May 26, 1931. A. DAWANS 1,807,307

APPARATUS FOR MELTING FINELY DIVIDED MATERIALS

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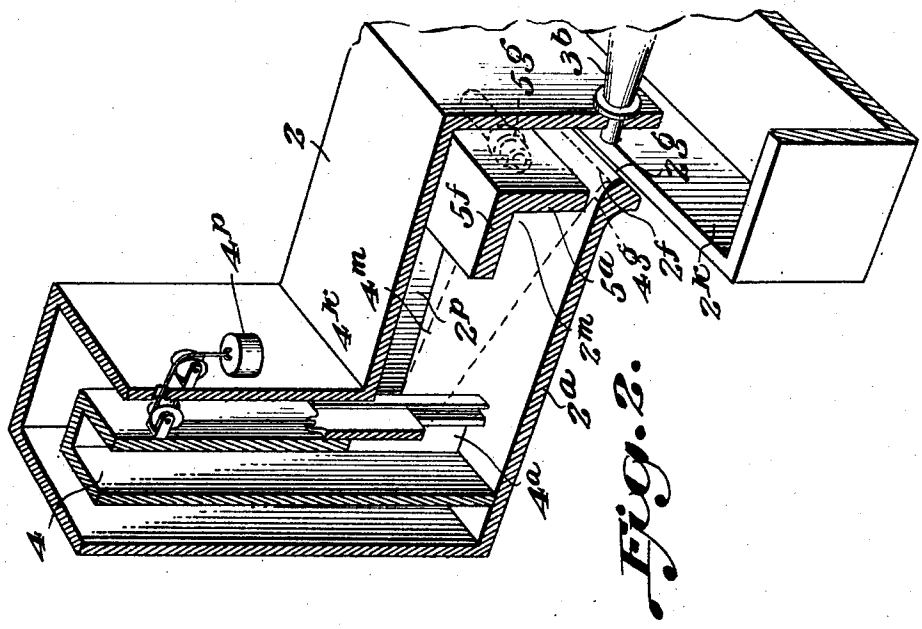



Fig. 2.

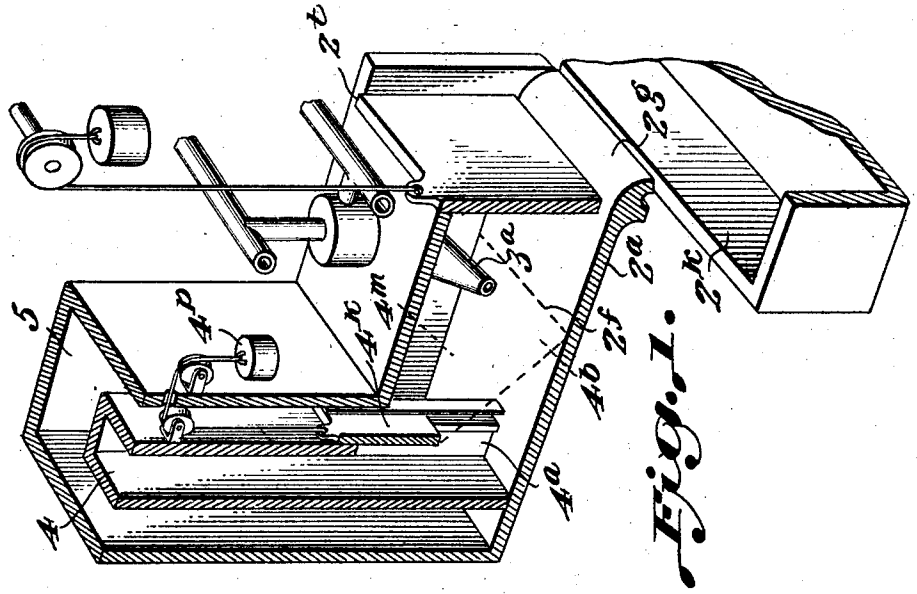



Fig. 1.

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## APPARATUS FOR MELTING FINELY DIVIDED MATERIALS

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This invention relates to apparatus for melting finely divided materials comprising a stationary inclined bed plate along which the melted materials slide by gravity.

With a view to replacing the material which has melted and flowed away, the zone of melting and flow is situated, according to the invention, at the foot of a pile of material, the angle of slope of which is the natural angle of repose of the material.

In order to prevent an agglomeration of the finely divided particles which would interfere with the flow of the molten metal, the invention provides a screen formed for example by a refractory wall by means of which the melting zone can be limited near the upper part of the hearth.

The invention further involves a particular embodiment wherein the zone in which the said material is led in a molten state may be situated in proximity to the lower end of the bed plate or may abut against the inclined surface of the pile.

Further, according to the invention, the gases of combustion may be led at a certain distance from the melting zone by means of a screen formed for example by a refractory wall. In order to permit use to be made of mechanical devices adapted to serve, in particular, for advancing the material, the two screens mentioned may produce in the hearth a zone which is at a lower temperature than that of the melting zone and which will be adapted to receive the said mechanical devices.

With a view to oxidizing in the upper part of the hearth certain oxidizable elements such as carbon, pyrites, etc., which may be contained in the said material, the invention further provides for an additional admission of air into the hearth.

The accompanying drawings illustrate by way of example and in a non-limiting manner two embodiments of the invention.

The latter extends to the various original features which the arrangements shown comprise.

Figure 1 is a perspective view with a part cut away of the device constructed for melting the said materials.

Figure 2 is a perspective view of the device with a screen.

The hearth comprises a bed plate $2a$ inclined at approximately 20° to the horizontal so as to discharge by gravity, over the downwardly-curved lip $2g$ at the end of the bed plate, the molten product which is obtained at $2f$ under the action of burners $3a$ supplied either with blast furnace gas or with pulverized coal, etc. The melting may, however, be obtained also by means of simple coal-burning hearths.

In order to effect the automatic feeding of the material to replace that which has been melted, the material to be treated, which is poured into the chute 4, descends the latter by gravity and flows out through the lower aperture $4a$ thereof onto bed plate $2a$ where it forms a pile, shown in dotted lines, whose surface $4b$ assumes naturally, when at rest, an inclined or sloping position known as its natural slope or angle of repose.

To vary the amount of the material supplied to the hearth and thus change the slope $4b$, the aperture $4a$ of the chute 4 (which latter is situated in the interior of the gas-discharging chimney 5) may be closed by a movable sliding door $4k$ balanced by a counterweight $4p$ and the position of which can be controlled from the outside by suitable means (not shown).

The melting of the material takes place at the foot of the slop $4b$, and the molten metal flows along the inclined bed plate and discharges into and solidifies in vessels $2k$ placed at the end $2g$ of the said hearth.

In order to make complete use of the heat contained in the fuel, the above mentioned material, which is fed to the hearth in a direction opposite to that in which the burning gases are discharged, is heated by the latter in the chute 4 and at the upper part $4m$ of the slope $4b$.

With the object of preventing an influx of cold air, the end or lip $2g$ of the hearth is partly closed by a movable wall $2t$ so as to leave merely a sufficient passage for the discharge of the product from the melting operation.

In the case of Fig. 2, in which the con-

struction is approximately the same as in Fig. 1, the material is led in proximity to the end or lip 2*g* of the said bed plate 2*a* where melting takes place under the action of burners 3*b* supplied with blast furnace gas, or with pulverized coal, etc. In this form, the melting zone is limited by means of a screen formed by a refractory wall 5*a* which is rigidly connected with the side walls 2*p* of the hearth and is arranged at a short distance from the end 2*g* of the hearth; the screen also comprising a top wall or member 5*f* which overhangs the lower part of the sloping pile and directs the hot gases from the molten material toward the upper part 4*m* of the pile where they heat the material. The two walls 5*a* and 5*f* may be integral, producing a structure of L-section.

For the purpose of reducing the depth or thickness of the material at the melting point 2*f*, the wall 5*a* is caused to penetrate into the sloping surface of the pile in such a way as to produce a second natural slope 4*g* which has a different inclination than the first or main slope.

In order to prevent too rapid solidification of the molten product and the formation of chains of solidified grains of material starting from the end 2*g* of the bed plate, the said product, before falling into the vessels 2*k* in which it solidifies, passes through a sheet of gas at a very high temperature obtained by arranging the burners 3*b* opposite and slightly below the said end 2*g*.

The gases coming from the melting pass in a conduit constituted by a refractory wall such as 5*f*, the side walls such as 2*p*, the upper wall of the hearth adjacent to the said side walls, and the incline of the material to be melted represented in the drawings by dotted lines toward the top of the hearth 2 where at 4*m* they reheat said material.

By the arrangement of these refactory walls 5*a* and 5*f* within the hearth 2, a zone 2*m* is produced in the hearth which is at a lower temperature than the melting zone 2*f*, in which zone 2*m* it will be possible to dispose mechanical devices such as blade wheels, etc.

In order to reduce further the temperature of the zone 2*m*, air admission tuyeres 5*g* (shown in dotted lines) may project into this zone above or in advance of the said wall 5*a*.

As a result of the addition of the amount of supplementary air a certain part of the carbon contained in the material charged into chute 4 and which may be formed by blast furnace dust, is burnt at 4*m*. The combustion of this carbon contributes in heating the material at 4*m* and consequently increases the efficiency of the apparatus.

In the operation of the invention, dust from blast furnaces may be treated in a hearth analogous to the one hereinbefore described, during which treatment the ferric oxide contained in this dust is transformed into ferrous oxide under the action of the heat before the products reach the end or lip 2*f* in the melting zone.

What I claim is:

1. Apparatus for melting finely-divided material, comprising a chamber provided with an inclined, fixed bed plate; a vertical duct situated at the upper end of the bed plate and through which the finely-divided material is introduced, said duct having an aperture in its bottom through which the material escapes and forms a pile extending along the bed plate and having its greatest height comprised between the upper edge of said aperture and the bed plate; melting means acting upon a definite portion of material situated at the intersection of the upper inclined surface of the pile and the plane of the bed plate; and a chimney surrounding the duct for discharging the gases of combustion.

2. Apparatus for melting finely-divided material, comprising a chamber provided with an inclined, fixed bed plate; a vertical duct situated at the upper end of the bed plate and through which the finely-divided material is introduced, said duct having an aperture in its bottom through which the material escapes and forms a pile extending along the bed plate and having its greatest height comprised between the upper edge of said aperture and the bed plate; melting means acting upon a definite portion of material situated at the intersection of the inclined surface of the pile and the plane of the bed plate; means for varying the height of said aperture so as to change the position of the foot of the pile in respect to said melting means; and a chimney surrounding the duct for discharging the gases of combustion.

3. Apparatus for melting finely-divided material, comprising a chamber provided with an inclined, fixed bed plate; a vertical duct situated at the upper end of the bed plate and through which the finely-divided material is introduced, said duct having an aperture in its bottom through which the material escapes and forms a pile extending along the bed plate and having its greatest height comprised between the upper edge of said aperture and the bed plate; melting means acting upon a definite portion of material situated at the intersection of the inclined surface of the pile and the plane of the bed plate; a chimney surrounding the duct for discharging the gases of combustion; and a screen located between the melting zone and the material to be melted, and directly behind the melting zone, said screen providing an upper free space for the passage of the gases and a lower one for the entrance of material into the melting zone.

4. Apparatus for melting finely-divided material, comprising a chamber provided with an inclined, fixed bed plate; a vertical

duct situated at the upper end of the bed plate and through which the finely-divided material is introduced, said duct having an aperture in its bottom through which the material escapes and forms a pile extending along the bed plate and having its greatest height comprised between the upper edge of said aperture and the bed plate; melting means acting upon a definite portion of material situated at the intersection of the inclined surface of the pile and the plane of the bed plate; a chimney surrounding the duct for discharging the gases of combustion; a screen located between the melting zone and the material to be melted, and directly behind the melting zone, said screen providing an upper free space for the passage of the gases and a lower one for the entrance of material into the melting zone; and a second screen associated with the first one to form at the upper part of the apparatus with the walls thereof a conduit through which the gases of combustion are forced to pass.

5. Apparatus for melting finely-divided material, comprising a chamber provided with an inclined, fixed bed plate; a vertical duct situated at the upper end of the bed plate and through which the finely-divided material is introduced, said duct having an aperture in its bottom through which the material escapes and forms a pile extending along the bed plate and having its greatest height comprised between the upper edge of said aperture and the bed plate; melting means acting upon a definite portion of material situated at the intersection of the inclined surface of the pile and the plane of the bed plate; a chimney surrounding the duct for discharging the gases of combustion; and an L-shaped screen, one branch of which is located between the melting zone and the material to be melted while the other branch is located in the upper part of the apparatus above the material to be melted.

6. Apparatus for melting finely-divided material, comprising a chamber provided with an inclined, fixed bed plate; a vertical duct situated at the upper end of the bed plate and through which the finely-divided material is introduced, said duct having an aperture in its bottom through which the material escapes and forms a pile extending along the bed plate and having its greatest height comprised between the upper edge of said aperture and the bed plate; melting means acting upon a definite portion of material situated at the intersection of the inclined surface of the pile and the plane of the bed plate; a chimney surrounding the duct for discharging the gases of combustion; an L-shaped screen, one branch of which is located between the melting zone and the material to be melted while the other branch is located in the upper part of the apparatus above the material to be melted; and pipes for the admission of supplementary air provided in the parts of the lateral walls comprised in the angle of the L-shaped screen, such supplementary air serving to oxidize certain elements contained in the material under treatment before it enters into the melting zone.

In testimony whereof I affix my signature.

ADRIEN DAWANS.