

Jan. 14, 1969

M. C. FALK

3,421,640

SCRAP CHARGING MACHINE

Filed May 17, 1966

Sheet 1 of 6

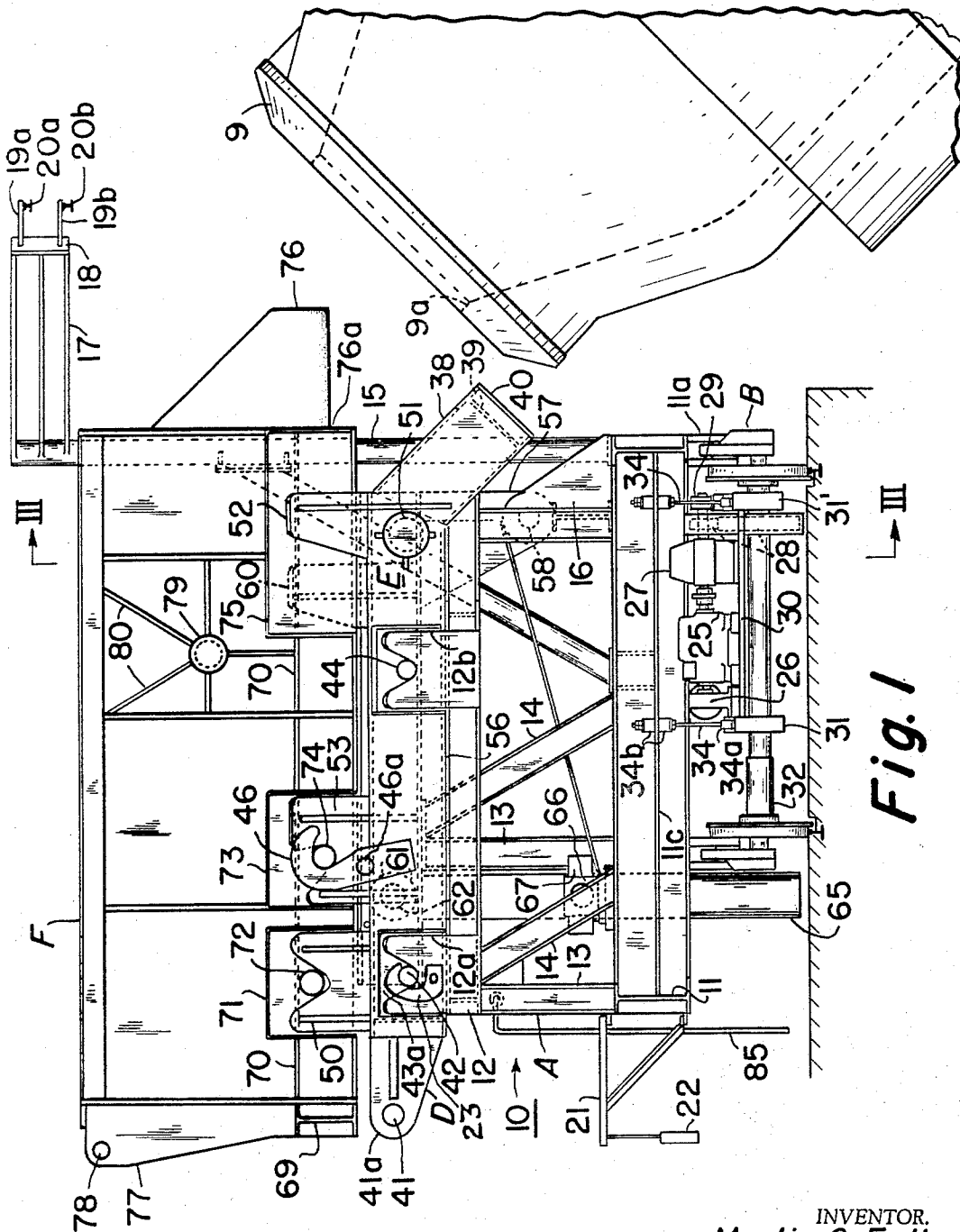


Fig. 1

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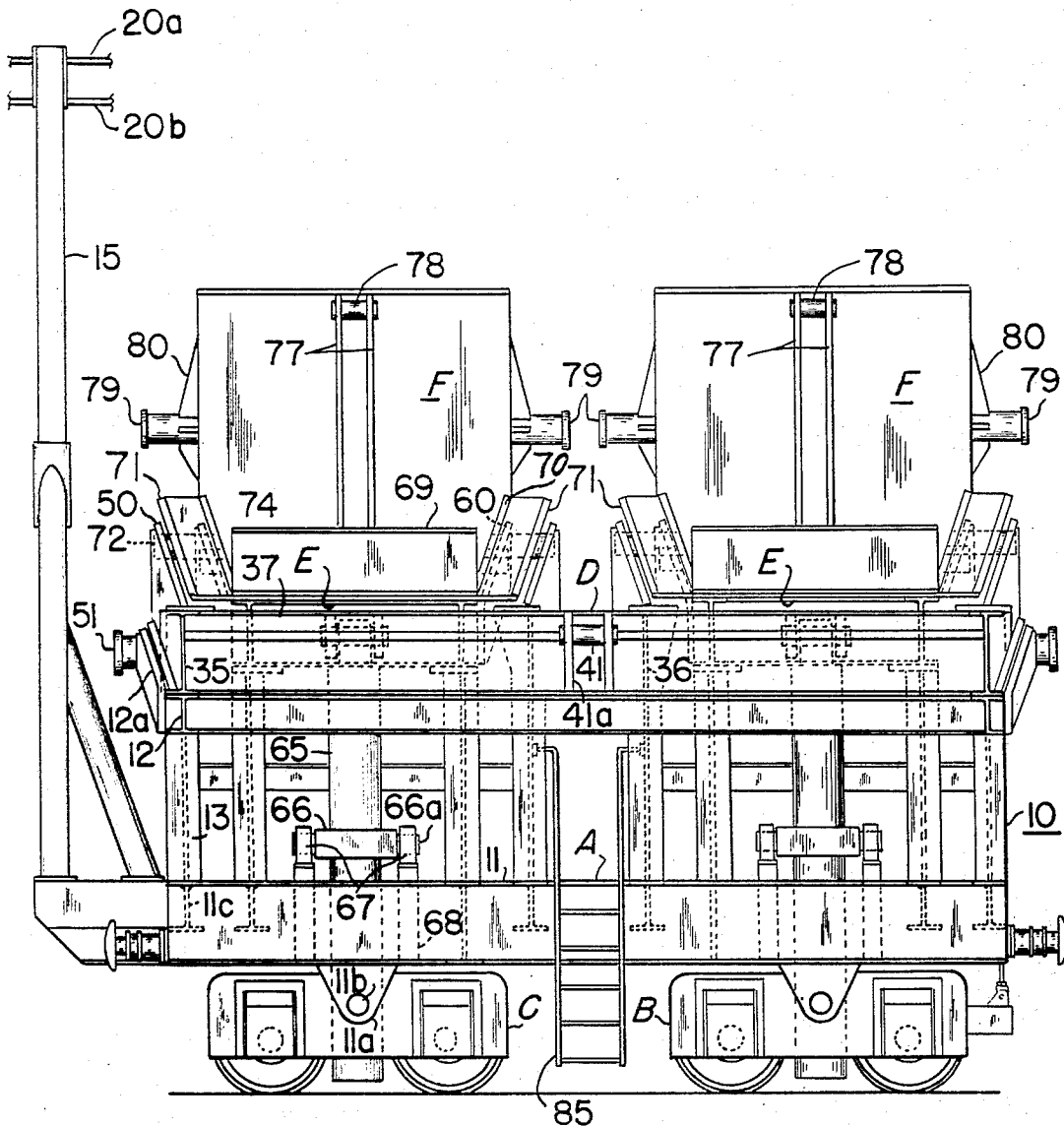


Fig. 2

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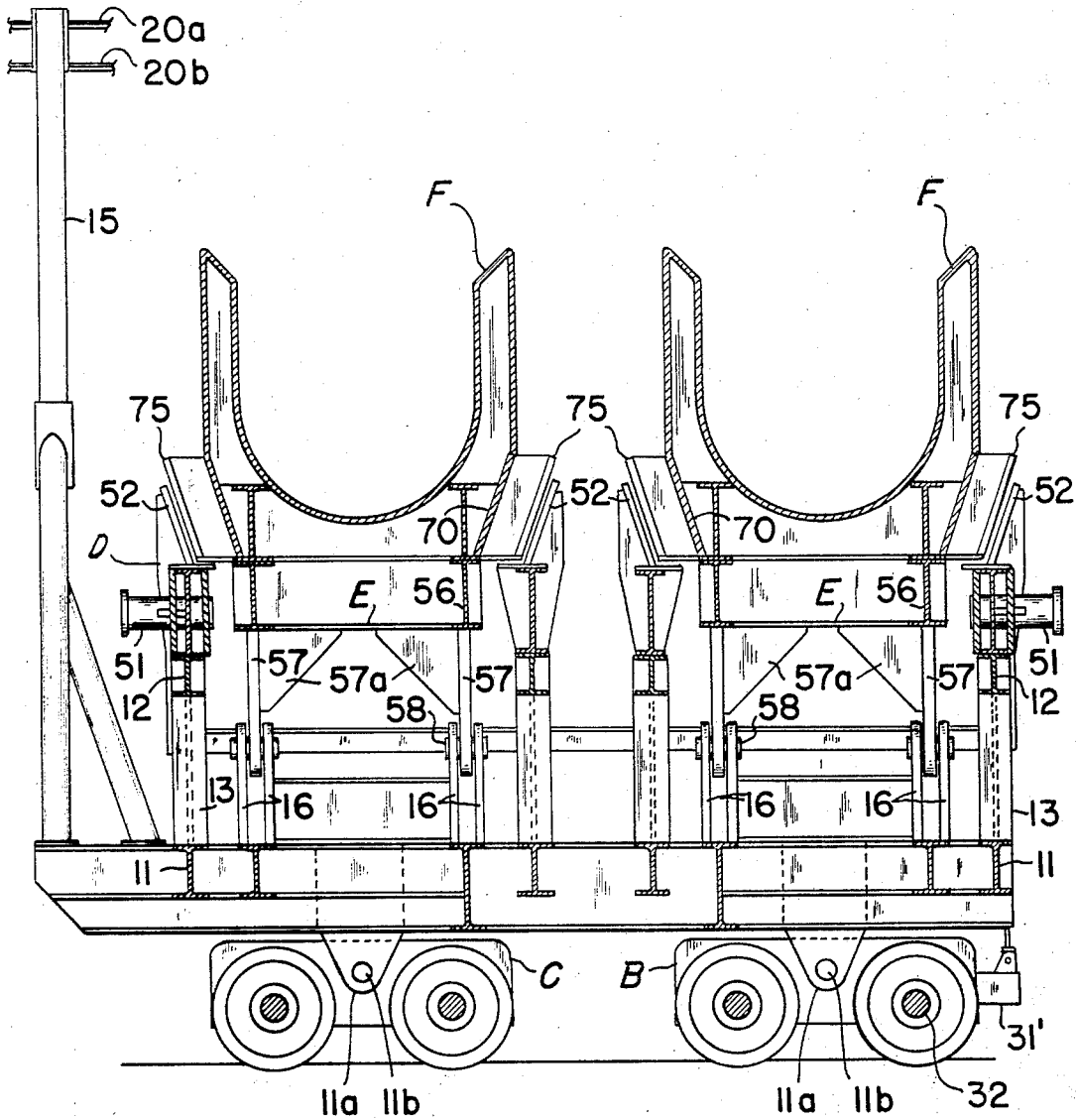


Fig. 3

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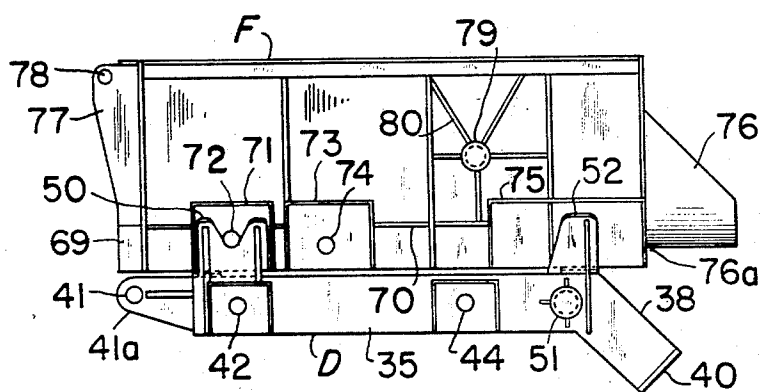
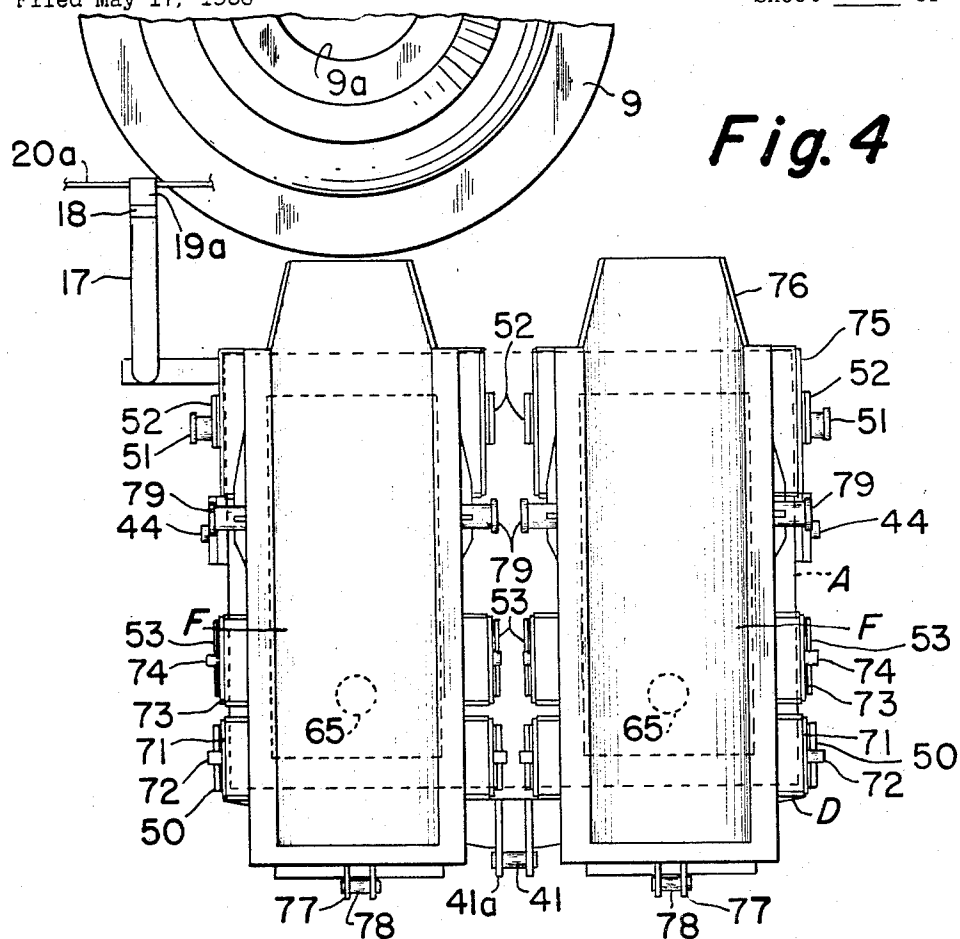
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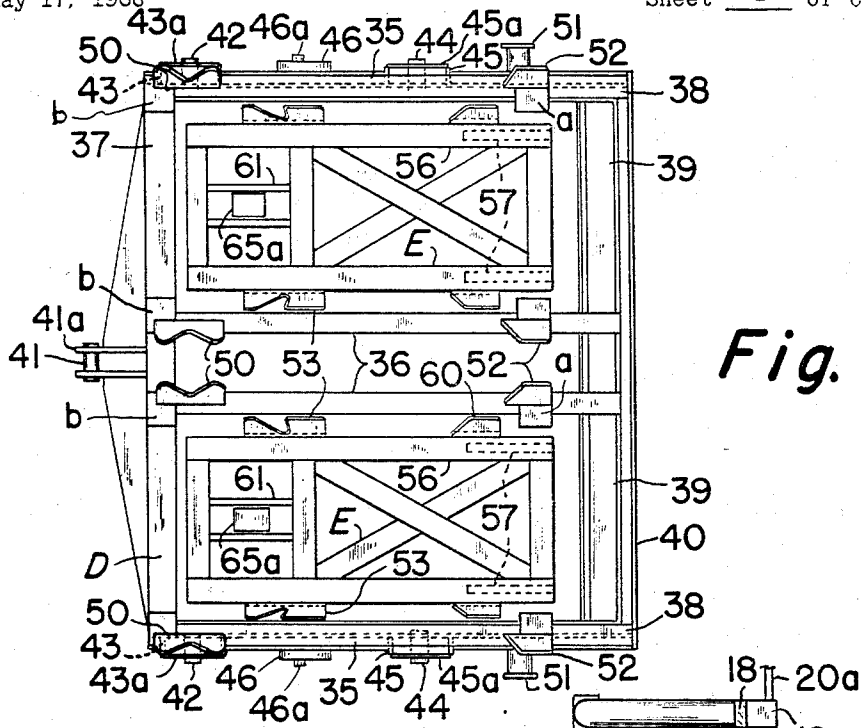


Fig. 6

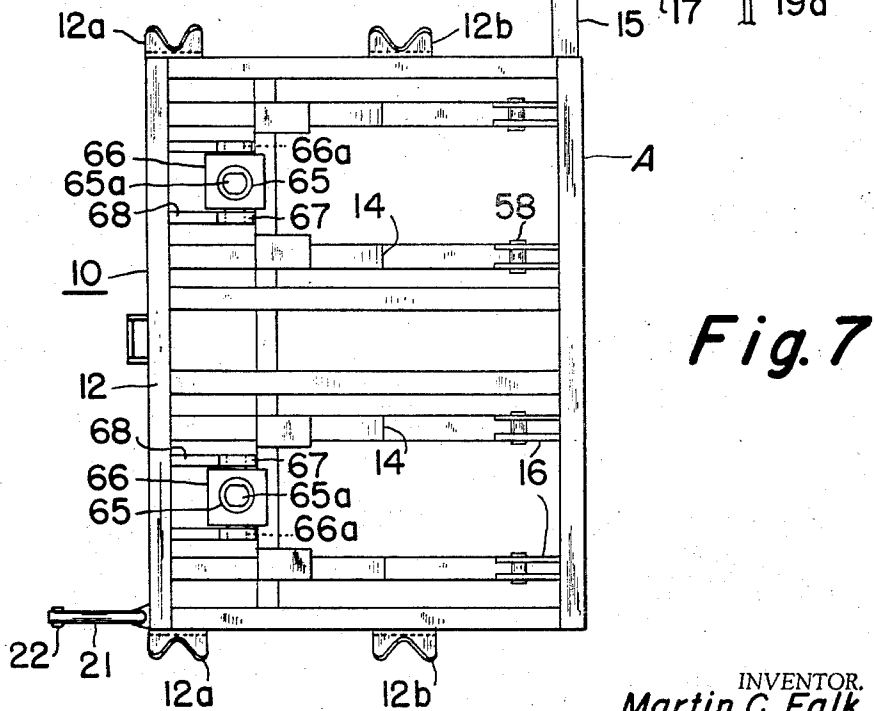


Fig. 7

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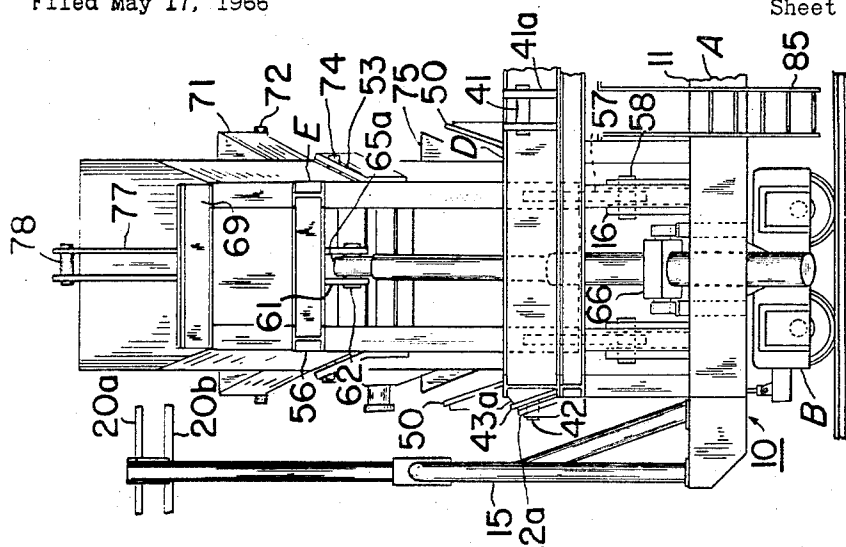


Fig. 9

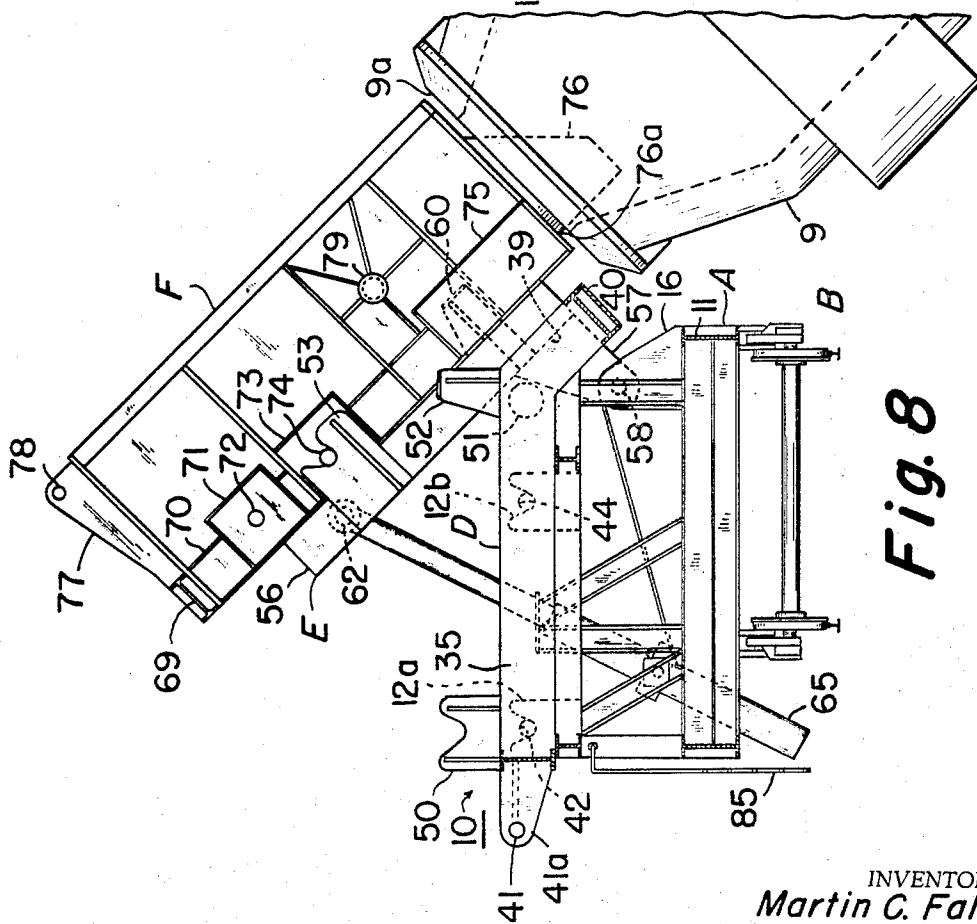


Fig. 8

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SCRAP CHARGING MACHINE

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U.S. Cl. 214—18

13 Claims

Int. Cl. F23k 3/06; C21b 3/00

ABSTRACT OF THE DISCLOSURE

A mobile charging machine is shown for overhead charging of solid material pieces, such as metal scrap, into an open mouth furnace. The machine has a stationary support frame and lift and tilt frames for carrying and tilting scrap charging boxes. Each lift frame has a sloped end portion for limiting the forward tilt positioning of an associated tilt frame, and safety latches are provided between the tilt frames and their associated scrap boxes and between an upper stationary frame and the tilt frames.

This invention relates to new and improved apparatus in the nature of a charging machine for handling and charging solid materials, such as irregular shapes and lengths of metal pieces in the nature of scrap metal, into a metal refining furnace in the nature of an open-mouth oxygen-blow vessel or converter.

This invention deals with an improved apparatus of the general nature and for the general purposes set forth in the Krause et al. Patent No. 3,214,035. It deals with an improved operative combination or construction, particularly from the standpoint of flexibility of utilization, larger charge-carrying capacity for the same backward extent, maximum safety to the workmen, and efficiency of operation. It is particularly suitable for effectively handling and charging heavy scrap material in large quantities for large tonnage furnace vessels.

An object of the invention has thus been to devise a new and improved mobile apparatus or machine which will have an improved stability from the standpoint of means for moving the scrap into or charging it into a furnace;

Another object of my invention has been to provide an improved furnace charging apparatus which may be self-propelled and which will have an increased efficiency and stability of tilting action in charging a furnace through its open mouth;

Another object of my invention has been to provide an improved charging machine which will enable a group of scrap buckets to be handled as a group or unit for the purpose of moving them from the machine to a filling station and from the filling station back to the machine and, at the machine, to be better individually operated for and supported in charging the scrap content of each into the open mouth or aperture of a furnace vessel;

A further object of my invention has been to provide tilting apparatus for a mobile charging machine that employs a group of tilting units, each of which is fully independent in its mounting and operation with respect to the other unit, and each of which can be utilized in a segregated relation with respect to the other unit in such a manner as to facilitate their individual operation without fouling the one unit with the charge of the other unit;

A further object of my invention has been to provide an operating assembly of tilting frames or cradles for a scrap charging machine that can be effectively utilized with a lift frame and, at the same time, will have the capability of handling scrap boxes of an improved contour and of a capacity that is increased by reason of their transverse shape and extent;

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A still further object of my invention has been to provide a charging machine whose removable units are positively guided into and out of position and retained with respect to other units for maximum safety to plant personnel and for maximum efficiency of charging of the material into a furnace vessel;

These and other objects of my invention will appear to those skilled in the art from the illustrated embodiment and the claims.

In the drawings, FIGURE 1 is a side (front to back) elevation of a charging machine employing my invention and showing one of its scrap boxes in an aligned relation with a furnace vessel that has been tilted to a charge-receiving position;

FIGURE 2 is a back end view in elevation on the scale of and of the machine shown in FIGURE 1;

FIGURE 3 is an end section in elevation on the scale of and taken along the line III—III of FIGURE 1;

FIGURE 4 is a top plan view of the machine and furnace vessel of FIGURE 1 on a reduced scale with respect thereto;

FIGURE 5 is a side view in elevation on the same scale as FIGURE 4, showing details of a lift carriage or frame, at tilt cradle or frame and an associated scrap box of the construction of FIGURES 1 and 4;

FIGURE 6 is a top plan view on the scale of FIGURES 4 and 5, showing details of the construction and relative positioning of a pair of tilt frames when the lift frame has been lowered on the machine about the pair of lift frames;

FIGURE 7 is a top plan view on the scale of FIGURE 6 illustrating details of the construction of an upper frame part of a stationary or main frame of the machine of FIGURES 1 and 2;

FIGURE 8 is a sectional side view in elevation of the apparatus of FIGURE 1 on the reduced scale of FIGURE 7, showing one of the tilt frames in a forwardly-downwardly tilted or declining scrap-charging position with respect to the furnace vessel; and

FIGURE 9 is a fragmental end view in elevation of the apparatus of FIGURE 8 showing it in the position of FIGURE 8.

In carrying out my invention, I employ an overhead charging machine or mobile unit 10 which may be self-propelled for longitudinal movement along a plant floor or track, in order that it may be moved into and out of general alignment with one or more furnace vessels 9, and may be moved so as to place one of its tilt frames and an associated scrap box in a fully endwise-aligned charging position with respect to the open mouth of a furnace vessel. The unit 10 has a main stationary support frame or structure A which is shown provided with a driven front truck unit B and back truck unit C, and which is adapted to removably receive a lift-off and lift-on frame or cradle D, and to swingably-operatively carry a group or pair of swing or tilt frames or cradles E. In addition, a pair of charge-carrying boxes F, such as scrap boxes, are adapted to be positioned as a group on and to be carried by the lift frame D. When positioned by the lift frame D on the stationary frames A of the machine, each box F has a cooperative swingable or tiltable positioning with an associated lift frame or cradle E.

The stationary or main support frame structure A has a lower support frame part 11 of I-beam construction from which the truck units B and C are pivotally suspended, each through the agency of a pair of transversely spaced-apart downwardly projecting mounts 11a and pivot pins 11b (see particularly FIGURES 1 and 2). The lower frame part 11 has cross-extending I-beam members at spaced locations therealong to form a unitary rigid structure. An upper frame structure part 12 is rigidly secured in a vertically-spaced relation above the lower frame

structure part 11 by means of connecting vertical beam members 13 and diagonal bracing beam members 14 to form a unitary structure A having upper and lower levels. The lower level represented by the frame part 11 may have a suitable floor plate structure to provide an operating area, serviced by a side-extending ladder 85, as shown in FIGURE 2. In this connection, the motor drive mechanism of the overall unit 10 may be either operated on the platform of the frame part 11 or from a side of the machine through the agency of a pendant control switch 22 (see FIGURE 1) which is suspended by a cable along a back end of the machine by means of an outwardly projecting shelf or arm 21. That is, a workman may either operate the machine 10 while riding with it or while walking along a side of the machine to one side of the tracks along which flanged wheels of the trucks B and C are adapted to move.

The upper frame part 12, as shown particularly in FIGURES 1, 7 and 8, is provided along its opposite sides with front and back pairs of upwardly projecting centrally-notched and outwardly flared wings 12b and 12a to removably receive outwardly projecting, cooperating, trunnion pins 44 and 42, respectively, which are carried by the lift frame D. It will thus be apparent that the lift frame which is adapted to rest on the upper stationary frame 12 may be vertically raised and lowered into and out of a secure fitted relation on the stationary frame A in such a manner that it will be accurately aligned thereon and that its rectangular frame will extend about the pair of tilt frames E (see FIGURE 6).

As shown particularly in FIGURE 2, a vertical or upright mast or post 15 is, at its lower end, secured on a back end of the lower frame part 11 to carry electric cables for supplying electric power from a suitable source to drive motors for the charging machine 10. As illustrated for example in FIGURES 1 and 4, the mast 15 has a horizontal top extension arm portion 17 that is provided with an insulating mounting pad 18 at its outer end from which a pair of current collector shoes 19a and 19b project. Overhead bus bar conductor rails 20a and 20b which are carried in an overhead relation and extend longitudinally in the direction of movement of the machine 10, are adapted to carry current from a suitable source to the collector shoes 19a and 19b and the shoes are adapted to slide therealong during movement of the machine 10.

The lower frame part 11, as shown particularly in FIGURES 1 and 3, has two pairs of bifurcated front mounting mounts 16 for pivotally or swingably receiving a pair of spaced-apart, front-positioned, downwardly projecting, tilt or swing arms 57 of each of the tilt frames E. As shown, the arms 57 project perpendicularly of the plane of and from the front end of an associated tilt frame E. It will be noted that each arm 57 is positioned between the two forks or bifurcated portions of each mount 16 in a supported relation therebetween for swingable movement thereon by means of a pivot pin 58. It will thus be apparent that each tilt frame or cradle E has separate swing mounts on the frame part 11 near the lower reaches of the machine 10, and that is independent of and spaced from the swing mechanism for the other tilt cradle or frame E of the pair or group.

By way of illustration, as shown particularly in FIGURE 1, the front truck B is shown as driven by a reversible electric motor 25. The motor 25 is secured on a platform 30 that is positioned to extend forwardly from a drive shaft 32 of the truck, through the agency of opposed, support bearings 31 and 31'. The shaft 32 has a pair of flanged wheels secured on its opposite ends that are adapted to engage rails of a track positioned along the plant floor (see FIGURE 1). The motor 25 drives the shaft 32 through a speed reduction unit 27 and a gear unit 28 having a meshing gear and pinion. Suitable electric control leads to the platform of the lower frame part 11 as well as to the side control switch 20

may be provided. One end of the drive shaft of the motor 25 is shown provided with a brake 26.

As shown in FIGURES 1 and 2, the platform 30 at its outer end is provided with a pair of torque rods which provide stability for it in its mounting on the drive shaft 32. Each rod 34, at its lower end, is connected by a pivot mount 34a to the platform 30 and, at its upper end, extends through a hole in the flange of an adjacent beam 11c. Resilient pads 34b carry the upper end of the rod in a secured relation thereon through the agency of nut and bolt assemblies, as shown particularly in FIGURE 1. It will thus be apparent that tilting force on the platform 30 set up by abrupt stopping and starting movement of the drive shaft 32 will be resiliently resisted by the pads 34b.

The lift frame D, as shown particularly in FIGURE 6, is of rectangular construction and its side, end, and cross members define two open spaces or compartments therein within which the individual lift frames E are adapted to extend without operative interference therewith. The lift frame D has a back connecting beam member 37, a downwardly offset, front-connecting beam 39, and a pair of side-connecting beams 35, as well as a pair of intermediate cross-extending beams 36. The pair of beams 36 have a centrally spaced-apart relation with each other, and each defines a compartment for an associated cradle frame E with an opposed side beam member 35. As illustrated also in FIGURES 1 and 5, the front beam 39, an adjacent front end portion of each of the side beams 35 and of each of the intermediate beams 36 have a forward-downward inclination or slope and are provided with a reinforcing front cap member 40. The front assembly of 36, 38, and 39, as shown particularly in FIGURE 8, serves as a front guide limit stop and support for the tilt frames E when they have been tilted or swung to a forwardly-declining furnace-charging position.

For facilitating carrying the lift frame D, it is provided adjacent its front end portion with a pair of outward projecting lift trunnions 51 and, at its back end, with a centrally positioned lift pin 41. The pin 41 is mounted between a spaced pair of arms 41a that project from the back beam member 37 and have reinforcing flanges extending therealong (see FIGURES 1 and 6). It will thus be apparent that the lift frame D, as illustrated for example in the Krause et al. Patent No. 3,214,035, may be lifted off the upper part 12 of the stationary or main frame A to carry the scrap boxes F to a suitable plant location at which they may be filled with scrap, and thereafter returned from such location and again placed in position on the stationary frame A. Such carrying and positioning of the scrap boxes by the lift frame D in no sense interferes with the operation of the tilt frames E which are retained on the stationary frame A at all times. It will be noted, as illustrated in FIGURES 1 and 6, that front and back pairs of positioning pins 44 and 42 of the lift frame D are provided with boxes 45 and 43 that, with their end plates 45a, and 43a, serve as accurate aligning means for positioning the lift frame D on side wings 12b and 12a of the upper stationary frame part 12. As shown in FIGURES 1 and 7, the front pair of side wings 12b as well as the back pair 12a are flared outwardly to guide the sides of the lift frame D into position and have upwardly open slots to receive the pins 44 and 42 of the tilt frame.

As particularly illustrated in the figure, each tilt frame E is of rectangular shape and is provided adjacent its front end with a sidewise outward tilted, sloped or flared pair of guide wings 60 and, adjacent its back end, with a pair of outwardly sloped or flared slotted wings 53 whose slots are open upwardly and backwardly. The front pair of wings 60 serves to cooperate with and to guidably receive downwardly-inwardly sloped, bottom side portions 70 of an associated scrap box F (see FIGURES 1, 2, 3, and 6), and the back pair of wings 53 serve to cooperate with and to guidably receive downwardly-inwardly sloped side plate portions 73 of the associated scrap box F. Each scrap box

F has one pair of outwardly projecting side pins 74 that extend from the side plate portions 73 and are adapted to be received in the slots of the back pair of wings 53. As shown in FIGURE 1, a safety latch 46 may be provided on an outer side of each lift frame E that is secured in a pivoted relation by a pin 46a thereto to project upwardly therefrom and latch-engage a side latch pin 74 projecting from the associated scrap box F. This positively prevents any inadvertent upward release of the scrap box F from its associated tilt frame E when it is to be tilted with its heavy load of scrap material into a furnace-charging position.

For positioning each scrap box F on the lift frame D, I have provided the frame D with front and back pairs of flat positioning pads *a* and *b* that are respectively carried thereon adjacent front and back portions thereof (see FIGURE 6). In addition, the two halves of the unitary lift frame D are provided with a pair of upwardly-outwardly flared or sloped front guide wings 52 and a pair of back-positioned outwardly flared or sloped wings 50 that have upwardly-open slot portions therein. The front pair of wings 52, as shown particularly in FIGURES 1, 3, and 5, are adapted to cooperate with and to guidably receive a pair of downwardly-inwardly sloped and outwardly offset front side plate portions 75 of the associated scrap box F, and the back pair of wings 50 are adapted to guidably receive downwardly-inwardly sloped and outwardly offset slide plate portions 71 (see FIGURES 2, 8, and 9) of the associated scrap box. Each scrap box F has a pair of back latching pins 72 projecting through the plate portions 71 to engage within the slotted portions of the pair of back wings 50 of the lift frame D.

As previously explained, the front end of each tilt frame F is swingably mounted by a front pair of spaced-apart side legs 57 within pairs of bifurcated mounts 16 that extend from the lower frame part 11 of the main frame A (see FIGURE 3). An elongated, vertically projecting, reciprocating fluid motor 65 is provided for actuating or tilting each of the frames E. Each motor 65 has, as shown particularly in FIGURE 9, a piston rod whose upper end portion 65a is flattened for operative-positioning within a bifurcated mount 61 that projects downwardly from an associated tilt frame E, adjacent its back end portion. The end portion 65a of the piston rod is provided with a pivot pin 62 for operatively connecting it to an associated tilt frame E. For providing free arcuate swinging movement of the fluid motor 65, it has a swing mounting on the lower part 11 of the stationary frame A, as provided by a saddle or collar 66, pins 66a projecting from opposite sides of the collar, and by a pair of bearing mounts 67 (see FIGURE 2). It will be noted that the bearing mounts 67 are carried on stands 68 that are secured to the lower frame part 11. It will thus be apparent that each fluid motor 65 may be actuated to swing an associated tilt frame E from its horizontal position of FIGURE 1 to its furnace charging position of FIGURES 8 and 9, and, after the scrap material has been charged into the furnace, to again return it to a horizontal position on the machine. Although any conventional means may be employed for providing individual or independent actuation of each fluid motor 65, a suitable electrical-motor-drive fluid-pump operating system is illustrated in FIGURE 14 of the McFeaters Patent No. 3,107,797.

As illustrated particularly in FIGURES 1, 2, 3, 4, 5, and 8, each scrap box F is provided with a side pair of outwardly projecting lift trunnions 79, adjacent its front end portion, and with a lift pin 78 that is positioned adjacent its back end. The mounting of the trunnions 79 is reinforced along the sides of the scrap box by a structure 80 (see FIGURE 1). As a result, each scrap box F can be handled by the hooks of an overhead hoist or crane, when desired, independently of the lift frame D and an associated tilt frame E. Each scrap box F has a cross-extending, back reinforcing member 69 and a pair of upwardly extending back flanges 77 secured thereto for reinforcing it and providing a mount for the back lift pin

78. The arrangement is such that the wing pairs 50 and 52 of each half of the lift frame D securely and accurately align the pair of scrap boxes F in position thereon but, at the same time, permit each box to be freely moved into and out of a tilted relation by an associated tilt frame E.

The front end of each scrap box F is open and is provided with a forwardly projecting delivery chute 76 which extends from the inner wall thereof and is shaped to correspond thereto, see the inner contour or shape illustrated in FIGURE 3. Each chute 76 is open at its top and forward end and has a forward inclination along its top edge and is blunt or vertical along its front edge and is adapted, as shown in FIGURE 8, to substantially fully enter the feed opening or mouth of the furnace vessel 9 and to rest upon a bottom portion of its lip edge 9a. The bottom portion 76a of the chute 76 has an upwardly offset angle-defining relation with the front end of the framing of each scrap box, such that a corner support is provided for the scrap box and an accurate fit is attained by it with respect to the lip edge 9a of the furnace vessel. This enables the scrap material from the scrap box F to be fed or charged without spillage into the furnace vessel to thus minimize danger to workmen walking on the plant floor.

As particularly illustrated in FIGURE 3, the individual swing mounting of each cradle frame E, not only provides a desired spacing between adjacent scrap boxes F, but also enables them to be shaped to the most desirable and efficient contour, e.g., to substantially fill the feed opening of the furnace vessel 9. It also prevents jamming of the apparatus by projecting rough scrap carried by one or both of the scrap boxes, in that each scrap box may be suitably transversely spaced from the other and is free to be individually charged into the mouth of the furnace. Also, importantly, the separate mounting construction of the tilt frames E enables each scrap box F to not only be provided with the most desirable contour, but also to have an increased transverse dimension for a greater capacity without lengthening it, to thus conserve plant space transversely of the furnace vessel. Also, one scrap box may, for example, provide an entire charge for a particular furnace vessel. Positive and fully aligned positioning is provided for each scrap box F, not only on the lift frame D, but also on its associated tilt frame E, all without interfering with the desired operation of either of the frames. Outside spillage of scrap during the charging operation or the jamming has been substantially eliminated. There is no possibility of endwise or side sway of the scrap boxes F when they are carried on the machine 10 and when they are being lifted into and out of a charging position. The swing mounting of each tilt frame E is such that the weight of each scrap box, as it is tilted, is carried at the lowest possible position with respect to the stationary frame A to stabilize the operation. In addition, the use of what may be termed a downward-angular-extending swing mounting of each tilt frame E provides it with a maximum effective length of lever arm for maximum leverage with minimum power requirements for the fluid motor 65 while, at the same time, minimizes the necessary backward extent or length of the machine transversely from the furnace mouth. The construction of the front end of the machine is such that there is no danger of overlifting the tilt frame (see the limit action of the member 39, etc., of FIGURE 8), and such that each tilt frame and its associated scrap box F is securely supported in its most desirable tilted charging position.

It will be apparent to those skilled in the art that although I have illustrated a particular embodiment of my invention, that various modifications and changes may be made in such structure without departing from its spirit and scope, and that the inventive features may be adapted to other utilizations, including the charging of other types of solid materials.

The safety latches 46 which are pivotally mounted (see FIGURE 1) on the outer side of each lift frame E are

not essential from the standpoint of the normal employment of the tilt frame E in moving the scrap boxes F between substantially horizontal and forwardly tilted positions in charging the furnace 9. In this connection, it will be noted that the back pair of wings 53 that are carried by each tilt frame E have their slots open backwardly in a direction opposite to the direction of forward tilting movement of the loaded scrap boxes. The safety latches 46 are, however, particularly useful when, for example, one of the reciprocating fluid motors 65 becomes inoperative and is desired in the emergency to tilt a particular scrap box F on its associated tilt frame E by the use of an overhead crane or hoist apparatus whose chain or cable supported hook is moved into engagement with the back pin 78 of the scrap box. A lifting of the back end of the scrap box by means of the hoist will thus accomplish a forward tilting action of the scrap box and its associated tilt frame about the forwardly-downwardly positioned swing axis of the latter. In addition, an overhead crane or hoist may be used with the forward trunnions 79 as well as the back pin 78 of a scrap box to lift and transport it independently of the lift frame D and, if desired, to tilt and charge it independently of its associated lift frame E. It will thus be apparent that the construction is flexible as to its utilization of the scrap boxes.

In FIGURE 1, I have shown a pair of safety latches 23 pivotally mounted on each of the back-positioned side wings 12a of the upper frame part 12. These may be employed, if desired, to latch-engage over back-positioned side-extending pins 42 of the lift frame D in order to, in effect, lock the lift frame D on the upper stationary frame part 12 during the operation of moving or tilting a scrap box F and its associated tilt frame E between their horizontal position and their forward tilted charging position or during the period when, as shown in FIGURE 8, a particular scrap box and its associated tilt frame are limited by and are resting on the cross-extending downwardly sloped front end portion of the lift frame D.

I claim:

1. In a charging machine for overhead charging solid material pieces such as metal scrap into an open mouth of a furnace wherein, the machine has a primary frame for forward alignment with the open mouth of the furnace, the primary frame has lower frame and upper frame parts, the upper frame part is integrally connected in an upwardly spaced relation on the lower frame part, at least one forwardly extending tilt frame is operatively positioned above the upper frame part for forwardly tiltable movement with respect thereto, and a scrap box is removably carried on the upper frame part for forwardly tiltable movement with the tilt frame, the improvement which comprises: a pair of spaced-apart swing mounts projecting upwardly from a front end portion of the lower frame part, a pair of spaced-apart swing arms integrally connected to a front end portion of and projecting downwardly substantially perpendicular to the tilt frame and swingably positioned at their lower ends on said pair of swing mounts for movement of the tilt frame to and from a substantial horizontal position and a forwardly tilted position with respect to the upper frame part to move the associated scrap box to and from a substantial horizontal position and a forwardly tilted charging position with respect to the open mouth of the furnace, reciprocal operating means carried by the main frame and operatively connected at its upper end to a back end portion of the tilt frame for swinging the tilt frame to and from its horizontal and forwardly tilted position, and a lift frame upwardly-removably carried on the upper frame part and provided with an open compartment therein for receiving the tilt frame therein, the improvement which also comprises: a forwardly-downwardly sloped front end portion on the lift frame for limiting the forwardly tilted positioning of the tilt frame and for supporting the tilt frame in its forwardly tilted position.

2. A charging machine as defined in claim 1 wherein

a saddle is swingably positioned on the lower frame part and is connected to a lower end portion of said operating means for providing swinging movement of said operating means when it is reciprocated for swinging the tilt frame and its associated scrap box to and from their horizontal and forwardly tilted positions.

3. A charging machine as defined in claim 1 wherein, each swing mount of said pair is of bifurcated construction and has a pivot pin extending thereacross, and an associated one of said swing arms projects within said bifurcated construction and is operatively mounted on said pin.

4. In a charging machine as defined in claim 1 wherein, means is carried by the upper frame part to removably latch-engage with the lift frame for securely latching it in position thereon during the movement of the tilt frame to and from its horizontal and forward tilted positions.

5. In a mobile charging machine for overhead charging solid material pieces such as metal scrap into an open mouth defined by a lip edge of a furnace wherein, the machine has a truck-mounted primary frame for movement into and out of forward alignment with the open mouth of the furnace, the primary frame has lower frame and upper frame parts, the upper frame part is integrally connected in an upwardly spaced and supported relation on the lower frame part, a lift frame is upwardly-removably carried on the upper frame part and has at least a pair of open compartments therein, at least a pair of tilt frames are operatively-positioned on the upper frame part within the open compartments of the lift frame, and at least a pair of scrap boxes are carried on the upper frame part in liftable association with the lift frame and in a forwardly tiltable relation with an associated one of the tilt frames, the improvement which comprises: pairs of swing mounts on a forward end portion of the lower frame part, one pair for each of the tilt frames; said pairs of swing mounts being in a spaced-apart relation with respect to each other along the lower frame part; each of said tilt frames having a pair of swing arms projecting substantially perpendicularly downwardly from a front end portion thereof and, at their lower ends, pivotally mounted on an associated pair of said swing mounts for movement to and from a substantial horizontal position on the upper frame part and a forwardly tilted position to move the associated scrap box to and from a substantial horizontal position and a forwardly tilted charging position with respect to the open mouth of the furnace, operating means carried by the primary frame part and connected to each of said tilt frames for swinging them and their associated scrap boxes between their horizontal and forwardly tilted positions; and wherein, the upper frame part has means for carrying each of the tilt frames in a horizontal position thereon, and the lift frame has a forwardly projecting downwardly inclined and cross-extending front end portion for limiting the maximum forward tilting movement of each of the tilt frames and for supporting a front end portion of each tilt frame thereon in its forwardly tilted position.

6. In a charging machine as defined in claim 5 wherein, each scrap box and its associated tilt frame are provided with cooperating means for retaining each scrap box in an aligned and latched relation with the associated tilt frame, said cooperating means permitting each scrap box when in its horizontal position to be lifted by the lift frame out of its latched relation with its associated tilt frame, supplemental means is carried by each of the tilt frames for positively latching it with its associated scrap box, said supplemental means is movable out of a latching relation when the associated scrap box is to be lifted out of position with respect to the tilt frame by the lift frame, and means is pivotally carried by the upper frame part for positively latching the lift frame thereon during movement of the tilt frames between their horizontal and forwardly tilted charging positions.

7. In a mobile machine as defined in claim 5 wherein a front pair of trunnions project sidewise outwardly from each scrap box and a lift pin is carried by the back end

of each scrap box centrally-backwardly thereof for receiving overhead crane hooks for tilting each scrap box independently of said operating means and for lifting each scrap box upwardly out of position on the upper frame part and for lowering it into position on the upper frame part independently of the lift frame.

8. In a mobile machine as defined in claim 5 wherein, said operating means comprises a pair of reciprocating fluid motors, one for each of the tilt frames, each fluid motor has an upwardly extending piston rod and is swingably mounted adjacent its lower end on the lower frame part to project upwardly therefrom, and means pivotally secures the upper end of the piston rod of each of said fluid motors substantially centrally to a back end portion of an associated tilt frame.

9. In a mobile machine as defined in claim 5 wherein, each scrap box has a forwardly projecting delivery chute portion as its front end projecting forwardly of its associated tilt frame and defining an angular under-portion with respect to the tilt frame to position the scrap box in its forwardly tilting charging position on a lower portion of the lip edge of the open mouth of the furnace vessel.

10. In a mobile machine as defined in claim 5 wherein, each electric motor means is carried by the lower frame part for actuating at least one of its trucks for moving the primary frame into and out of alignment with the furnace vessel, said operating means for the tilt frame is electric motor actuated, and a side-positioned upwardly extending mast is secured on the primary frame and has slide contact means for supplying electric current to said motors from an electric current source.

11. In an machine as defined in claim 10 wherein, a side-positioned arm is carried by the main frame, and an electrical control is suspended from said arm for controlling the operation of the motors from a side of the machine.

12. In a charging machine as defined in claim 1 wherein safety latch means is carried by the tilt frame to removably latch-engage with the scrap box for securely latching it in position thereon against inadvertent release of the scrap box when it is forwardly tilted into a charging position.

13. In a mobile charging machine for overhead charging solid material pieces such as metal scrap into an open mouth defined by a lip edge of a furnace wherein, the machine has a truck-mounted primary frame for movement into and out of forward alignment with the open mouth of the furnace, the primary frame has lower frame and upper frame parts, the upper frame part is integrally connected in an upwardly spaced and supported relation on the lower frame part, a lift frame is upwardly-removably carried on the upper frame part and has at least a pair of open compartments therein, at least a pair of tilt frames are operatively positioned on the upper frame part within the open compartments of the lift frame, and at least a pair of scrap boxes are carried on the upper frame

part in liftable association with the lift frame and in a forwardly tiltable relation with an associated one of the tilt frames, the improvement which comprises: pairs of swing mounts on a forward end portion of the lower frame part, one pair for each of the tilt frames; said pairs of swing mounts being in a spaced-apart relation with respect to each other along the lower frame part; each of said tilt frames having a pair of swing arms projecting substantially perpendicularly downwardly from a front end portion thereof and, at their lower ends, pivotally mounted on an associated pair of said swing mounts for movement to and from a substantial horizontal position on the upper frame part and a forwardly tilted position to move the associated scrap box to and from a substantial horizontal position and a forwardly tilted charging position with respect to the open mouth of the furnace, operating means carried by the primary frame part and connected to each of said tilt frames for swinging them and their associated scrap boxes between their horizontal and forwardly-tilted positions; and wherein, the lift frame has forward pairs of guide wings positioned adjacent front end portions of each of its compartments to receive a front end portion of each of the scrap boxes therebetween, a pair of backwardly positioned slotted guide wings are provided adjacent the back end of each compartment on the lift frame to receive a back end portion of each scrap box therebetween, each of the scrap boxes has a pair of outwardly projecting pins adapted to slidably downwardly fit within an associated pair of said slotted guide wings, each tilt frame has a pair of upwardly and outwardly projecting forwardly positioned guide wings to receive a forward end portion of an associated scrap box therebetween, a pair of backwardly positioned and slotted guide wings are provided adjacent the back end portion of each tilt frame for receiving a back end portion of an associated scrap box therebetween, each scrap box has a second pair of outwardly projecting pins adjacent its back end portion to slidably-downwardly fit with said pair of slotted guide wings of the associated tilt frame, the upper frame part has front and back pairs of upwardly projecting wings thereon for guidably receiving the lift frame and said back pair of wings has upwardly open slotted portions, and a pair of outwardly projecting pins extend from a back end portion of the lift frame and are adapted to engage within slotted portions of said back pair of wings of the upper frame part.

References Cited

UNITED STATES PATENTS

3,214,035 10/1965 Krause et al. ----- 214—18

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,421,640

January 14, 1969

Martin C. Falk

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 24, "at" should read -- a --; line 59, "frames" should read -- frame --. Column 4, line 38, "outward" should read -- outwardly --. Column 7, line 2, "frame" should read -- frames --; line 34, "forward" should read -- forwardly --; line 48, "titlable" should read -- tiltable --. Column 9, line 18, "as" should read -- at --; line 32, "an" should read -- a --.

Signed and sealed this 17th day of March 1970.

(SEAL)

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Commissioner of Patents