushing 62 to rigidly connect the drive bar 41 to the trough 10 and effect a drive thereto, upon reciprocal movement of said drive bar.

The bar 64 has a stop and support bar 65 abutting its forward end and secured thereto as by machine screws 66. The bar 65 extends upwardly of the bar 64 between the reinforcing channels 22, 22 and forms a stop for the saddle 60. A bracket plate 67 is welded or otherwise secured to the forward end of the bar 65 and extends upwardly therefrom. The bracket plate 67 forms a mounting and reaction member for the free end of a piston rod 70 along which the cylinder 53 moves, to extensibly or retractibly move the trough line 10 along the channel guides 31. The free end of the piston rod 70 is secured to the bracket plates 67 as by a nut 69, threaded on the end of the piston rod 70 and suitably locked thereto.

The cylinder 53 extends between the plates 50, 50 and reinforcing channels 22, 22 and is secured to the trough 10, for extensibly and retractibly moving said trough along the channeled guides 31, upon movement of said cylinder along the piston rod 70. As shown in FIGURES 3 and 5, the cylinder 53 has a bracket 73 on its piston rod end abutting the bottom of a bracket plate 74 and bolted or otherwise secured thereto. The bracket plate 74 extends between the plates 50, 50 and abuts the bottom of a channel 23, and may be welded or otherwise secured to the channel 23 and to the plates 50, 50. The head end of the cylinder may be supported between the channels 22 in a similar manner.

The side thrusting actions on the trough 10 are taken by horizontal rollers 75, 75 shown in FIGURES 1, 2 and 5 as being disposed adjacent the front and back of the trough 10. The rollers 75, 75 engage the inner edges of the horizontal legs of the angles 32 of the channeled guide 31, and are mounted between the furcations of bifurcated brackets 76, on vertical shafts 77, mounted in the furcations of said brackets. The brackets 76 are shown as being mounted on bars 79 depending from the channels 23 and welded or otherwise secured thereto. The brackets 76 in turn may be welded or otherwise secured to the outer faces of the bars 79.

The drive bar 41 is reciprocally driven by a shaker conveyor drive mechanism 80. The drive mechanism 80 may be of any conventional form, reciprocally driving the trough 10 on the rollers 29 in a straight line with a flat back and forth motion, when the trough 10 is in its extended position in delivery relation with respect to the melting vessel 11. The drive mechanism, therefore, need not herein be described further except to point out that it is mounted on a base 82, suitably mounted between the I-beams 37, and is driven from a motor 83 through a drive coupling 85. The motor 83 drives gearing within the housing of the drive mechanism to rotatably drive a crank 86 at a varying angular velocity to reciprocally drive the drive bar 41. The drive from the crank 86 to the drive bar 41 includes a drive link 87 journaled on the

crank 86 at one end and pivotally connected to the rear end of the drive bar 41 at its opposite end, on a pivot pin 88.

The means for selectively engaging the drive pin 63 with the hollow interior of the bushing 62 at the front end of the drive bar 41, to impart a reciprocable shaker conveying action to the trough 10, includes a fluid pressure cylinder 89 having a piston rod 90 extending therefrom for extensible and retractible movement with respect thereto. The drive pin 63 extends from the outer end of said piston rod, and is suitably mounted thereon. The cylinder 89 may be an air cylinder and is mounted on the saddle 60, to one side thereof, on a bracket structure 91, including a base 93 suitably secured to the piston rod end of the cylinder 89, and laterally projecting arms 95 suitably secured to one side wall of the saddle 60 and projecting laterally therefrom and forming a mounting for the base 93.

It should here be noted that the roller support 49 for the drive bar including the rollers 56, 56 is disposed closely adjacent the saddle 60 when the trough is in its extended delivery position and maintains the bar 41 in aligned relation with respect to said saddle. The rollers 56, 56 moving with the extending trough 10 maintain the apertured portions 61 of the saddle 60 and the drive pin 63 in horizontal alignment with the hollow interior of the bushing 62 as the saddle 60 moves into engagement with the rear face of the bar or stop 65, said stop also being so located as to align the apertured portion 61 and drive pin 63 with the inner wall of the bushing 62, to accommodate ready insertion of the drive pin 63 within the bushing 62, to effect a reciprocating shaker conveying drive to the trough 10, and to accommodate ready release of the drive pin 63 from the inner wall of the bushing 62, when it is desired to retractibly move the trough 10 into its load receiving and storage position.

The cylinder 53 may be supplied with air under pressure to extensibly and retractibly move the trough 10 with respect to the furnace into its charging and load receiving and storage positions by suitable valve means (not shown) which may be remote from the furnace, to place the operator away from the heat of the furnace. The admission of air under pressure to the cylinder 89 to engage and withdraw the drive pin 63 may also be under the control of suitable valve means (not shown), which may be close to the valve means for effecting extensible and retractible movement of the trough 10.

During operation of the apparatus the entire trough 10 may be retractibly moved by the admission of fluid under pressure to the head end of the cylinder 53 to effect movement of the cylinder 53 along the piston rod 70 for the full length of the stroke of said cylinder, into the position shown in FIGURE 5. The trough 10 may then be loaded with its furnace charge, which may be scrap or ore of a selected type. When the trough is fully loaded, which is usually at the end of the furnace charging operation, the charge may be stored in the trough until the preceding charge has been melted and poured. The trough 10 may then be advanced with its delivery end over the furnace into the position shown in FIGURE 1. The drive pin 63 may then be engaged with the hollow interior of the bushing 62, to directly connect the drive bar 41 with the trough through the saddle 60, mounted between the plates 50, 50. The motor 85 may then be energized to rotatably drive the crank 86 and reciprocally move the drive bar 41 and trough 10 with a straight line reciprocable conveying action, to effect steady movement of the charge along the trough line into the furnace 11. When the charge in the trough has been completely loaded into the furnace, the shaker conveyor drive may be stopped, by deenergizing the motor 83. The drive pin 63 may be withdrawn from driving connection between the drive bar 41 and saddle 60 and the trough may then be withdrawn on the rollers 29 riding along the rails 30, 30 of the channeled guides 31, 31. The receiving

end of the trough may then be loaded with a charge for the next succeeding furnace charging operation.

It should be understood that the trough 10 is capable of accepting the charge for a complete furnace loading operation, which may be in the neighborhood of 8000 pound of scrap or ore, and feeds the scrap or ore into the melting furnace when in its extended position, at a controlled rate.

It should also be understood that the feeding of the furnace is controlled by starting and stopping of the shaker conveyor drive mechanism 80, and that reciprocable movement of the trough may be started and stopped under full load, and feeding by the reciprocable action of the trough line effects a smooth feed of scrap or ore to the furnace in the exact amount required for each charge.

While we have herein shown and described one form in which the invention may be embodied, it may readily be understood that various variations and modifications in the invention may be attained without departing from the spirit and scope of the novel concepts thereof.

We claim as our invention:

1. In a charging apparatus for melting furnaces, a shaker conveyor trough having a charge receiving end and an opposite charge delivery end, means reciprocably driven by power for reciprocably driving said trough to effect the progression of material from the receiving to the delivery end thereof, power means bodily moving said trough along said means for reciprocably driving said trough into charge delivery relation with respect to the furnace, and retractably moving said trough into a charge receiving position, the means for reciprocably driving said trough including a selective drive connection operable only when the trough is in a charge delivery position.
2. In a furnace charging apparatus, a shaker conveyor trough, means supporting said trough for reciprocable movement in a generally horizontal plane and for movement into an extended furnace charging position and into a retracted position to be loaded with a charge, a shaker conveyor drive mechanism fixed from movement with said trough into its extended furnace charging position and its retracted loading position and including a crank rotatably driven, a link driven thereby, a rectilinearly guided drive bar extending beneath and along said trough and reciprocably driven by said link in the direction of the longitudinal axis of the trough, and an operative connection between said drive bar and trough, selectively operable to effect a drive from said drive bar to said trough in the extended position of said trough along said bar and to accommodate movement of said trough along said bar into its extended and retracted positions.
3. A furnace charging apparatus comprising, a reciprocably guided shaker conveyor trough having a receiving end and an opposite delivery end, a roller support for said trough supporting said trough for reciprocable movement to effect the progression of material therein from the receiving to the delivery end thereof and for extensible movement into a furnace charging position and retractable movement into a charge receiving position, power means moving said trough into its charge receiving and furnace charging positions, a reciprocably guided drive bar guided for movement in the direction of movement of said trough, means reciprocably driving said drive bar, said trough moving along said drive bar when moving into its charge receiving and furnace charging positions,

and means selectively operable to drivingly connect said drive bar with said trough when said trough is in its furnace charging position.

4. A furnace charging apparatus comprising, a reciprocably guided shaker conveyor trough having a receiving end and an opposite delivery end, a roller support for said trough supporting said trough for reciprocable movement to progress material from the receiving to the delivery end thereof and for extensible movement into a furnace charging position and retractable movement free from the furnace, a reciprocably guided drive bar disposed beneath said trough and extending therealong in alignment with the longitudinal center thereof, means reciprocably driving said drive bar, fluid pressure operated cylinder and piston means extending beneath said trough for moving said trough along said drive bar into its extended furnace charging position, and a selectively operable drive connection from said drive bar to said trough, operable when said trough is in its extended furnace charging position only, and controllable from a position remote from said drive connection.

5. A furnace charging apparatus in accordance with claim 4

wherein the drive connection is a fluid pressure operated pin and aperture drive connection.

6. A furnace charging apparatus comprising, a reciprocably guided shaker conveyor trough having a receiving end and an opposite delivery end, a roller support for said trough supporting said trough for reciprocable conveying movement and for extensible movement into a furnace charging position and for retractable movement free from the furnace, power means moving said trough into its charging and charge receiving positions, a drive bar disposed beneath said trough and extending therealong to a position adjacent the forward end of said trough when in its retracted charge receiving position, a selectively operable drive connection from the forward end portion of said drive bar to said trough operable when said trough is in its charge delivery position, a stationary guide for said drive bar guiding said drive bar for rectilinear movement, means reciprocably driving said guide bar, a movable guide for said drive bar spaced forwardly of said stationary guide and depending from said trough and movable along said drive bar with said trough upon movement of said trough into its extended furnace charging position, and holding said drive bar in aligned relation with respect to said trough and in position to effect said selectively operable drive connection when said trough is in its charge delivery position.

7. A furnace charging apparatus in accordance with claim 6

wherein the stationary and movable guides are in form of roller supports, wherein the selectively operable drive connection is a pin and aperture drive connection, and wherein the movable guide retains said drive bar in position to effect and release said pin and aperture connection.

8. A furnace charging apparatus comprising, a reciprocably guided shaker conveyor trough having a receiving end and an opposite delivery end, a roller support for said trough supporting said trough to be driven with a reciprocable conveying action to progress material from the receiving to the delivery end thereof and for movement into a furnace charging position and into a charge receiving position, a fluid pressure operated cylinder disposed beneath said

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trough and extending along the longitudinal center thereof and secured thereto,
 a piston rod extending from said cylinder,
 a drive bar disposed beneath said trough and extending therealong to a position adjacent the forward end of said trough when in its retracted charge receiving position,
 a supporting connection between the forward end of said piston rod and said drive bar,
 a stationary roller guide for said drive bar disposed adjacent the rear end of said trough,
 a movable roller guide for said drive bar depending from said trough and movable with said trough along said drive bar toward the forward end thereof, upon movement of said trough into its extended furnace charging position,
 a saddle suspended from the bottom of said trough and extending downwardly along said drive bar,
 a shaker conveyor drive mechanism including
 a rotatably driven crank,
 a link connecting said crank with said drive bar for reciprocally driving said drive bar, and a selectively operable drive connection between said drive bar and said saddle when said trough is in its extreme extended position.
 9. A furnace charger in accordance with claim 8 wherein the selectively operable drive connection is a pin and aperture drive connection maintained in aligned relation at the extreme end of a charge position of said trough line by said movable guide.
 10. In a charging apparatus for metal melting furnaces, a frame spaced from the furnace, inwardly facing channeled guides extending along said frame,
 a shaker conveyor trough having a closed receiving end and an open delivery end,
 roller supports rideable along said channeled guide and supporting said trough for movement along said frame into an extended charge delivery position and into a retracted charge receiving position,
 a drive bar disposed beneath said trough and extending therealong,
 a stationary roller guide mounted on said frame and supporting the rear end of said drive bar for reciprocable movement,

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a movable roller supporting guide secured to said trough and depending therefrom and movable along said drive bar upon movement of said trough into an extended charge delivery position,
 a cylinder secured to the bottom of said trough and extending therealong,
 a piston rod extending forwardly of said cylinder,
 a support bar extending upwardly of the forward end of said drive bar and having supporting connection with the forward end of said piston rod,
 said cylinder moving along said piston rod upon the supply of fluid under pressure thereto and said drive bar holding said piston rod from movement,
 a shaker conveyor drive mechanism,
 a link connecting said drive mechanism with said drive bar for reciprocally driving said drive bar to impart a shaker conveying action,
 a saddle secured to and depending from said trough and extending along opposite sides of said drive bar forwardly of said movable roller supporting guide, said support bar forming a stop for said saddle,
 a pin carried by said saddle,
 an aperture in said drive bar spaced in horizontal alignment with said pin upon engagement of said saddle with said support bar and spaced in vertical alignment with respect to said pin by said movable support, and means registering said pin with said aperture to effect a shaker conveyor drive to said trough when said trough is in its extended charging position.
 11. A furnace charging apparatus in accordance with claim 10 wherein a fluid operated cylinder is mounted on said saddle to one side thereof and is operable to engage said pin with said aperture and to release said pin therefrom to accommodate retractible movement of said trough into a charge receiving position.

References Cited by the Examiner

UNITED STATES PATENTS

2,815,135	12/1957	Kullmar	214—18
3,019,889	2/1962	Carrier	198—220

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