Dec. 18, 1951 C. WHITE 2,579,409

FURNACE CHARGER

Filed April 25, 1946 2 SHEETS—SHEET 1

Fig. 1.

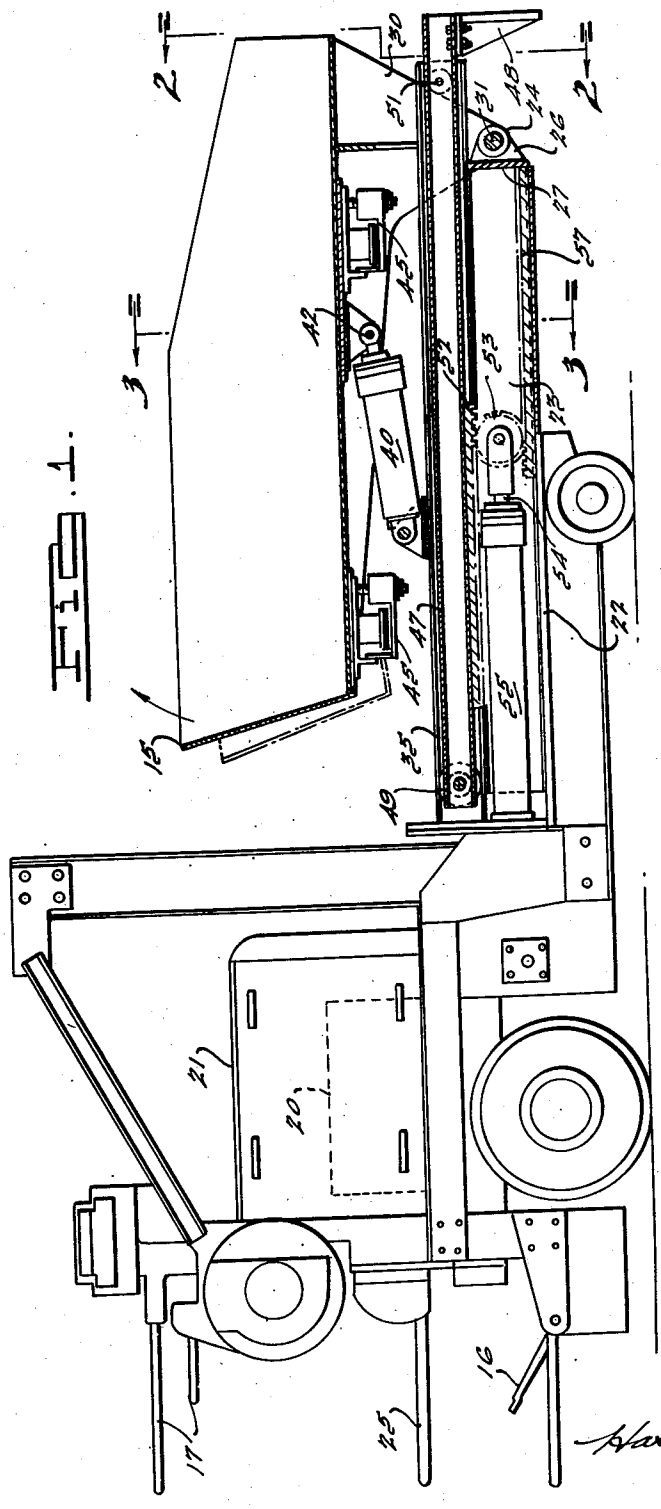
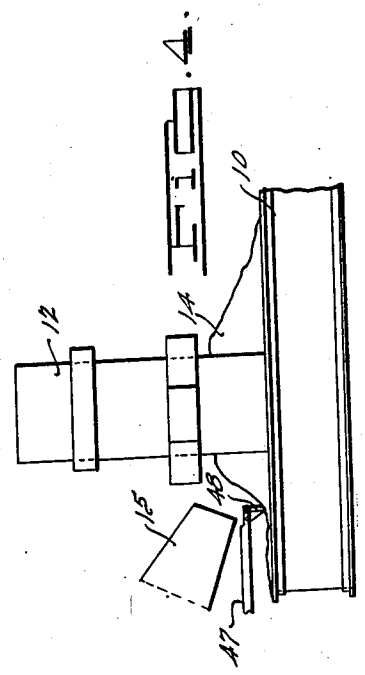


Fig. 4.



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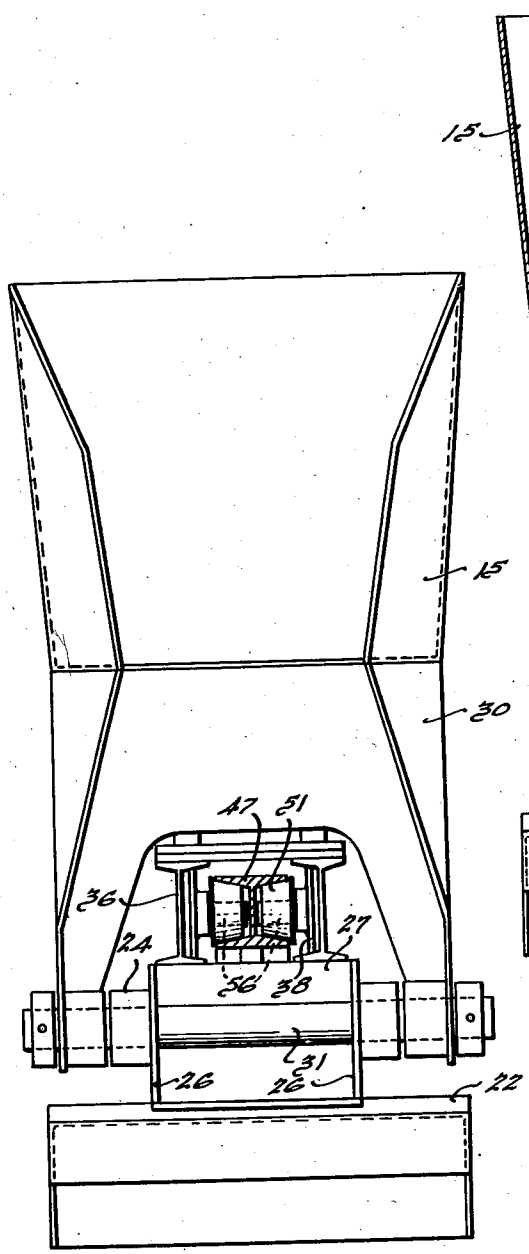

Fig. 2.

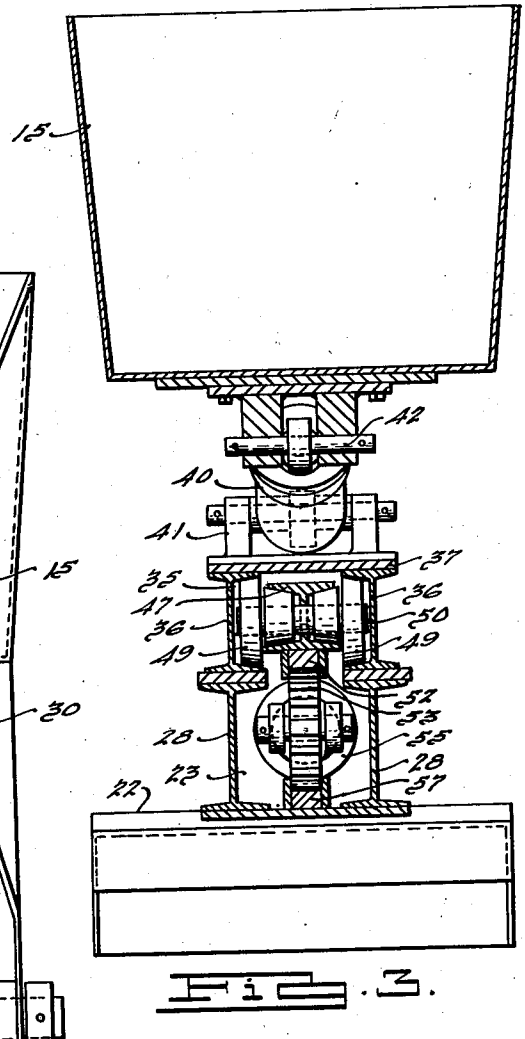

Fig. 3.

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FURNACE CHARGER

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7 Claims. (Cl. 214—18)

1

This invention relates to material feeding and handling devices and particularly to power-operated mechanisms for carrying, feeding, and distributing the charge and breaking up any incrustations which may form in open-top furnaces, with particular reference to furnaces of the so-called "alloy electric" type. It has heretofore been the practice to charge such furnaces by hand, by means of shovels, and to distribute the charge and break up incrustations by means of hoes, pokers, and other manual tools. Such operations of course require workmen to be so close to the furnace that the extreme heat represents a great physical hardship. It is an important object of this invention to provide power-operated means whereby such furnaces may be charged, the charge may be distributed, and incrustations may be broken up under the remote control of a workman who may be stationed at a sufficient distance and so protected that he is able to work in relative comfort and with greater efficiency.

In order properly to charge furnaces of the indicated type, it is frequently necessary that the charging materials be applied in various quantities to different areas of the furnace, and this fact has constituted one important reason why hand shoveling has been considered necessary. It is another important object of the present invention, therefore, to provide such power-operated charging means which permits accurate control of the amount of charge delivered to the furnace at any one time, and permits placement of such controlled charge at any desired point in the furnace, with accuracy comparable to that of hand feeding.

Another object is to provide such a power-operated charging and charge-manipulating mechanism which is adapted to be mounted upon and powered by a standard lift truck of one of the commercially available varieties commonly used for the transporting and lifting of materials and merchandise in industrial establishments.

Other objects and advantages will become apparent upon consideration of the present disclosure in its entirety.

In the drawings,

Fig. 1 is a side elevational view, partly in longitudinally section, of a furnace charging device constructed in accordance with the present invention;

Figs. 2 and 3 are vertical sectional views taken substantially on the lines 2—2 and 3—3 respectively of Fig. 1 and looking in the direction of the arrows; and

Fig. 4 is a partly diagrammatic side elevational view of a furnace of a type adapted to be charged by my improved apparatus, fragmentarily showing the charging and charge-handling apparatus.

2

Referring now to the drawings, reference character 10 designates generally an alloy electric furnace, the contents of which are adapted to be heated by electrical means, including the electrode 12. The details of construction of the furnace form no part of my present invention and accordingly will not be considered. The open top of such a furnace commonly has a cross-sectional area of something over 100 sq. ft., and the charge is ordinarily piled above the level of the sides, as indicated at 14. Such furnaces are located in an open floor area, so that all sides are accessible for charging and to enable manipulation of the charge for spreading and breaking it, as previously mentioned.

My improved mechanism includes a bin body 15 for the premixed charge, the bin being carried by a lift truck of a type commonly used in factories, commercial establishments, and warehouses for material handling generally. The truck includes a load-carrying platform 22 which may be raised and lowered at the will of the operator. As shown in Fig. 1, the load platform 22 projects from one end of the truck while the operator stands upon a smaller platform 25 at the opposite end of the truck, and an engine 20 is located in a compartment 21 between the load platform and the operator's station. The engine is so connected that it functions both to drive the truck and to operate the lift mechanism for the platform, and suitable controls are provided at the operator's station, as indicated generally at 16, 17. The bin 15 is open at its end farthest from the truck and from the operator. The entire truck is accordingly between the operator and the furnace when charging, and the operator is well protected from the heat of the furnace. If desired, elevating mechanism may also be provided for the operator's platform so that he may raise himself for a better view of the furnace when necessary. The details of construction of the truck itself, and of the lifting mechanism for the platforms 22 and 25, form no part of my present invention, and accordingly will not be described in detail.

The platform 22 carries a longitudinally elongated box housing 23 rigidly attached to and projecting from the same and provided at its ends with a pair of trunnion bearings 24 carried by brackets 26 attached to and projecting from a bolster plate 27 attached to and closing the end of the box housing 23. A shaft 31 carried in trunnion bearings 24 rockably supports a cradle

30 to which the bin is attached and for which it provides a supporting framework. The box housing 23 may be formed by a pair of spaced I-beams 28 attached to the top of the platform 22 as best shown in section in Fig. 3.

A second tubular boxlike frame 35 is rigidly mounted on top of the box frame section 23 and may be constituted by a second pair of spaced I-beams 36 mounted on top of the first. I-beams 36 may be bridged by a horizontal top plate 37 which serves both as a structural member and as a support for a hydraulic hoist cylinder 40 trunnioned in a pair of upstanding bearing brackets 41 attached to the top of the plate.

The cylinder 40 forms the housing of a telescopic hydraulic hoist which may be of one of the commercially available varieties. As the details of its construction form no part of my present invention, they need not be considered. The piston rod of the hoist assembly projects for pivotal attachment to the underside of the bin, as indicated at 42, at a point so spaced from the bin hinge pivot axis represented by shaft 31 and so related to the stroke of the hydraulic hoist that the latter may raise the bin to a desired angle to dump its contents from its open end. The bin is ordinarily carried with its closed inner end lower than its open, discharge end, to retain the load, which may be discharged simply by tilting the bin by means of the hoist.

The hoist is preferably so constructed that the bin may be stopped at any desired angle, and vibrating means are provided whereby the bin may be agitated to promote free and uniform flow of the charge from the bin. The vibrating means may also be hydraulic, two such units being shown, each designated 45, one located near each end of the bin and attached to the under side of its floor. Such vibrating units are also commercially available, and therefore no detailed description will be given.

The upper tubular casing 35 is open at its rear end and supports a longitudinally slidable cantilever support formed by a I-beam 47 which projects from its end and carries a depending hoe plate 48. At its inner end the hoe-supporting beam 47 fixedly carries a cross shaft 50 upon which are rotatably mounted a pair of rollers 49 which roll between the webs of the I-beams 36, as beam 47 is telescoped with respect to its housing 35, the arrangement of these rollers being shown in Fig. 3. A second pair of rollers 51 is supported by the I-beams 36 near their outer ends, these rollers riding in the top and bottom flanges of the beam 47 and serving to support the projecting end of the latter. One of the rollers 51 is supported by each of the beams 36 as upon a stub shaft 56 secured to and projecting inwardly from a supporting plate 38 attached as by welding to the I-beam 36 in vertical position spaced from but relatively close to the inner face of its central web. A rack 52 is dependingly secured to the bottom of the beam 47 and meshes with a driving pinion 53 attached to the piston rod 54 of a horizontally disposed hydraulic ram assembly generally designated 55 housed in the lower box-housing compartment 23. The pinion 53 also meshes with a stationary rack 57 secured to the bottom of the box section 23 and constituting a reaction driving element by which the pinion is rotated in the direction of its translatory movement during its piston-induced travel, as a result of which the rack 52 and the hoe beam 47 are driven at twice the speed of the ram piston.

The hoist and ram cylinders 40 and 55 are separately operable and may be stopped at any desired position, so that the operator has complete control of the action of the mechanism. The vibrators 45 may also be started and stopped at will, so that by varying the angle of the bin and using the vibrators in a controlled manner, the amount and rapidity of discharge from the bin may be accurately regulated. The hoe element 48 may be raised and lowered by raising and lowering the truck platform 22 so that the hoe may be used both as a poker and as a hoe or scraper.

It will be apparent that variations and modifications may be introduced without departing from the spirit and scope of the subjoined claims.

I claim:

1. A charging mechanism for open-topped furnaces and the like comprising a mobile lift assembly including a vertically actuatable substantially horizontal frame, a motor carried by said frame, a charge manipulator carried by said frame and actuatable by said motor to project to greater or lesser degree beyond the frame a substantially imperforate load-carrying body also carried by said frame and arranged above said manipulator, means for pivotally connecting the body to the frame including a support extending downwardly from the body and pivotally connected to the frame below the manipulator and near the outer end of the frame so that the body, manipulator and frame lie close to one another and coact to represent a substantially uninterrupted heat barrier while permitting the body to pivot to a dump position with respect to the frame, a dump motor for actuating said body to swing the same to and from said dump position, and control means for regulating the action of both of said motors located on the opposite side of said frame and body from the side from which said manipulator projects.

2. A charging and charge manipulating structure adapted to be carried by and vertically movable with the lift platform of a lift truck and including an elongated hollow frame structure adapted to be horizontally disposed upon such a platform, a hydraulic cylinder-type motor arranged horizontally within the lower portion of such frame, a charge manipulating element including a slidable beam also carried by and within said frame and extending in horizontal position over and operatively connected to said motor, whereby the beam may be moved horizontally to project more or less beyond the end of said frame, a rockable bin carried by said frame and arranged above said beam, pivotal supporting means for said bin including pivot portions carried by a lower portion of said frame and in substantial horizontal alignment with said cylinder, said supporting means including a pair of arms extending upwardly upon either side of said beam to support said bin, and means also carried by said frame for tilting said bin.

3. Means as set forth in claim 2 including a truck provided with an engine compartment, said bin, manipulating means and lift portion being carried by the truck upon one side of said engine compartment, said truck having a driver's station located upon the opposite side of said engine compartment and equipped with controls for operating the truck, and means including a movable control element also accessible from said driving station for regulating the action of said lift portion, dumping means and charge manipulating means.

4. Means as set forth in claim 2 wherein said means for tilting the bin comprises a second hydraulic cylinder-type motor arranged between said beam and said bin, said last mentioned cylinder being secured at one end to said frame.

5. A charging and charge manipulating structure adapted to be carried by and vertically movable with the lift platform of a lift truck and including an elongated hollow frame structure of open-ended tubelike form adapted to be horizontally disposed upon such a platform, a hydraulic cylinder-type motor arranged horizontally within the lower portion of such frame, a charge manipulating element including a slidable beam also carried by and within said frame and projectable from the open end thereof and extending in horizontal position over and operatively connected to said motor, whereby the beam may be moved horizontally to project more or less beyond the end of said frame.

6. A charging and charge manipulating structure adapted to be carried by and vertically movable with the lift platform of a lift truck and including an elongated open-ended tubular frame structure comprising two superposed pairs of transversely aligned and spaced I-beams adapted to be horizontally disposed upon such a platform, a hydraulic cylinder-type motor arranged horizontally within the lower portion of such frame, a charge manipulating element including a slidable beam also carried by and within said frame and projectable from the open end thereof and extending in horizontal position over and operatively connected to said motor, said element being disposed between and guided by the upper pair of I-beams whereby the slidable beam may be moved horizontally to project more or less beyond the end of said frame, a fixed rack carried by the frame parallel to and below the level of

and adjacent the front end of the motor, a movable rack carried by the beam and movable over the motor in a path above and parallel to the fixed rack, and a gear meshing with both racks and rotatably connected to and bodily actuatable by the motor, whereby the beam may be actuated by the motor in such manner as to impart to the beam twice the rate and stroke of the motor.

7. A mechanism as defined in claim 1 wherein said first-mentioned motor and said dump motor are servomotors, and a prime mover for propelling the entire mechanism and to supply energy to power said servomotors, said prime mover being arranged between said body and said control means.

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