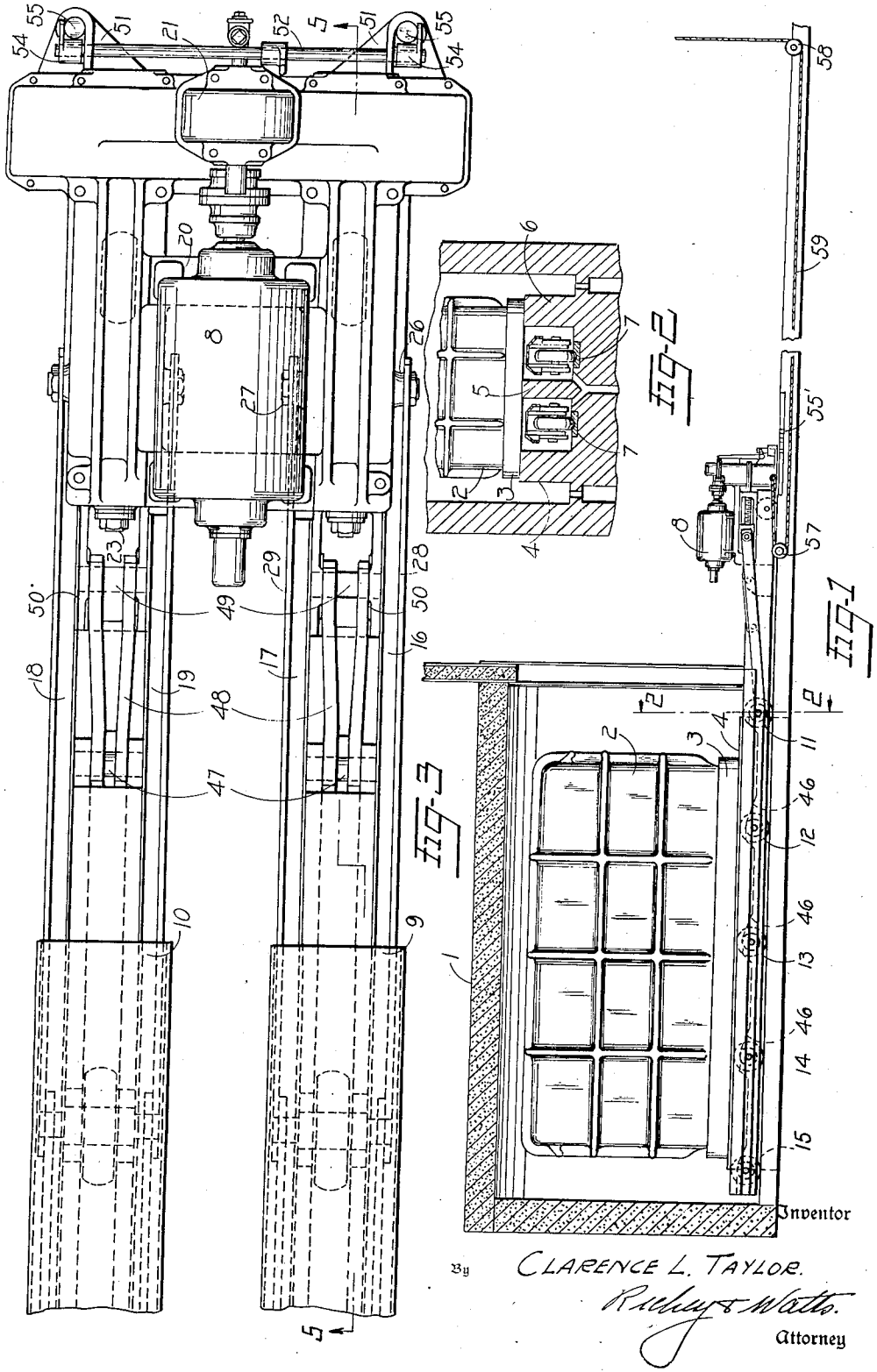
Oct. 29, 1935. C. L. TAYLOR 2,019,102

FURNACE CHARGING MACHINE

Filed Jan. 25, 1934 3 Sheets-Sheet 1



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FURNACE CHARGING MACHINE

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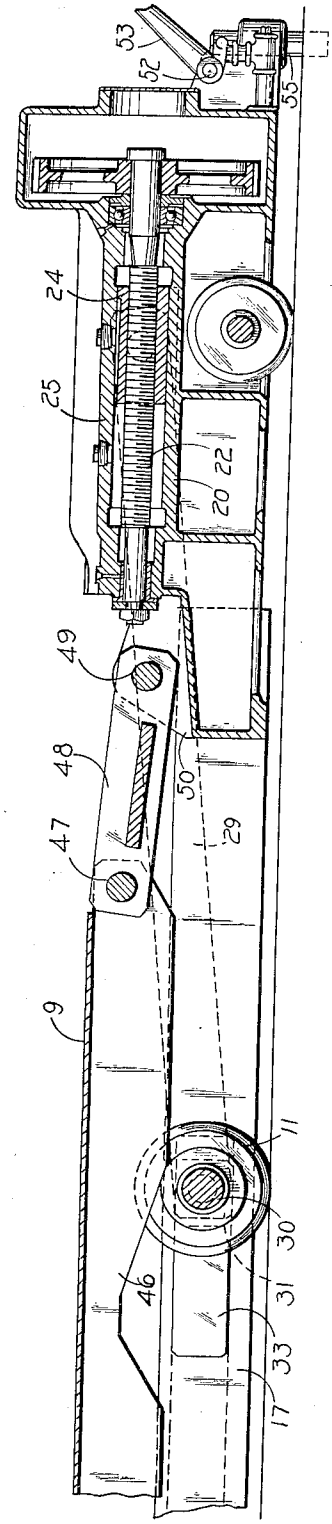


Fig. 5

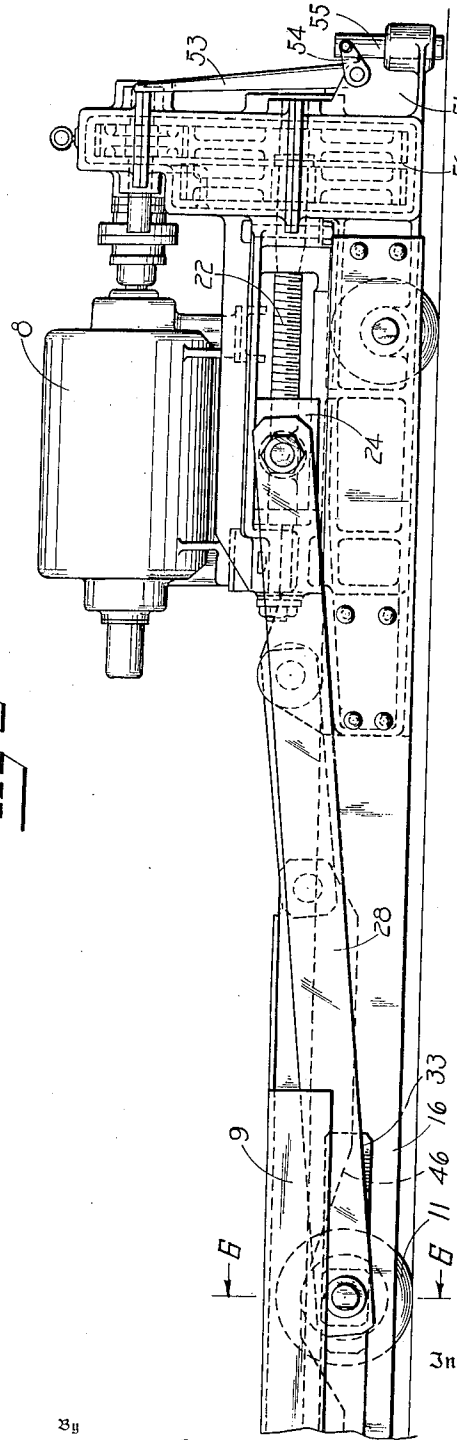


Fig. 4

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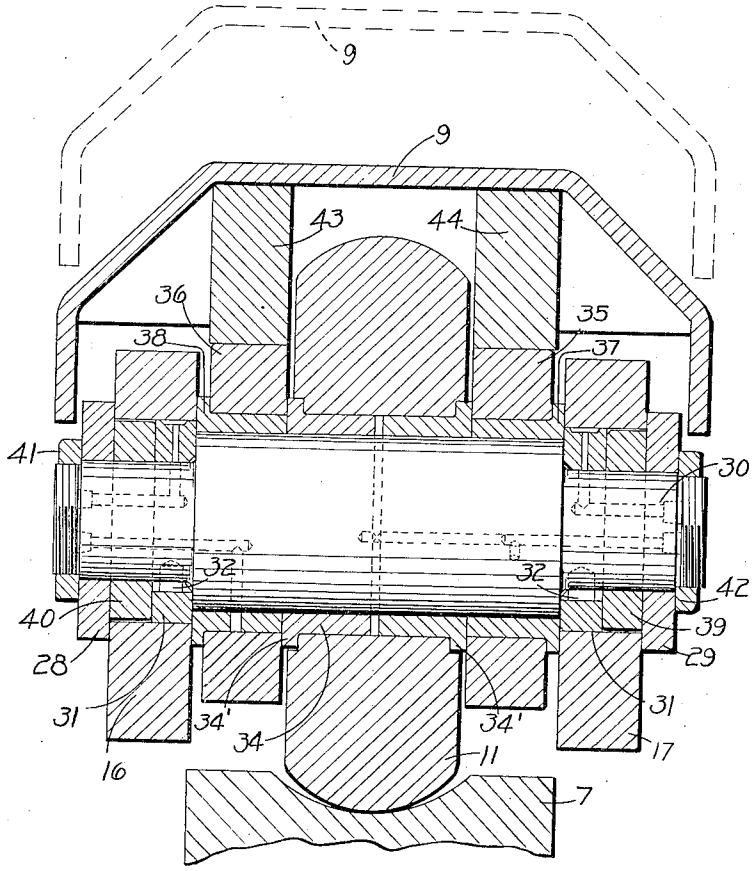


Fig-6

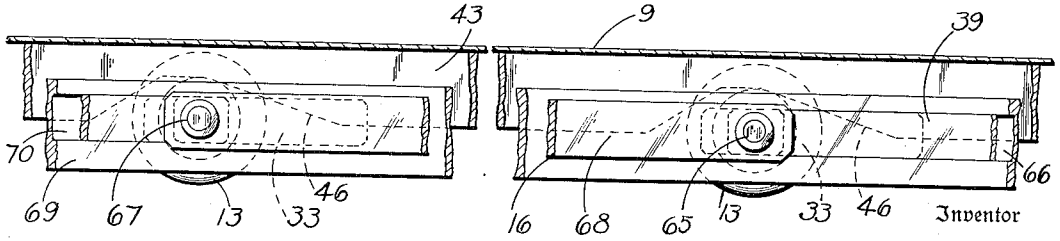


Fig-7

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UNITED STATES PATENT OFFICE

2,019,102

FURNACE CHARGING MACHINE

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Application January 25, 1934, Serial No. 708,217

8 Claims. (Cl. 214—26)

This invention relates to furnace charging apparatus, and more particularly to certain improvements in the type of charging apparatus which is particularly adapted for loading annealing boxes into and removing them from an annealing furnace.

In annealing of sheet steel and the like it is the usual practice to place the sheets to be annealed in a cast steel annealing box, the edges of which are sealed with suitable material to exclude the atmosphere and thereby prevent excessive oxidation during the annealing operation. When loaded with the material to be annealed, these annealing boxes are extremely heavy and care must be exercised in placing them in and removing them from the furnace, in order to prevent damage to the furnace structure and the annealing box itself.

In order to properly handle these annealing boxes, apparatus has been provided which comprises a wheeled carriage and means for moving the carriage, together with the annealing box, into and out of the furnace. Means are also provided for vertically lifting and lowering the portion of the charging apparatus which carries the annealing box so that the box may be deposited on suitable supports in the furnace and lifted therefrom without appreciable lateral movement of the box. Due to the great weight of the loaded boxes which may be as much as 225 tons, any lateral or sliding movement of the box on the support may seriously damage the support.

In United States patent to L. Johnson, No. 1,531,407, there is illustrated and described a charging machine of the general type referred to herein. However, the machine illustrated in the Johnson patent has certain inherent defects which have been overcome in the present invention.

It is among the objects of my invention, therefore, to provide an improved furnace charging machine of extremely simple and rugged construction, whereby the cost of upkeep and repairs is reduced to a minimum. Other objects of my invention are: the provision of a charging machine of the type described in which the load, i. e., the annealing box, is carried directly on the axles of the wheels which carry the apparatus into and out of the furnace; the provision of an improved and simplified supporting wheel and lifting roller assembly for furnace charging machines whereby friction of the moving parts is reduced to a minimum; the provision of a furnace charging machine in which the load is supported directly on the axles of the wheels, thereby eliminating the necessity of an extremely heavy frame structure as has been previously required.

The above and other objects of my invention will appear from the following description of a preferred embodiment thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation, partly in section, illustrating my furnace charging device in an annealing furnace in which an annealing box has been deposited by the charging machine.

Figure 2 is a cross section taken on line 2—2 of Figure 1.

Figure 3 is an enlarged fragmentary plan view of the charging mechanism, illustrating the driving motor and its connections to the lifting mechanism.

Figure 4 is a side elevation of the apparatus shown in Figure 3, illustrating the lifting platforms in their lowest positions.

Figure 5 is a view similar to Figure 4 but showing the parts in cross section taken on line 5—5 of Figure 3, and illustrating the load carrying platforms in their elevated positions.

Figure 6 is an enlarged cross section taken on line 6—6 of Figure 4, and illustrating my improved wheel and roller arrangement whereby the load is supported directly upon the wheel axles.

Figure 7 is a sectional side elevation of the wheel supporting frame, illustrating the linkage for connecting and spacing the wheel axles.

Referring now to Figure 1, the furnace 1 is diagrammatically illustrated and may, of course, be of any desired and suitable type. The annealing box cover 2 rests upon the base portion 3, which in turn rests upon the spaced piers or supports 4, 5 and 6, extending upwardly from the bottom of the furnace (see Figure 2). The tracks 7 for the charging machine are laid in the spaces between the supports 4 and 5 and supports 5 and 6. These tracks extend out beyond the door of the furnace whereby the charging mechanism may be completely withdrawn from the furnace. As illustrated, the tracks 7 are grooved to guide and support the wheels of the charging device.

The general arrangement of my charging device includes a set of side frame members which extend the entire length of the apparatus and which carry the driving motor 8 and its accessories for lifting and lowering the load carrying platforms 9 and 10, and also the load supporting wheels 11, 12, 13, 14 and 15.

Referring now particularly to Figures 3, 4 and

5, the charging mechanism comprises two parallel pairs of frame members, one pair of these members 16 and 17, being adapted to guide one set of load supporting wheels, and the other pair of frame members 18 and 19, being adapted to guide the other set of load supporting wheels. A driving motor 8 is located at the right hand end of the frame members 16, 17, 18 and 19. This motor 8 is mounted on a suitable frame 20 and is connected through a double set of gears mounted in the gear box 21 to drive a pair of horizontally disposed screws 22 and 23. Each of these screws 22 and 23 carries a traveling nut, one of which, 24, is seen in Figures 4 and 5. When the motor 8 is operated the screws 22 and 23 will be rotated and the traveling nuts will be moved simultaneously in the guideways 25 formed in the frame 20.

In describing the construction of my charging machine, reference will be had to one side of the structure only, i. e., one set of supporting wheels, one platform, etc., as both sets of parts are the same and are operated simultaneously. The nut 24 is provided with a pair of trunnions 26 and 27 which project outwardly from its sides and on which are mounted the platform operating links 28 and 29. The lower ends of the links 28 and 29 are pivotally mounted on the opposite ends of the shaft 30 of the supporting wheel 11. Rectangular bearing blocks 31 are pinned to the non-rotating shaft 30 by the pins 32 and are adapted to slide in the elongated slots 33 in the side frame members 16 and 17.

As is clearly seen in Figure 6 the wheel 11 carries a split bushing 34 which has a bearing on the central portion of shaft 30. The bushing 34 is provided with side flanges 34' which serve to space the wheel 11 from the rollers 35 and 36. These rollers are provided with the bushings 37 and 38, respectively, which are also rotatably mounted on the shaft 30. The shaft 30 has end portions of reduced diameter which end portions carry the operating links 28 and 29 and the wheel axle connecting links 39 and 40. The ends of axle 30 are threaded and nuts 41 and 42 are provided to hold the shaft assembly together. As is seen from the dotted lines in Figure 6 the shaft 30 is drilled to provide lubricating passageways to the bearing surfaces between the shaft and the wheel 11 and rollers 35 and 36.

The annealing box supporting platform 9 is of inverted channel shape and extends longitudinally over the side frame members 16 and 17 and the wheels 11, 12, 13, 14 and 15. Longitudinally extending bars 43 and 44 are secured to the underside of the platform 9. As is seen in Figures 1, 4 and 5 these bars 43 and 44 are formed with a plurality of inclined cam surfaces 46. These cam surfaces 46 engage the rollers 35 and 36 at each axle and it will thus be seen that the load imposed upon the platform 9 by the annealing box 2 will be carried directly by the axles which carry the wheels 11, 12, 13, 14 and 15 and no bending moment or direct load will be imposed upon the side frame members 16 and 17. The ends of the platforms 9 and 10 nearest to the driving motor 8 carry transverse pins 47 and guide links 48 are pivoted at one end to the pins 47 and at their opposite ends to pins 49 which are carried by suitable brackets 50 on the frame 20. These links 48 control the upward movement of the platforms 9 and 10 causing all movement of the platforms relative to the frame members 16, 17, 18 and 19 to be in a substantially vertical direction and without harmful horizontal component.

As is best seen in Figures 6 and 7 the axle 30 of the wheel 11 is connected to the axle 65 of the wheel 12 by the links 39 and 40 which are disposed in suitable grooves 66 in the side frame members. The axle 65 of wheel 12 and the axle 67 of wheel 13 are similarly linked together by the connecting link 68. This link 68 is substantially the same as link 39 but fits on axles 65 and 67 outside of the link 39 and is not disposed in a groove in the side frame member as is link 39. Link 69 which connects the axle 67 to the axle of wheel 14 is exactly like the link 39 and is similarly disposed in a groove or channel 70 in the side frame member. The function of these wheel axle connecting links is to cause all the wheels and axles to move simultaneously with wheel 11 and its axle 30.

Brackets 51 are secured to the gear case 21 and are provided with bearings for the transverse shaft 52. An upwardly extending operating lever 53 is secured to the shaft 52 as are also the short levers 54. These levers 54 are mounted at the outer ends of the shaft 52 and are pivotally connected to the vertical pins 55 which are supported and guided for vertical movement in suitable apertures in the brackets 51. It will be seen from Figures 4 and 5 that movement of the lever 53 to the right from the position shown in Figure 4 into that shown in Figure 5 will move the pins 55 downwardly. As is seen in Figure 1 a series of suitably spaced holes 55' in the floor of the building adjacent the track 7 permit the entire furnace charging apparatus to be locked in any one of a number of positions against movement along the track. As will be seen from the description of the operation of my apparatus it is desirable to lock the side frame members of my apparatus in order to insure the desired lifting of the annealing box without horizontal movement.

In Figure 1 there is also diagrammatically illustrated a means for moving the charging mechanism and the annealing box into and out of the furnace. Outwardly projecting studs 56 are mounted on the sides of the gear box 21 and sheaves 57 and 58 are mounted at or below the floor level of the shop. When it is desired to move the charging device into the furnace one end of a cable is hooked to the stud 56 and the cable is carried around the sheaves 57 and 58, as shown in Figure 1. When the end of the cable is connected to the regular overhead crane a pull on the cable will move the furnace charging mechanism into the furnace. In order to withdraw the charging mechanism from the furnace the cable 59 is connected directly from the stud 56 to the pulley 58 and an upward pull on the end of the cable will then pull the charging mechanism out of the furnace. It will be understood by those skilled in the art that other means, such as a rack set in the floor and a pinion driven by the motor on the charging mechanism, may be provided to move the charging apparatus, together with its load, into and out of the furnace.

The operation of my apparatus will now be described. We may assume that the annealing box has been heated in the annealing furnace for the desired length of time and is ready for removal. As shown in Figure 1 the charging apparatus has been moved into the furnace with the supporting platforms 9 and 10 in their lowered positions in which they clear the bottom of the base 3 of the annealing box. Figure 4 also illustrates the parts

of the charging device in this position. In order to lift the annealing box vertically without lateral movement and without danger to the box supports the operator starts the motor 8 which will drive the screws 22 and 23 through the gear box 21 in directions to cause the traveling nuts 24 to move to the right (Figures 4 and 5) in their guideways 25. This movement of the nuts 24 to the right is transmitted through the links 29 to the axles 30 of the wheels 11 and causes the bearing blocks 31 to slide in the slots 33 from the position shown in Figure 4 into that shown in Figure 5. During this movement of the axle 30 to the right or towards the motor 8 the rollers 35 and 36 engage the cam surfaces 46 of the bars 43 and 44 and, due to the angle of the surfaces 46, causes the supporting platforms 9 and 10 to be lifted from the position shown in Figure 4 into that shown in Figure 5. As the axles of the wheels 12, 13, 14 and 15 are all connected to each other and to axle 30 of wheels 11, each axle and its cam rollers will be moved to exert a lifting force on the bars 43 and 44. Thus, the load is properly distributed and the platforms 9 and 10 maintained horizontal during their lifting and lowering movements. During the lifting movement of the supporting platforms the links 48 swing upwardly and prevent lateral movement of the platforms of undesirable degree. During this operation the charging apparatus is locked against movement on the track by means of the pins 55. After the annealing box has been elevated in this manner and lifted off of the box supports 4, 5 and 6, the entire charging apparatus, together with the annealing box, is pulled out of the furnace by the cable 59.

In order to deposit an annealing box in the furnace the reverse of the above described operation is carried out and the charging device, together with the annealing box, is pulled into the furnace with the platforms 9 and 10 in elevated position and then the motor 8 is operating to move the traveling nuts 24 from the position shown in Figure 5 to that shown in Figure 4 thus lowering the platforms 9 and 10 without appreciable horizontal movement and depositing the annealing box on the supports in the furnace.

It will be seen from the above description that in my improved furnace charging mechanism the load on the platforms 9 and 10 is transmitted directly to the axles of the supporting wheels. In the previously proposed apparatus of this type with which I am familiar the load has been transmitted from the platforms to the frame members at points intermediate the wheels. Because of the heavy loads handled this construction necessitated extremely heavy side frame members. My arrangement eliminates the necessity of such heavy construction and, as friction is reduced to a minimum by the provision of my inclined surface and roller lifting arrangement, the entire unit may be very readily handled and economically operated. By transmitting the load directly to the axles the weight of the entire structure may be materially reduced. In addition to the saving in first cost of the apparatus this is an important consideration in equipment of this type because a single charging device is customarily employed to handle the loading and unloading of a number of annealing furnaces. The entire charging unit is picked up by the crane and moved from one furnace to another as required. My light weight construction greatly facilitates the handling of the apparatus and also results in a considerable saving of time and power.

Although I have described in considerable detail the illustrated embodiment of my invention it will be understood by those skilled in the art that modifications and variations may be made in the specific form herein shown and described without departing from the spirit of my invention. I do not, therefore, wish to be limited to the exact apparatus described herein but claim as my invention all embodiments thereof coming within the scope of the appended claims.

I claim:

1. In combination in a furnace charging machine, a frame, a wheel mounted on an axle supported by said frame, a cam roller carried by said axle, a load supporting platform disposed over said axle, wheel and roller, a cam member secured to said platform, said cam member being supported on said roller and having an inclined surface adapted to engage said roller, means carried by said frame for moving said axle and roller relative to said frame and to said inclined surface whereby said platform may be raised and lowered.

2. In combination in a furnace charger, a frame having a slot, a wheel mounted on an axle supported by said frame for movement in said slot, a cam roller carried by said axle adjacent said wheel, a load supporting platform disposed over said axle, wheel and roller, and having an inclined surface adapted to engage said roller, means carried by said frame for moving said axle and roller in said slot relative to said inclined surface and means for guiding said platform whereby the movement thereof due to said relative movement of the roller and inclined surface will be substantially vertical.

3. A furnace charging machine including a frame having spaced slotted side members, a plurality of wheels disposed between said parallel side members, each wheel being mounted on a separate axle and each axle being supported in slots in said side members and adapted to be moved in said slots, a load carrying platform disposed above said wheels, said platform having a plurality of inclined surfaces associated therewith, said inclined surfaces being positioned to engage roller surfaces carried by said axles, means for restraining said platform against substantial horizontal movement relative to said frame and means for moving said axles in said slots whereby said roller surfaces and said inclined surfaces will coact to lift and lower said platform.

4. In a charging machine of the class described, a wheel mounted on an axle, a load carrying platform, an inclined surface carried by said platform, a roller surface carried by said axle, said inclined surface being positioned to rest on said roller surface whereby the load on said platform will be transmitted directly to said axle and wheel, and means for moving said axle and roller surface in a horizontal direction while restraining said platform and inclined surface from substantial horizontal movement.

5. A furnace charging machine adapted to be moved along a track, said machine including a frame having spaced slotted side members, wheels mounted on axles having bearing blocks slidably disposed in the slots in said side members, links connecting said axles for simultaneous movement in said slots, roller cam surfaces carried by said axles, a load carrying platform having cam surfaces, said cam surfaces of said platform having inclined portions, means for moving said axles and roller cam surfaces in said slots in said frame, and means for anchoring said platform

against movement relative to said frame except in a substantially vertical direction.

6. A furnace charging machine adapted to be moved along a track, said machine including a frame having spaced slotted side members, wheels mounted on axles having bearing blocks slidably disposed in the slots in said side members, links connecting said axles for simultaneous movement in said slots, roller cam surfaces carried by said axles, a load carrying platform having cam surfaces adapted to rest on and be supported by said roller cam surfaces, said cam surfaces of said platform having inclined portions, means carried by said frame for moving said axles and roller cam surfaces in said slots in said frame, and means for anchoring said platform against movement relative to said frame except in a substantially vertical direction.

7. A furnace charging machine adapted to be moved along a track, said machine including a frame having spaced slotted side members, wheels mounted on axles having bearing blocks slidably disposed in the slots in said side members, links connecting said axles for simultaneous movement in said slots, roller cam surfaces carried by said axles, a load carrying platform having cam surfaces adapted to rest on and be supported by said roller cam surfaces, said cam surfaces of said platform having inclined portions, means carried by said frame for moving said axles and roller cam surfaces in said slots in said frame, means for anchoring said platform against movement relative to said frame except in a substantially vertical direction, and means for anchoring the charging machine against movement along said track.

8. In combination in a furnace charger, a frame having a slot, an axle supported by said frame for movement in said slot, a wheel mounted on said axle, a cam roller carried by said axle, a load supporting platform disposed above said axle and having an inclined surface adapted to engage said roller, means carried by said frame for moving said axle and roller in said slot relative to said inclined surface and means for guiding said platform whereby the movement thereof due to said relative movement of the roller and inclined surface will be substantially vertical.

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