

July 17, 1923.

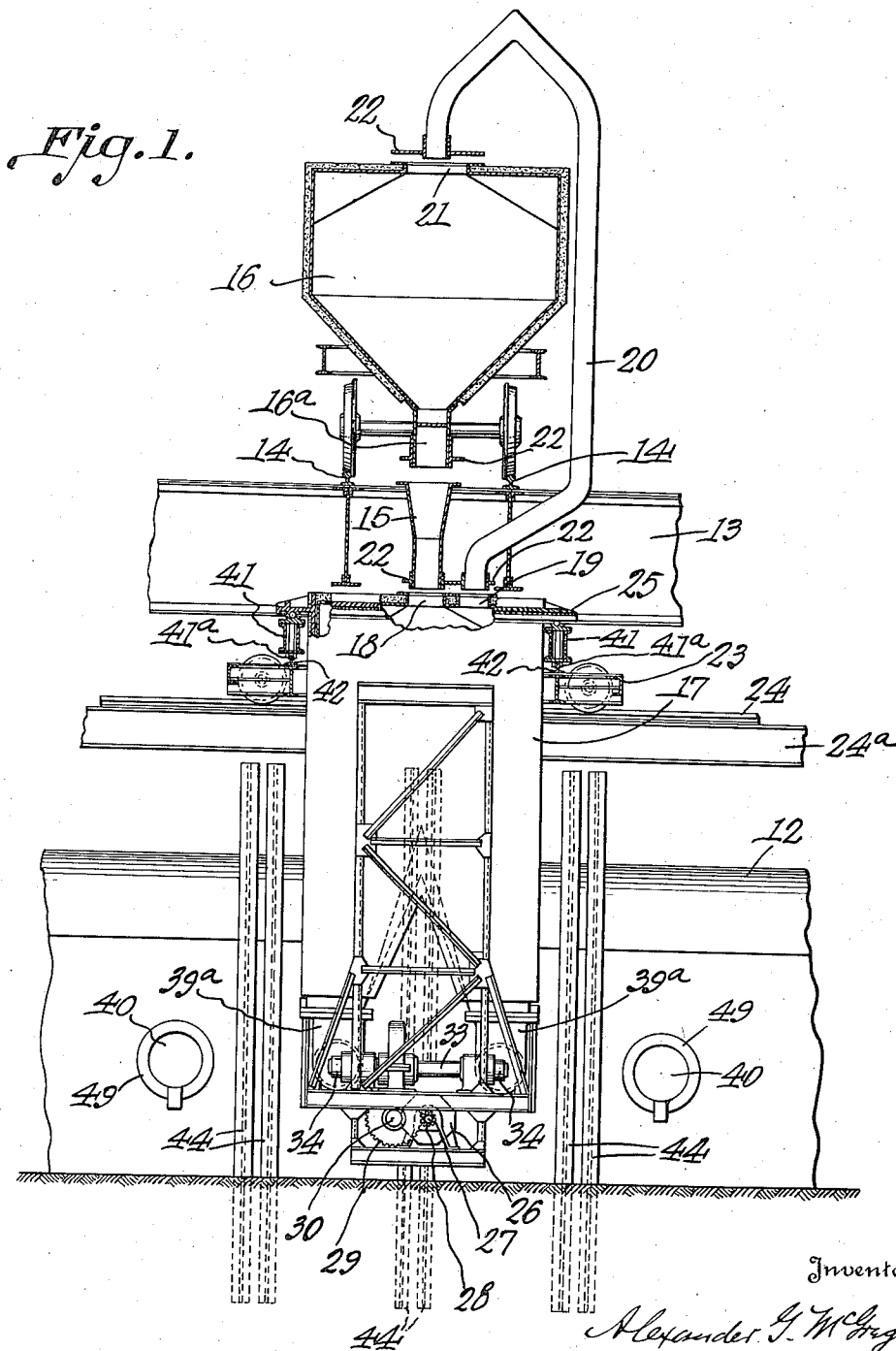
1,461,801

A. G. MCGREGOR

APPARATUS FOR CHARGING REVERBERATORY FURNACES

Filed Jan. 9, 1922

3 Sheets-Sheet 1



Inventor:

Alexander G. McGregor

By

Charles H. Hattis

Attorneys

July 17, 1923.

A. G. MCGREGOR

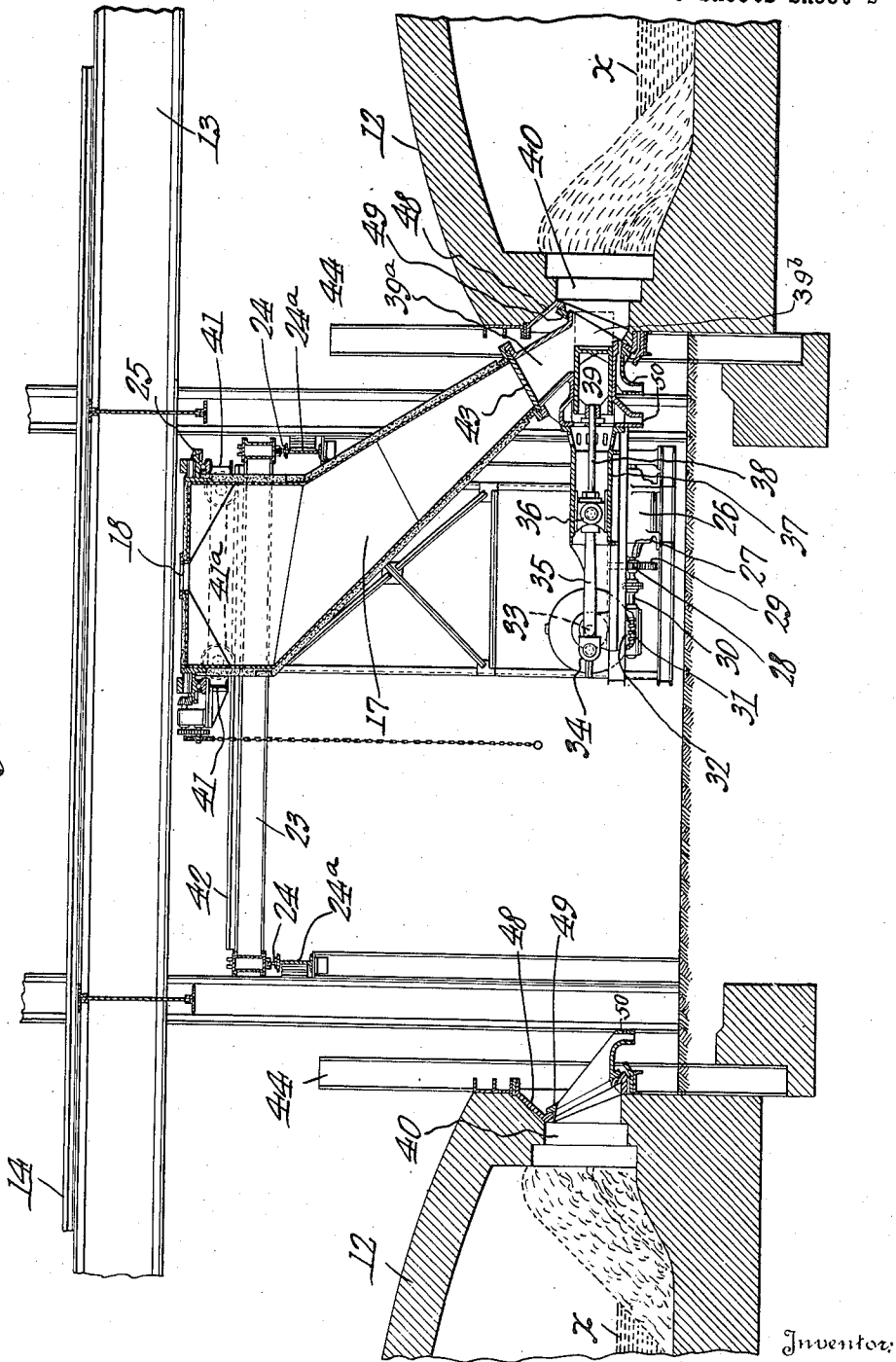
1,461,801

APPARATUS FOR CHARGING REVERBERATORY FURNACES

Filed Jan. 9, 1922

3 Sheets-Sheet 2

Fig. 2.



Inventor:
Alexander G. McGregor,
By Robert Kalvin,
Attorney.

July 17, 1923.

1,461,801

A. G. MCGREGOR

APPARATUS FOR CHARGING REVERBERATORY FURNACES

Filed Jan. 9, 1922

3 Sheets-Sheet 3

Fig. 3.

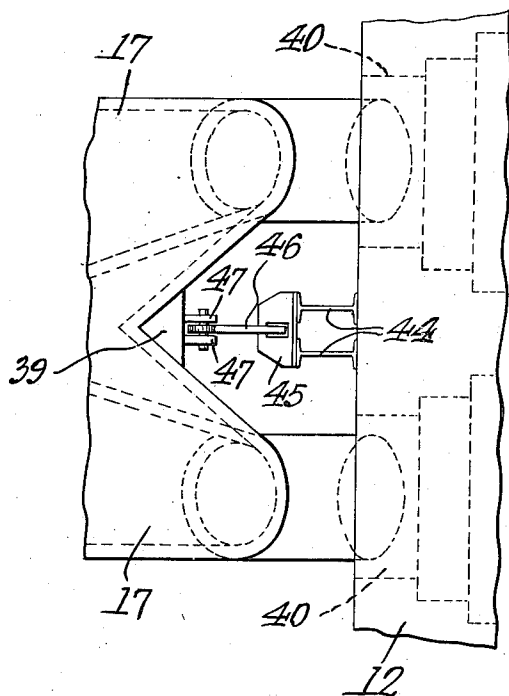
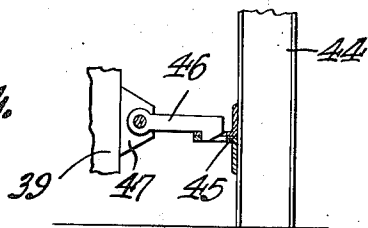


Fig. 4.



Inventor:

Alexander G. McGregor

By

Robert Taylor

Attorneys

Patented July 17, 1923.

1,461,801

UNITED STATES PATENT OFFICE.

ALEXANDER GRANT MCGREGOR, OF WARREN, ARIZONA.

APPARATUS FOR CHARGING REVERBERATORY FURNACES.

Application filed January 9, 1922. Serial No. 527,987.

To all whom it may concern:

Be it known that I, ALEXANDER G. MCGREGOR, a citizen of the United States, residing at Warren, in the county of Cochise and State of Arizona, have invented or discovered certain new and useful Improvements in Apparatus for Charging Reverberatory Furnaces, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to apparatus for charging reverberatory furnaces and which is intended to obviate certain difficulties heretofore existing, as set forth in my application Serial No. 420,645, filed October 30, 1920, the present invention having for its object to provide certain improvements on the apparatus described in my said application whereby the furnaces are charged through openings in the side walls thereof in such a manner as to deposit the charges inside the furnace walls just above the slag line, so that in each instance the new charge is pushed in back of and beneath the previous charge with the result that the charges advance from the side walls of the furnace step by step growing hotter as they advance until they finally become exposed to the intense heat of the furnaces and are smelted down and dissolved in the molten bath of the furnace, as fully set forth in my said application.

In the accompanying drawings Fig. 1 is a sectional elevation of an apparatus embodying the present invention, and Fig. 2 is a sectional view, taken at right angles to Fig. 1, of the apparatus shown in the lower part of Fig. 1, together with fragmentary sectional views of two furnaces between which the apparatus is located. Fig. 3 is a detail plan and Fig. 4 a detail elevation or side view illustrating means for holding the charging carriage in place during a charging operation.

Referring to the drawings, two reverberatory furnaces 12 are fragmentarily shown in Fig. 2. 13 denotes an elevated support for tracks 14 on which a calcine car, comprising a suitable hopper, may run. The support 13 will, in practice, be provided with a series of chutes 15 with one of which the discharge spout 16^a of the calcine car hopper 16 may be brought into register when the charging hopper 17 is to be filled from the calcine car, said hopper 17 having at its top an opening 18 which will be brought beneath and into

register with a chute 15. The hopper 17 is also provided with a vent opening 19 which will be brought into register with the lower end of a vent pipe 20 the upper end of which is turned down so as to register with an opening 21 in the top of the calcine car hopper when the contents of the latter are to be discharged, the said vent pipe 20 being, it is understood, mounted on and stationary with the support 13. The escape of dust, when the hopper 17 is being charged, will be prevented by flanged sleeves 22 at the upper and lower ends of the vent pipe 20 and also on the discharge spout 16^a of the hopper 16, and the lower end of the chute 15, these sleeves being at this time lowered so that the flanges thereof rest on the parts beneath them. The dust escaping from the charging hopper 17, when the latter is being filled from the calcined car, will be returned to the calcined car hopper 16 through the vent pipe 20, as will be understood.

The charging hopper 17 is indirectly supported by a crane bridge 23 having wheels 23^a adapted to run on tracks 24 extending parallel to the furnace walls and resting on girders or beams 24^a, said crane bridge supporting a turn table device 25 from which the hopper 17 is suspended in such a manner that the charging machine may be partially rotated so as to be adapted to charge two furnaces which are located opposite each other.

The apparatus thus far described is similar to that set forth in my application No. 420,645, hereinbefore referred to, and the present improvement relates more particularly to the means for positively forcing the charges from the hopper 17 into the furnaces. Suitably supported beneath the hopper 17 is an electric motor 26 having a shaft 27 on which is mounted a pinion 28 meshing with a gear wheel 29 on a shaft 30 carrying a worm 31 meshing with a worm wheel 32 on a shaft 33 provided with cranks 34. The cranks 34 are connected by pitmen 35 to slides 36 to which the said pitmen are jointed and which slides 36 work in suitable guideways 37. To the slides 36 are connected rods 38 which operate plungers 39 working in suitable guideways in a discharging casting 39^a which is formed at its top with openings communicating with the openings or discharge mouths at the lower end of the charging hopper 17.

The side walls of the furnaces 12 are pro-

vided with inwardly enlarged and preferably stepped openings 40, the lower edges of the outer parts of which are preferably about on a level with or only slightly above the slag line α of the furnace to be charged, and when the charging operation is to be performed the crane bridge 23, supporting the charging hopper 17, is moved along on the tracks 24 so as to bring the plungers 39 into register with the said openings 40 in the side walls of the furnaces. The charging hopper 17 is supported directly by the turntable 25 mounted on a charging carriage 41 having wheels 41^a adapted to run on tracks 42 mounted on the crane bridge 23 and extending at right angles to the tracks 24, so that the said hopper-supporting and charging carriage and other parts connected therewith may be moved toward and from the furnaces on the said tracks 42. Thus after the plungers 29 have been brought into register with the openings 40 in the side walls of a furnace the carriage 41 and the charging hopper and other parts supported therefrom will be moved toward a furnace wall on the said tracks 42 so as to bring the lower end of the charging hopper close to the wall of the furnace to be charged, as shown in Fig. 2. The motor 26 will then be thrown into operation and, through the reducing gearing hereinbefore described, will operate the cranks 34 which will in turn move the plungers 39 back and forth, thereby forcing the successive charges, in the form of blocks or plugs through the said openings 40 in the side walls of the furnace. When the hopper is to be moved from one set of openings 40 to another the plungers 39 will be moved forward to the position denoted by dotted lines in Fig. 2 so as to close the chutes or openings in the casting 39^a and which chutes or openings communicate with the discharge mouths of the charging hopper 17, so that no material will be wasted when the carriage is shifted from one charging position to another. The casting 39^a is preferably provided with a sliding gate 43 which may be closed when it is desired to prevent the calcine from passing down into the chutes in said casting.

Of course when a charging operation is occurring it is necessary to provide some means for holding the charging carriage in place against the furnace in opposition to the thrust of the charging plungers 39, and this may be done by any suitable means. A simple holding device by which the charging carriage may be anchored in charging position is shown in Figs. 3 and 4. Attached to the buck-stays 44 of the furnace is a catch 45 adapted to be engaged by a hook or latch 46 pivotally mounted on ears 47 on the casting 39. Thus when the charging carriage 41 is moved on the tracks 42 toward the furnace 12 to charging position the hook or

latch 46 will engage the catch 45, by gravity, and thus anchor the charging carriage in place for the charging operation.

When the furnace is sufficiently charged at one point the holding device or anchor for the charging carriage will be released, the carriage moved backward on the tracks 42 far enough to remove the discharging parts of the casting 39^a from the stationary parts on the furnace, and the bridge crane 23 will be moved along on the tracks 24, parallel with the furnace wall, to bring the charging machine to a new charging position opposite other openings 40 in the furnace wall, and the charging operation just described will be repeated. When the entire side of a furnace has been charged the turntable supporting charging machine may be given a half revolution to bring the parts in position for charging an oppositely located furnace.

Mounted on the side wall of the furnace is a plate or casting 48 having openings registering with the openings 40 in the said side wall, the said plate or casting having an outward slope downwardly. Attached to said plate or casting 48, preferably by bolts passing through slots permitting adjustment, is a second sloping plate or casting 49 also having openings registering with the openings in said plate or casting 48. The plate or casting 49 may be so adjusted, when being attached in place, that its openings will register properly with the discharge mouths of the casting 39^a. The discharge end portion of the casting 39^a, in which the plungers 39 work, is formed sloping, corresponding to the outwardly and downwardly sloping parts of the plates or castings 48 and 49, said lower end of said casting 39^a being entered into the openings in the said plates or castings 48 and 49 when the charging machine is in charging position against the furnace wall.

The faces of the castings 48 and the recessed faces of castings 49, as also the discharge ends of castings 39^a are sloped outward downwardly. The slope of these parts corresponds approximately to the repose angle of the charge material, so that when the charging machine is withdrawn from the furnace only a little, if any, of the charge material will fall back toward the outside of the furnace and none will fall outside of the lower part of casting 49.

The passageways or openings 40 in the furnace walls between the plungers and the inside of the furnace, for the charge material, increase in cross sectional area toward the inside of the furnace. This greatly reduces the frictional resistance to the movement of the charges from the plungers to the inside of the furnace, compared with what it would be if the inside diameters of the charge openings 40 in the furnace wall were uniform throughout and only a little

larger than the outside diameter of the discharge ends of castings 39^a.

From the foregoing it will be understood that the present invention comprises means whereby successive charges in the forms of comparatively thin blocks or plugs of calcine or other powdered material may be successively forced into the openings in the side walls of reverberatory furnaces in a low down position, so that each new charge will be forced beneath and back of the previous charge and the material to be smelted will thus accumulate against the side walls of the furnace in such a manner as to protect the same, while the material first charged into the furnace will be subjected to the greatest heat and the succeeding charges will be successively heated, as hereinbefore stated.

Any surplus dust in the plunger chambers or casing 39^a will be discharged through the spouts 50 into any suitable receptacles or bags, and thus be saved.

Having thus described my invention I claim and desire to secure by Letters Patent:

1. The combination with a reverberatory furnace the side walls of which are provided with charging holes located down near the slag line of the molten material, of a travelling charging machine comprising a hopper for the material to be entered into the furnace, a motor mounted on said machine to travel therewith, a charging member communicating at its top with the chamber of said hopper, one of more plungers working in said charging member, said connecting operating mechanism comprising a shaft operated by said motor, a second shaft geared to the motor shaft and provided with a worm, a crank shaft having a worm-wheel meshing with said worm, and one or more cranks connected with said plunger or plungers.

2. The combination with a reverberatory furnace the side walls of which are provided with charging holes down near the slag line of the molten material, of a sloping plate mounted on the furnace wall and having openings registering with the openings in said wall, a hopper for the material, a discharging member or casting having a chamber communicating with said hopper and having a discharge mouth which is formed sloping to correspond to said plate, one or more plungers working in said discharging member, and means for operating said plunger or plungers.

3. The combination with a reverberatory furnace the side walls of which are provided with charging holes down near the slag line of the molten material, of a sloping plate mounted on the furnace wall and having openings registering with the openings in said wall, a hopper for the material, a discharging member having a chamber com-

municating with said hopper and having a discharge mouth which is formed sloping to correspond to said plate, one or more plungers working in said discharging member, means for operating said plunger or plungers, and a movable carriage on which said hopper, discharging member, plunger or plungers and operating means are mounted.

4. The combination with a reverberatory furnace the side walls of which are provided with charging holes down near the slag line of the molten material, of a sloping plate mounted on the furnace wall and having openings registering with the openings in said wall, a hopper for the material, a discharging member having a chamber communicating with said hopper and having a discharge mouth which is formed sloping to correspond to said plate, one or more plungers working in said discharging member, means for operating said plunger or plungers, a movable carriage on which said hopper, discharging member, plunger or plungers and operating means are mounted, and a turn-table on said carriage supporting said hopper, discharging member, plunger or plungers and operating mechanism, so that when one side of a furnace has been charged the charging machine as a whole may be turned about to charge an oppositely placed furnace.

5. A reverberatory furnace having down near the slag line inwardly enlarged stepped openings in its side wall, combined with a charging machine comprising one or more reciprocating plungers for forcing material through said openings into the furnace chamber, and means for operating said plunger or plungers.

6. A reverberatory furnace having down near the slag line inwardly enlarged stepped openings in its side wall, combined with a charging machine comprising one or more reciprocating plungers for forcing material through said openings into the furnace chamber, means for operating said plunger or plungers, and a movable carriage on which said charging machine is mounted.

7. The combination with a reverberatory furnace having openings in its side wall down near the slag line, of a plunger or plungers, a plunger casing having one or more chambers in which said plunger or plungers work, said chamber or chambers opening into a discharge mouth or mouths progressively enlarged towards the furnace, said openings in the furnace wall being progressively enlarged inwardly or towards the chamber of the furnace, and means for operating said plunger or plungers.

8. The combination with a reverberatory furnace having openings in its side wall down near the slag line, of a plunger or plungers, a plunger casing having one or more chambers in which said plunger or

- plungers work, said chamber or chambers opening into a discharge mouth or mouths progressively enlarged towards the furnace, a hopper surmounting said plunger casing and communicating with the latter, said openings in the furnace wall being progressively enlarged inwardly or towards the chamber of the furnace, and means for operating said plunger or plungers.
9. The combination with a reverberatory furnace having openings in its side wall down near the slag line, of a plunger or plungers, a plunger casing having one or more members in which said plunger or plungers work, said chamber or chambers opening into a discharge mouth or mouths progressively enlarged towards the furnace, said openings in the furnace wall being progressively enlarged inwardly or towards the chamber of the furnace, and means for operating said plunger or plungers, the discharge mouth or mouths being materially larger in diameter than the plunger chamber or chambers, and the smaller parts of the said openings in the furnace wall being materially larger than the said discharge mouth or mouths.
10. The combination with a reverberatory furnace having openings in its side wall down near the slag line, of a plunger or plungers, a plunger casing having one or more chambers in which said plunger or plungers work, said chamber or chambers opening into a discharge mouth or mouths progressively enlarged towards the furnace, a hopper surmounting said plunger casing and communicating with the latter, said openings in the furnace wall being progressively enlarged inwardly or towards the chamber of the furnace, and means for operating said plunger or plungers, the discharge mouth or mouths being materially larger in diameter than the plunger chamber or chambers, and the smaller parts of the said openings in the furnace wall being materially larger than the said discharge mouth or mouths.
- In testimony whereof I affix my signature.
- ALEXANDER GRANT MCGREGOR.