

Nov. 29, 1960

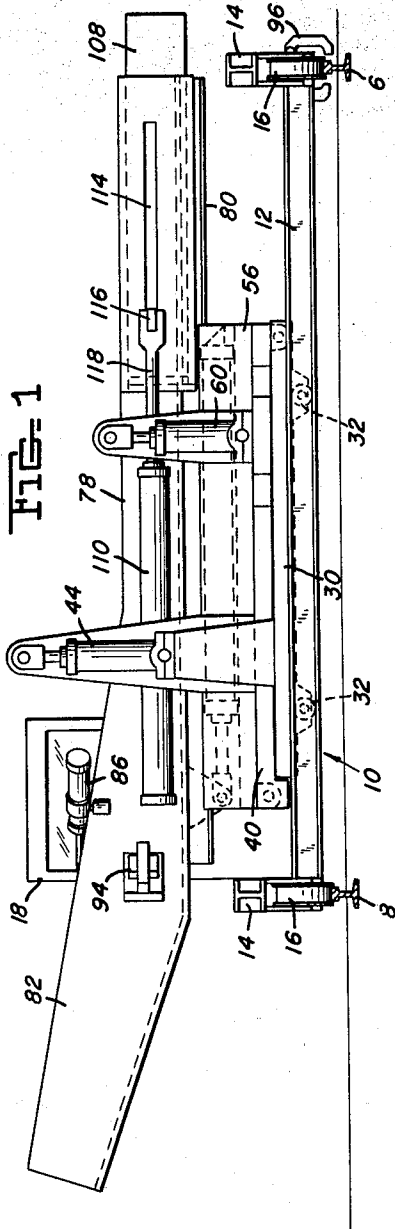
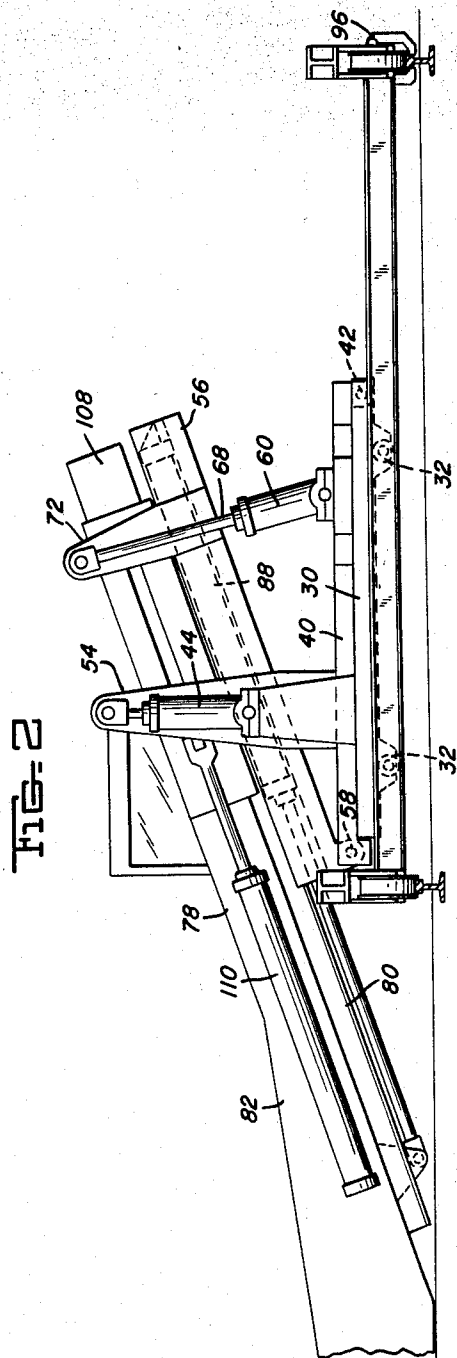
H. F. SHEKELS

2,962,174

APPARATUS FOR CHARGING OPEN HEARTH FURNACES

Filed Dec. 24, 1958

4 Sheets-Sheet 1



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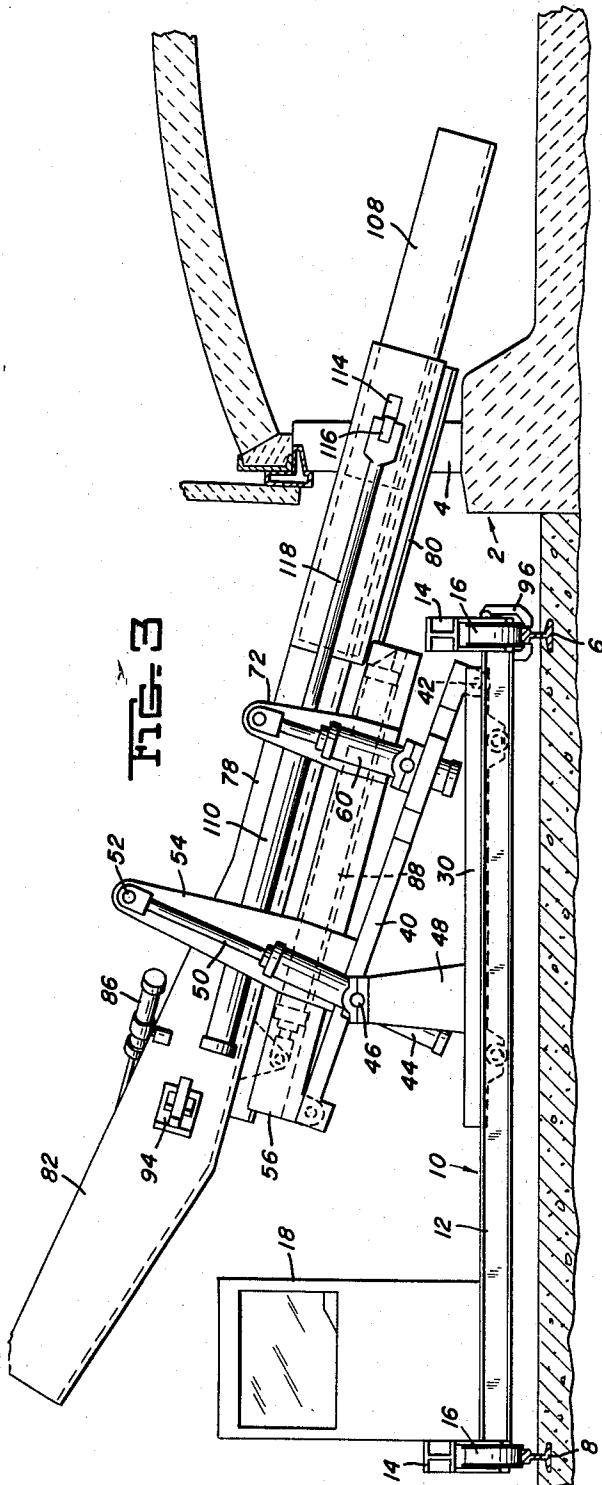
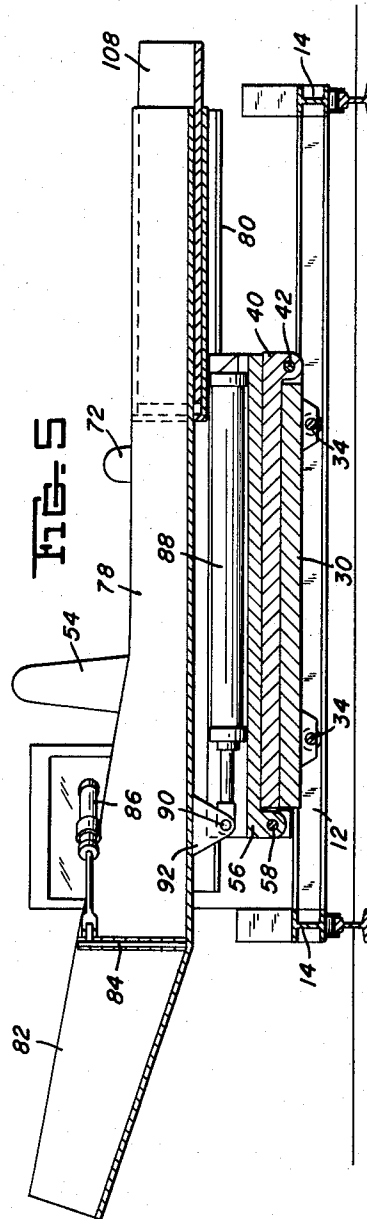
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4 Sheets-Sheet 2



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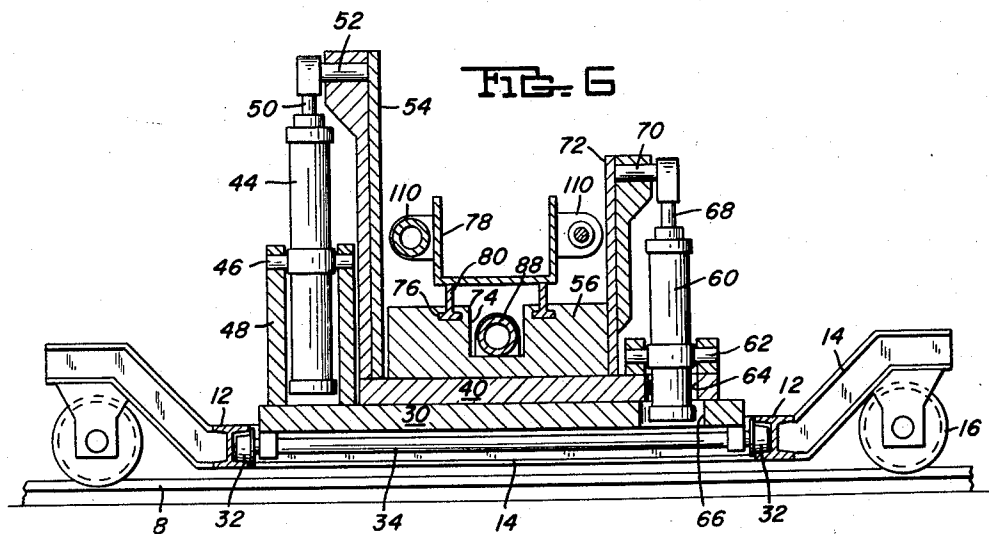
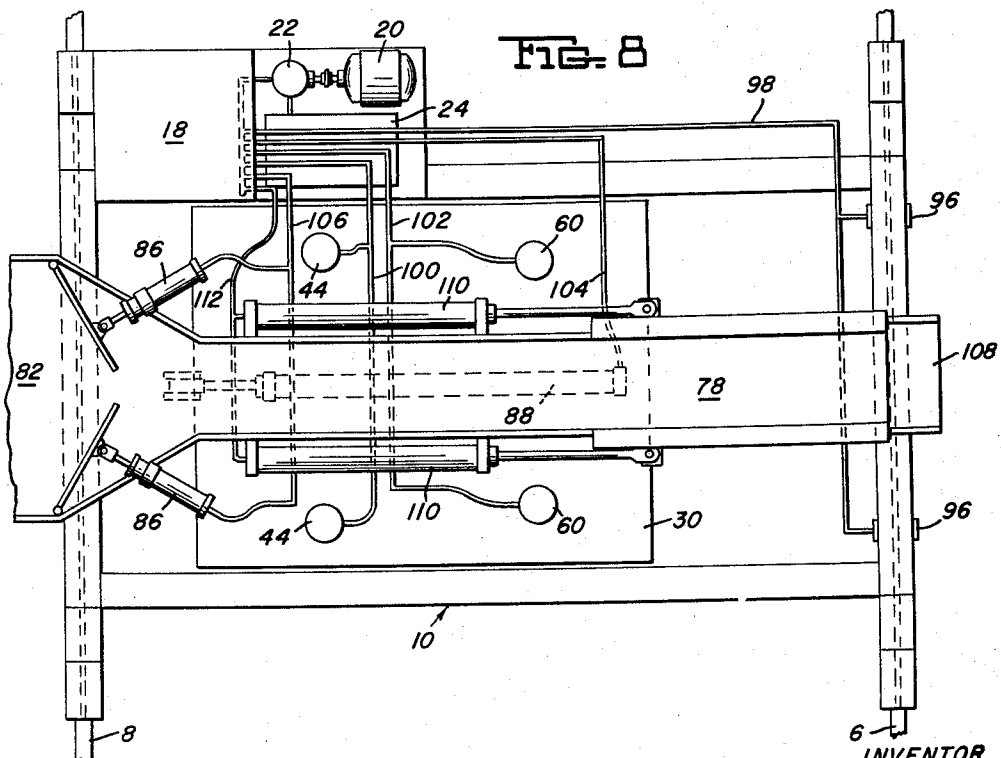
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APPARATUS FOR CHARGING OPEN HEARTH FURNACES

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4 Claims. (Cl. 214—18)

This invention relates to apparatus for charging furnaces and more particularly for charging scrap into an open hearth furnace. The most common way of charging scrap into an open hearth furnace at present is by moving charging buggies containing charging boxes in front of the furnace and then lifting the boxes from the buggies with a charging machine. The charging machine has a peel which engages a slot in the end of the charging box and lifts the box and inserts it through the doorway into the open hearth furnace. The peel then rotates about its axis to turn the box upside down and dump the scrap or other charge into the furnace. The box is then withdrawn from the furnace and replaced on the buggy. The charging machine is moved from one door to another until the charging of the scrap or cold metal is completed. The charging of scrap in this manner takes an unreasonably long time. For example, when charging sixty tons of scrap into a 145 ton furnace by the present method, approximately 1½ hours is required to complete the charge during which time the doors of the furnace are open while the charging machine maneuvers the string of charging buggies back and forth and charges the furnace. This cools the furnace and wastes fuel. Also, the buggies delay traffic into and out of the shop and block charging machine movements. They are frequently derailed, thus causing numerous delays. Iron and/or limestone are also charged into the open hearth in the same manner as the scrap or other cold charge. Because of the foregoing the time required to produce a heat of steel is unduly long.

It is therefore an object of my invention to provide apparatus for rapid charging of solids into an open hearth furnace.

Another object is to provide such apparatus which eliminates the need of trackbound charging machines and cars carrying charging boxes.

These and other objects will be more apparent after referring to the following specification and attached drawings, in which:

Figure 1 is a side elevation of the charging machine of my invention;

Figure 2 is a view, similar to Figure 1, showing the parts in a different position;

Figure 3 is a view, similar to Figure 1, but showing the parts in position for charging an open hearth furnace;

Figure 4 is a plan view of the machine as shown in Figure 1;

Figure 5 is a view taken on the line V—V of Figure 4;

Figure 6 is a view taken on the line VI—VI of Figure 4;

Figure 7 is a view taken on the line VII—VII of Figure 4; and

Figure 8 is a fragmentary plan view showing the hydraulic system.

Referring more particularly to the drawings, reference numeral 2 indicates a conventional open hearth

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furnace having a charging doorway 4 therein. Widely spaced rails 6 and 8 are arranged in front of the furnace generally parallel to the open hearth door. The apparatus of my invention includes a carriage 10 having longitudinal beams 12 connected by transverse beams 14. The transverse beams 14 support wheels 16 which ride on the rails 6 and 8. An operator's cab 18 is mounted on the carriage 10 and extends to the outboard side of one of the beams 12. A motor 20, a pump 22 operated thereby, and a reservoir 24 are also mounted on the carriage 10 adjacent the cab 18. Electric and hydraulic control panels (not shown) are also mounted in the cab 18. A bridge 30 is mounted on the carriage 10 for movement toward and away from the door 4. Pairs of wheels 32 connected by shafts 34 are supported by the bridge 30 with the wheels 32 being received between the flanges of the beams 12. At least one of the shafts 34 is driven by a motor 36 through gearing 38 (Figure 4) to propel the bridge 30 toward and away from the door 4. A first lifting platform 40 is pivotally mounted on the bridge 30 by means of a pivot connection 42 at the furnace end of the bridge 30. The lifting platform 40 is moved about the horizontal pivot connection 42 by means of a pair of lifting cylinders 44 which are pivotally supported by means of pins 46 on brackets 48 which in turn are supported on the bridge 30. Piston rod 50 of each cylinder 44 is connected by means of a pin 52 to an arm 54 attached to the lifting platform 40. A second lifting platform 56 is pivotally connected by means of a pivot connection 58 to the end of lifting platform 40 remote from the furnace. The second lifting platform 56 is pivoted around horizontal pivot connection 58 by means of a pair of cylinders 60. Each of the cylinders 60 is pivotally connected to platform 40 by means of pin 62. Elongated recesses 64 and 66 are provided in lifting platform 40 and bridge 30, respectively, to permit installation and operation of cylinders 60. The piston rod 68 of each cylinder 60 is connected by means of a pin 70 to an arm 72 connected to the lifting platform 56. As best shown in Figure 6, the lifting platform 56 has a longitudinal recess 74 therein located between two longitudinal T-shaped recesses 76. A chute 78 is connected to platform 56 by means of T-shape rails 80 received in openings 76. A large hopper 82 is connected to the end of chute 78 remote from the furnace 2. Pivoted doors 84 are provided between the chute 78 and hopper 82 and are operated by cylinders 86 pivotally mounted on chute 78. A cylinder 88 in recess 74 is pivotally connected to hopper 82 by means of a pin 90 passing through a support bracket 92 which is attached to the underside of chute 78 adjacent one end thereof. The other end of cylinder 88 is rigidly connected to lifting platform 56. Syntrol vibrators 94 are mounted on the chute 78 as shown in Figure 4 and in other locations found desirable. Rail clamps 96 are mounted on the carriage 10 for grasping the rail 6. The rail clamps may be of any suitable type such as shown in Snow Patent No. 2,856,030, dated October 14, 1958 and consists generally of two arms operable by a hydraulic cylinder (not shown). The cylinder is connected through hydraulic lines 98 to pump 22. The cylinders 44 are operated by fluid from pump 22 through flexible conduits 100. Fluid from pump 22 is delivered to cylinders 60 through flexible conduits 102. Fluid from pump 22 is delivered to the cylinder 88 through flexible connection 104 and to cylinders 86 through flexible connections 106.

In some open hearth shops where the width of the charging floor is limited, restrictions in the overall length of the open hearth charging device requires the use of an extensible chute in order to reach the rear of the furnace.

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As best shown in Figures 4 and 7, this is done by making the main chute 78 double walled with an opening 107 therebetween for receiving a chute section 108. Cylinders 110 are also mounted on the main chute section 78 and fluid is provided thereto from pump 22 through flexible connection 112. Longitudinal slots 114 are provided in the outer wall of chute 78 and lateral extension 116 from each piston rod 118 passes through each slot 114 and is attached to chute section 108. It will be noted that suitable valves and switches (not shown) will be provided for operating the various electric and hydraulic motors, these forming no part of the present invention.

In operation, carriage 10 is moved along tracks 6 and 8 until it is positioned in front of one of the doors 4 of the open hearth to be charged. Rail clamps 96 are then actuated to clamp the machine to the rail 6 and prevent vertical movement of the carriage 10. Bridge 30 is then moved away from the furnace 2 by motor 36 and gearing 38. The cylinders 44, 60 and 88 are then actuated so as to move the chute 78 and hopper 82 to the position shown in Figure 2 with the hopper 82 resting on the floor. Large quantities of prepared scrap or other furnace additions are then dumped into the hopper 82 by any suitable equipment such as a truck, not shown. Cylinders 44, 60 and 88 are again actuated to bring the hopper 82 and chute 78 to a horizontal position on bridge 30 as shown in Figure 1. The bridge 30 is then moved forwardly toward the furnace 2 by means of motor 36 with the forward end of the chute extending into the furnace 2. The cylinders 44, 60 and 88 are then actuated to move the chute 78 into the furnace with the rearward end of the chute being elevated as shown in Figure 3. If an extension 108 is necessary it will have been moved forwardly by means of cylinders 110 as shown. Thus, regardless of whether an extensible or non-extensible chute is used the forward end of the chute will be positioned adjacent the bottom and back of the furnace. The doors 84 are then opened by means of cylinders 86 and the vibrators 94 are actuated so that the scrap is charged into the furnace. The chute 78 is gradually withdrawn until the hopper 82 is emptied and that portion of the furnace fed through the door 4 is charged. The chute 78 is then returned to a horizontal position on the bridge 30, the rail clamps 96 are released and the carriage 10 is moved along tracks 6 and 8 to the next furnace door where the charging operation is repeated. This operation is repeated until the furnace is completely charged.

While one embodiment of my invention has been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. Apparatus for charging an open hearth furnace through a door thereof which comprises a carriage movable in a path generally parallel to the open hearth door, a bridge mounted on said carriage for movement toward and away from said door, a first lifting platform, means pivotally mounting said first lifting platform on one end of said bridge for movement about a generally horizontal axis, means for raising and lowering said first lifting platform about its pivot, a second lifting platform, means pivotally mounting said second lifting platform on the end of said first lifting platform remote from said first named means for movement about a generally horizontal axis, means for raising and lowering said second lifting platform about its pivot and a chute mounted on said second lifting platform for movement toward and away from said door.

2. Apparatus for charging an open hearth furnace through a door thereof which comprises a carriage movable in a path generally parallel to the open hearth door, a bridge mounted on said carriage for movement toward

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and away from said door, a first lifting platform, means on said bridge at the end adjacent said furnace for pivotally mounting said first lifting platform for movement about a generally horizontal axis, means on said bridge at a point remote from said first means for raising and lowering said first lifting platform about said first means, a second lifting platform, means on said first named lifting platform at the end remote from said furnace for pivotally mounting said second lifting platform for movement about a generally horizontal axis, means on said first lifting platform at a point remote from said last named means for raising and lowering said second lifting platform about said last named means, a chute mounted on said second lifting platform for movement toward and away from said door, and means on said second lifting platform for moving said chute toward and away from said door.

3. Apparatus for charging an open hearth furnace through a door thereof which comprises a carriage movable in a path generally parallel to the open hearth door, a bridge mounted on said carriage for movement toward and away from said door, a first lifting platform, means pivotally mounting said first lifting platform on one end of said bridge for movement about a generally horizontal axis, a second lifting platform, means pivotally mounting said second lifting platform on the end of said first lifting platform remote from said first named means for movement about a generally horizontal axis, a chute mounted on said second lifting platform for movement toward and away from said door, said chute having a hopper attached thereto at the end thereof remote from said furnace door for receiving solids for charging into said furnace, and movable closure means between said chute and hopper.

4. Apparatus for charging an open hearth furnace through a door thereof which comprises a carriage movable in a path generally parallel to the open hearth door, a bridge mounted on said carriage for movement toward and away from said door, a first lifting platform, means on said bridge at the end adjacent said furnace for pivotally mounting said first lifting platform for movement about a generally horizontal axis, means on said bridge at a point remote from said first means for raising and lowering said first lifting platform about said first means, a second lifting platform, means on said first named lifting platform at the end remote from said furnace for pivotally mounting said second lifting platform for movement about a generally horizontal axis, means on said first lifting platform at a point remote from said last named means for raising and lowering said second lifting platform about said last named means, a chute mounted on said second lifting platform for movement toward and away from said door, said chute having a hopper attached thereto at the end thereof remote from said furnace door for receiving solids for charging into said furnace, a movable closure means between said chute and hopper, and means on said second lifting platform for moving said chute toward and away from said door.

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