

March 24, 1931.

T. D. STAY ET AL
METAL RECOVERING FURNACE

1,797,276

Filed June 25, 1926

3 Sheets-Sheet 1

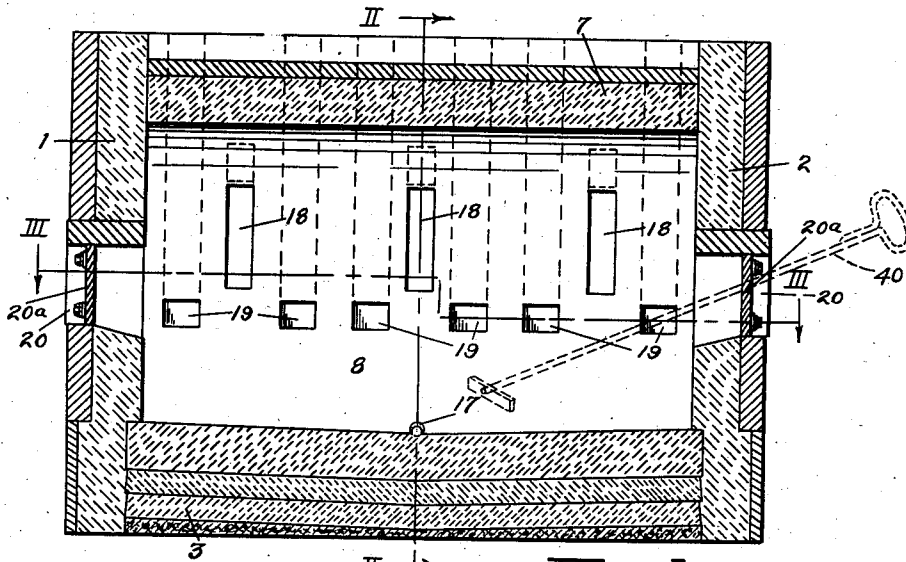


FIG. I

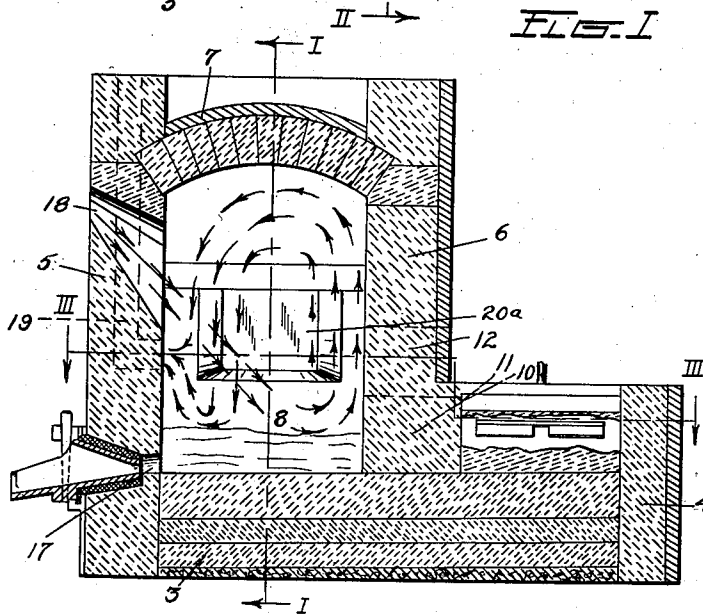


FIG. 2

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3 Sheets-Sheet 2

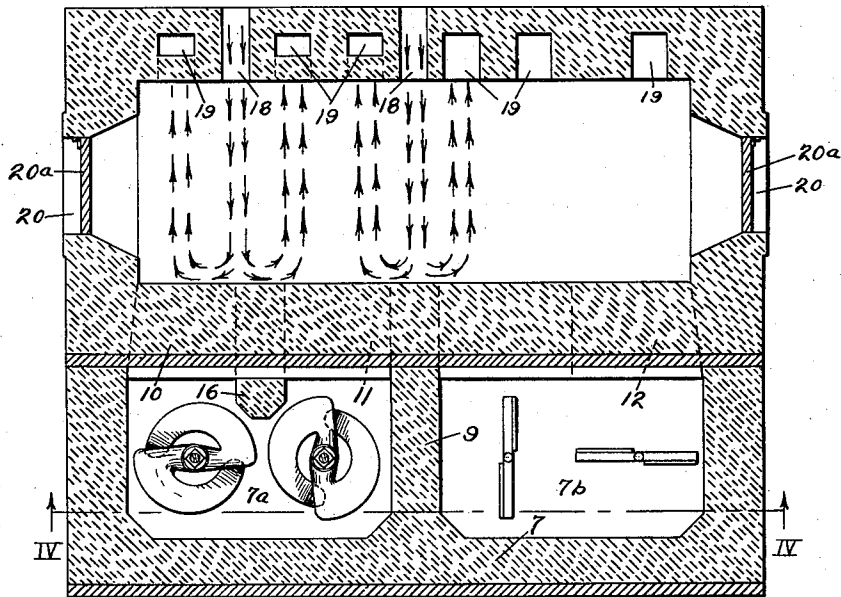


FIG. 3

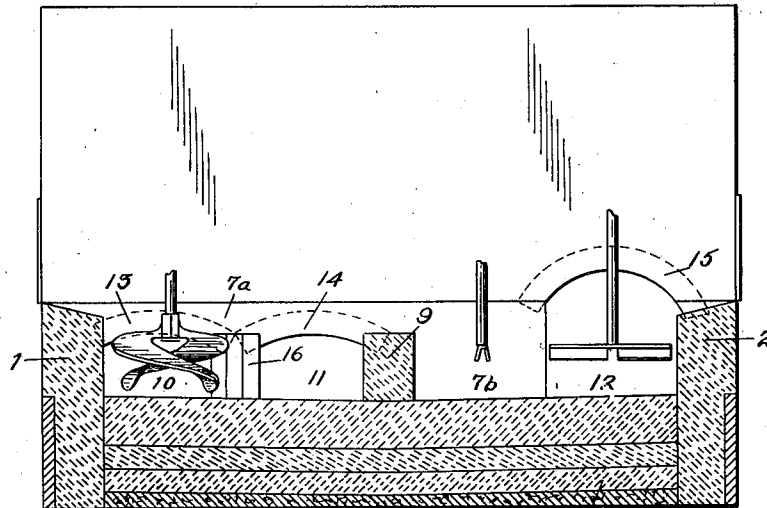


FIG. 4

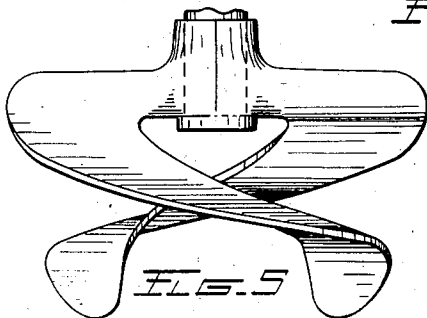


FIG. 5

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3 Sheets-Sheet 3

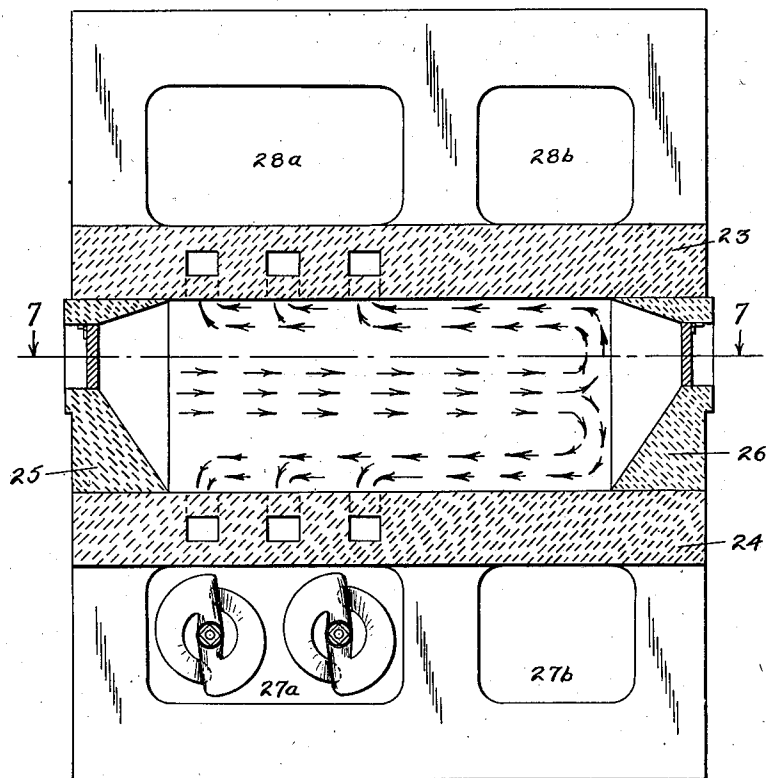


FIG. 6

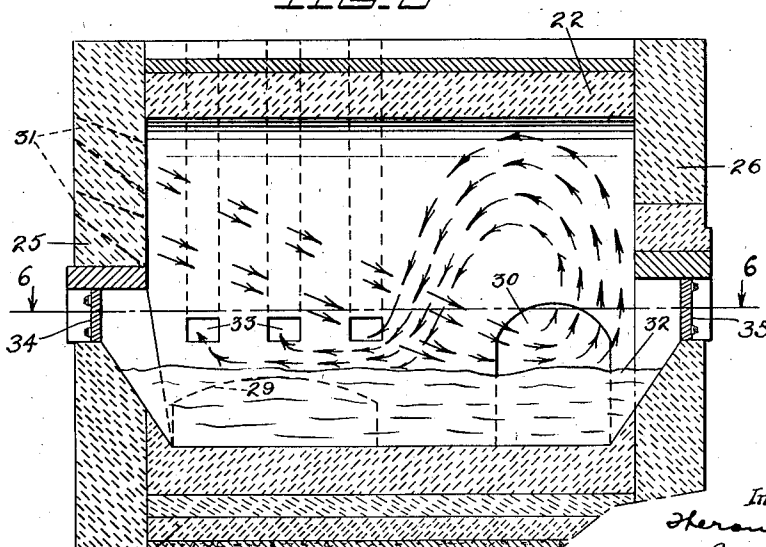


FIG. 7

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UNITED STATES PATENT OFFICE

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METAL-RECOVERING FURNACE

Application filed June 25, 1926. Serial No. 118,504.

This invention relates to a method of and apparatus for reclaiming scrap metals.

It is particularly suitable for reclaiming metals which are readily oxidizable or subject to other chemical change at high temperatures.

One object of the invention is to provide an improved process which will reclaim scrap metal and prevent any substantial loss of the metal due to oxidation.

Another object is to provide a process for reclaiming scrap metal which can be carried on continuously.

Another object is to provide an apparatus for performing the improved process which will be simple in construction, efficient in operation and economical of floor space, fuel and labor.

Other objects will hereinafter appear.

The invention contemplates a furnace in which metal scrap may be melted and separated from dross and from which the reclaimed metal will be delivered ready for use.

The invention will be better understood from the description of one practicable embodiment of the apparatus, which is illustrated in the accompanying drawings, in which,

Fig. 1 is a cross section of the rear part of the furnace.

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

Fig. 3 is a plan view thereof, partly in section, taken on line 3—3 of Fig. 1.

Fig. 4 is a front elevation, partly in section, taken on line 4—4 of Fig. 3.

Fig. 5 is a view of one of the stirrers.

Fig. 6 is a plan view, partly in section of a modified form of furnace taken on line 6—6 of Fig. 7, and,

Fig. 7 is a vertical section taken on line 7—7 of Fig. 6.

The furnace shown comprises ends 1 and 2, a bottom 3, a front wall 4, a rear wall 5, a wall 6 intermediate the front and rear walls and substantially parallel to them, and a main top arch 7.

These parts form a shallow open trough between the front and intermediate walls and a higher, enclosed chamber 8 between the

rear and intermediate walls. The trough is divided into two compartments 7a and 7b hereinafter called the submerging and skimming compartments, respectively, by a wall 9 and these compartments communicate with the chamber through openings 10, 11 and 12, shown as provided with arched tops 13, 14 and 15. The adjacent ends of arches 13 and 14 are supported by a pier 16, the end of which projects slightly into the submerging compartment as shown.

In the compartments may be rotatable stirrers, shown in Figs. 1 to 4, as two on each compartment, the construction and operation of which will be hereinafter described.

The bottom of the furnace is nearly level, but slopes upward slightly from the tap 17 which extends through the rear wall, so that when the furnace contains molten metal, part or all of this metal may be drawn out through the tap. The rear wall is also provided with openings or ports 18 through which jets of flame may be directed upon the contents of the lower part of the furnace in the manner of a reverberatory furnace and with vents 19 for the escape of gaseous products of combustion from a short distance above the surface of the metal. These gases circulate in substantially the manner indicated by the arrows and impinge twice upon the surface of the metal and sweep around the entire inner wall of the furnace. The ends are provided with openings 20 giving access to the enclosed chamber above the bottom thereof and these openings are closed by doors 20a.

The stirrers in the submerging compartment comprise helically shaped arms terminating in downwardly and outwardly inclined tips and are substantially the same as those shown in Patent No. 1,630,301 of May 31, 1927, filed October 28, 1921. These stirrers throw the fluid in which they revolve downward and then outward, maintaining a vortex about the stirrer.

The stirrers in the skimming compartment comprise radially extending flat arms slightly inclined to the axes of the shafts by which they are carried and rotate just above the surface of the molten metal.

The operation of the apparatus is as follows:

The lower part of the furnace is partly filled, preferably to a level slightly above the tops of openings 10 and 11 with molten metal, which is kept in the molten state by jets of flame directed through ports 18 and which is free to flow between the heating chamber and either compartment of the tank and thus maintain its level throughout the apparatus. Both sets of stirrers are rotated continuously by any desired source of power. Those of the submerging compartment create vortices and downward currents as above stated, and those of the skimming compartment, just above the top of the metal bath, throw the floating dross upwardly.

Scrap metal is fed into the submerging compartment and is immediately carried under the surface of the metal by the down currents at the stirrers. This prevents oxidation of small particles of the scrap metal which would occur if it were melted while exposed to the air. The down currents retain the scrap below the surface long enough for the smaller pieces of metal to melt. Dross separates from the metal, the separation being facilitated by the agitation due to the stirrers, but is prevented from accumulating on the surface of the metal in the submerging compartment by the strong currents and the paddles. Of course, as more material is supplied to the submerging compartment and the surface of the metal rises, the fluid will flow into the heating chamber and thence into the skimming compartment and will carry floating dross with it. When the dross reaches the skimming compartment, it is broken up by the stirrers and tossed above the metal bath, giving particles of metal entrained in it a chance to drop out into the bath. The dross is removed at this point and may be further treated for the recovery of any remaining metal therein. The separation of dross and metal is preferably aided by the addition of a flux at the skimming compartment. In many instances the stirrers of the skimming compartment are unnecessary and may be omitted.

The movement of the dross from the submerging to the skimming chamber will be slow and uncertain if the flow of the metal bath be relied on alone, hence it is preferable to assist this movement by pushing the dross along the heating chamber with bars, rables or the like 40 extending through the openings 20.

Scrap may be continuously fed to the submerging compartment, molten metal continuously drawn from the tap, and dross continuously removed from the skimming compartment, although any one, a plurality, or all of these acts may be performed intermittently without affecting the others. There is no loss of heat due to alternate heating and

cooling of the furnace and its contents, radiation losses are low, and the thermal efficiency is therefore high.

Figs. 6 and 7 illustrate a modified form of furnace embodying my invention. This form consists of a heating chamber having a bottom 21, top 22, sides 23 and 24, and ends 25 and 26. Troughs 27 and 28 are provided on the sides of the heating chamber and these divided, as is the trough of the first modification, into receiving or submerging compartments 27a and 28a and skimming or dross removing compartments 27b and 28b. These compartments communicate with the heating chamber through arches 29 and 30, through which the molten metal is free to circulate. Either or both compartments 27a and 28a may be provided with submerging paddles, as above described, and if one is not so provided, this compartment may be used for receiving large pieces of material which might damage the paddles or which need not be immediately submerged. The heating jets are directed through ports 31 in end 25 and impinge upon the surface 32 of the metal near the opposite end of the heating chamber. Vents 33 are provided in both side walls near end 25 and these vents communicate with the interior of the chamber by openings near the surface of the metal.

This arrangement causes the hot gases to follow a path, somewhat like that shown by the arrows in Figs. 6 and 7, flowing downwardly from the ports, impinging on the surface of the metal and giving up some of their heat, flowing upwardly to the top of the chamber and giving up heat to the end 26 and the top, which heat will largely be radiated back to the metal, then being directed downwardly to again impinge upon the surface of the metal before escaping through the vents. It has been found in practice that this circulation of the gases of combustion improves the thermal efficiency of the furnace very markedly and that the waste gases are very little above the molten metal in temperature.

Openings closed by doors 34 and 35 are provided in the ends to permit access to the heating chamber, as for pushing dross along the same.

The operation of the furnace last described is substantially the same as for that first described, it being possible however to supply scrap at either or both receiving compartments and remove dross at either or both skimming compartments. Thus the productive capacity of the furnace is substantially doubled while the radiating surface thereof is not materially changed.

Labor is reduced as the apparatus runs continuously and there is no starting, stopping and shifting of parts.

The scrap, reclaimed metal, and dross may be periodically or continuously supplied or

removed as the case may be, and the handling of these may therefore be adapted to the needs and convenience of other operations being performed thereon.

5 Obviously the apparatus may be arranged in many different ways without departing from the spirit of the invention, as the submerging and skimming compartments may be on opposite sides of the heating chamber if a long and narrow space is available, and the dross can then move in a straight line instead of being moved around the corners shown. It is intended to include all such variations and modifications in what we claim as our invention and we do not limit ourselves to the precise embodiment shown except as set forth in the subjoined claims.

What is claimed is:

1. In an apparatus for reclaiming scrap metal, a furnace of substantially rectangular cross section having inlets at one side thereof for the heating medium, downwardly directed jets set in the inlets arranged to direct the medium in a substantially diagonal direction across the furnace into contact with the surface of the metal, and outlets at the same side as and lower than the inlets for escape of exhaust gases.

2. Apparatus for reclaiming scrap metal comprising a hearth for molten metal, part of the hearth being enclosed and provided with means for heating the metal, two other parts of the hearth being open, the first for supplying metal being provided with submerging means for submerging the scrap metal as supplied, and the second being accessible for the removal of dross from the surface of the metal.

3. In a furnace, a hearth for molten metal at the bottom of the furnace, and extending beyond the furnace to form a plurality of open compartments, means in one compartment for submerging metal being supplied below the surface of the molten metal in the hearth, and dross removing means in another compartment.

4. Apparatus for reclaiming scrap metal comprising a furnace having an enclosed compartment in which molten metal is heated, and a plurality of open top compartments for receiving and delivery communicating with the enclosed compartment, the molten metal being free to circulate throughout all the compartments, one open compartment having means therein for submerging unmelted scrap metal and the other compartment having means therein for separating dross and molten metal.

5. A furnace having a heating chamber provided with inlet openings for a heating medium through one side adjacent the top of a chamber, downwardly directed jets in said openings directing the heating medium substantially diagonally across the chamber and into contact with the upper surface of mate-

rial being treated in the chamber prior to contact with any of the chamber walls, and outlet openings for the products of combustion near the side of the furnace in which the inlet openings are positioned and close to the upper surface of the material being treated.

6. A furnace having a hearth in the bottom thereof and a combustion chamber thereabove, heating medium inlet openings through a side wall of said combustion chamber near the top thereof, outlets near said inlets and adjacent to the upper surface of material contained in the hearth, and jets in said inlet openings directing said heating medium downwardly diagonally across the combustion chamber to impinge upon the surface of material contained in the hearth before reaching the opposite side wall.

7. Apparatus for reclaiming scrap metal comprising a hearth for molten metal, part of the hearth being enclosed and provided with means for heating the metal therein, part of the hearth being exposed, the metal being free to circulate throughout all portions of the hearth, and a current producing device in the exposed portion of the hearth causing downwardly directed currents in the molten metal.

8. Apparatus for reclaiming scrap metal comprising a hearth for molten metal, part of the hearth being enclosed and provided with means for heating the metal therein, part of the hearth being exposed, the metal being free to circulate throughout all portions of the hearth, a current producing device in the exposed portion of the hearth causing downwardly directed currents in the molten metal, and means at another exposed portion of the hearth for removing dross from the surface of the molten metal.

9. A furnace, a hearth in the bottom thereof and extending outside the furnace to form compartments for molten metal in communication with that in the furnace, means in one compartment for submerging scrap metal, means in another compartment for removing dross, and means for accommodating a device for moving the dross through the furnace.

10. An apparatus for reclaiming scrap metal comprising in combination a furnace providing a substantially closed chamber, a second chamber, a conduit connecting the two chambers below the surface of material contained in the closed chamber, and movable means in one of the chambers for producing agitating currents in molten metal contained therein, said means including members arranged to contact unmelted finely divided scrap metal substantially at the surface of such molten metal and quickly carry the same beneath the surface.

11. An apparatus for reclaiming scrap metal comprising in combination a furnace including two chambers, a conduit connect-

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ing the chambers for maintaining a constant level of molten metal in each of said chambers, and means in one of the chambers for submerging unmelted material in one chamber and propelling molten material through the conduit into the other chamber, said means including members arranged to contact unmelted material substantially at the surface of such molten material and quickly carry the same beneath the surface.

In testimony whereof we hereunto affix our signatures this 21st day of June, 1926.

THERON D. STAY.

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