A. F. PLOCK.

APPARATUS FOR SINTERING ORES.

APPLICATION FILED JULY 14, 1914.

1,140,710.

Patented May 25, 1915.

2 SHEETS—SHEET 1.

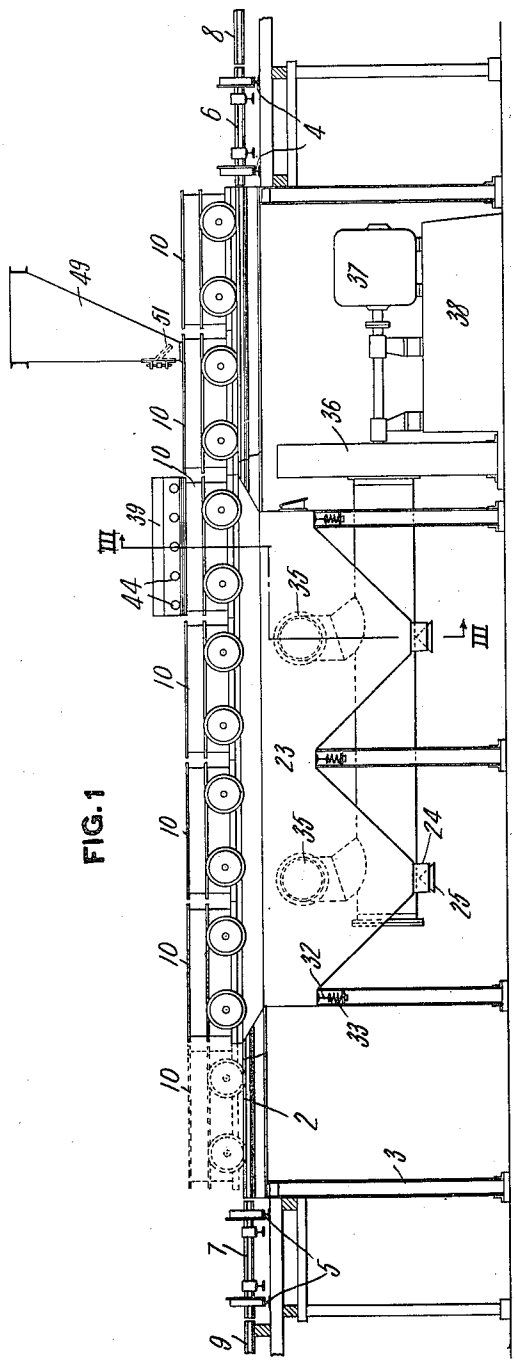


FIG. 1

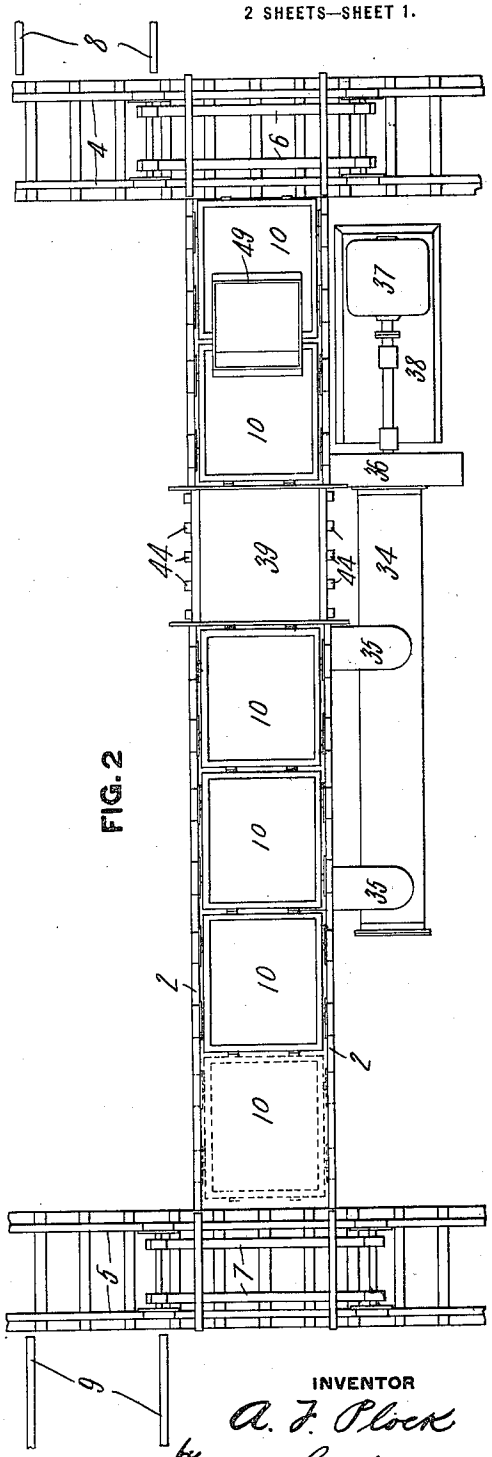


FIG. 2

WITNESSES

R. D. Little

W. T. Holman

INVENTOR

A. F. Plock

by C. C. Linthicum

his Attorney

A. F. PLOCK.

APPARATUS FOR SINTERING ORES.

APPLICATION FILED JULY 14, 1914.

1,140,710.

Patented May 25, 1915.

2 SHEETS—SHEET 2.

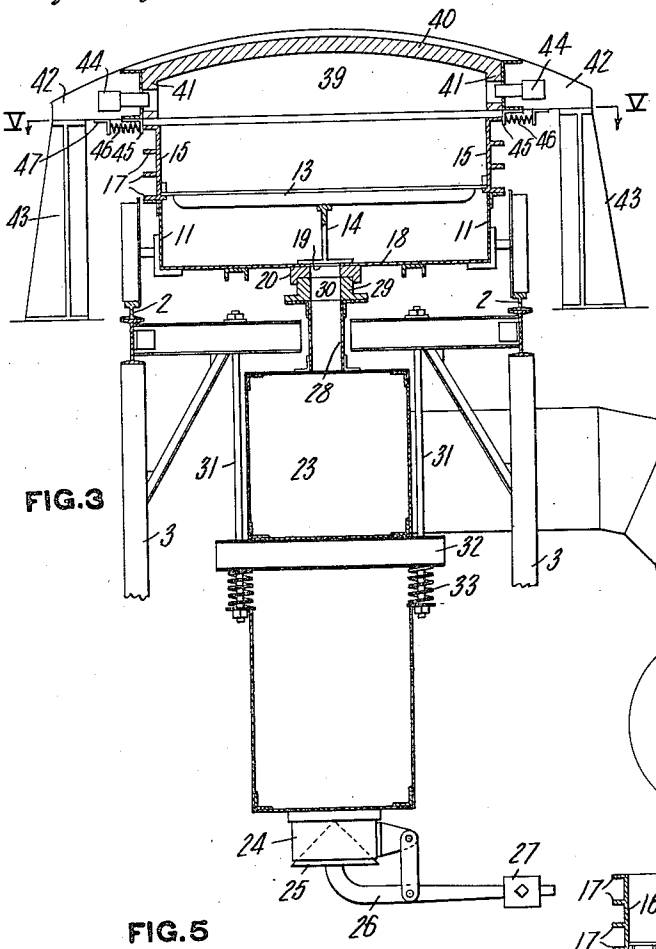


FIG. 3

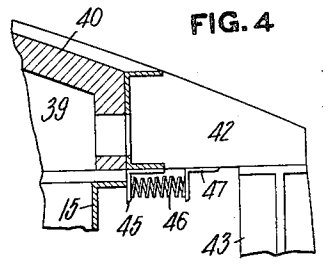


FIG. 4

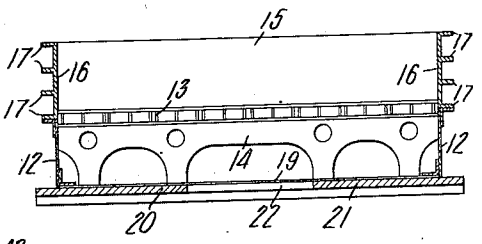


FIG. 6

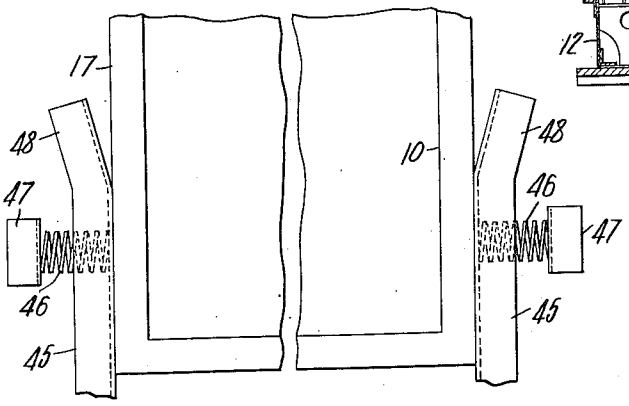


FIG. 5

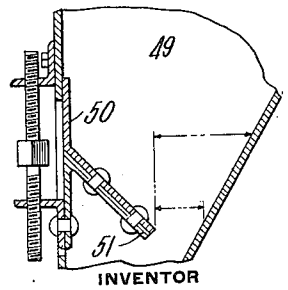


FIG. 7

WITNESSES

R. D. Little

J. T. Holman

INVENTOR

A. F. Plock

by C. C. Linthicum

his Attorney

UNITED STATES PATENT OFFICE.

ALBERT F. PLOCK, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO THE PITTSBURGH METALLURGICAL COMPANY, INCORPORATED, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

APPARATUS FOR SINTERING ORES.

1,140,710. Specification of Letters Patent. Patented May 25, 1915.

Application filed July 14, 1914. Serial No. 850,883.

To all whom it may concern:

Be it known that I, ALBERT F. PLOCK, a citizen of the United States, and resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Sintering Ores, of which the following is a specification.

My invention relates to apparatus used in sintering ores, flue dust, and similar finely divided materials, containing carbon, sulfur or other combustible, the carbon or other combustible being added to the materials to be sintered when found desirable or necessary.

One object of my invention is to provide apparatus for sintering ores of improved construction having novel means whereby the ores are ignited and another object of the invention is to provide apparatus having improved means whereby a suction or draft is created through the body of materials being sintered.

A further object of this invention is to provide sintering apparatus of improved construction having novel means whereby ingress of air to the firing or ignition chamber of the apparatus is regulated and controlled and apparatus having improved means whereby the finely divided solids passing through the air chamber are separated from the air and gaseous products of combustion and are collected in bulk.

A further object of the invention is to provide a furnace having novel means whereby the dust catcher forming part of the exhaust chamber is supported and is maintained or held in operative position relative to the movable cars forming part of the sintering apparatus.

A still further object of this invention is to provide apparatus having improved means for supplying or discharging the materials to be sintered upon the cars and spreading and compacting the finely divided materials over the sintering bed formed on the cars, forming part of the apparatus, and still further objects of the invention will become apparent as is more fully disclosed hereinafter and is specifically pointed out in the appended claims.

Referring now to the accompanying drawings, forming part of this specification, Figure 1 is a longitudinal side elevation, partly in section, showing one arrangement of apparatus constructed in accordance with my invention. Fig. 2 is a plan of the apparatus showing the relative arrangement of the tracks and other portions of the apparatus. Fig. 3 is a sectional end elevation of the apparatus of Figs. 1 and 2, the section being taken on the line III—III of Fig. 1, showing the construction of the firing or ignition chamber forming part of my improved apparatus. Fig. 4 is a detail sectional end elevation on an enlarged scale, showing the construction of the means employed in regulating and controlling the leakage of air into the firing chamber forming part of my improved apparatus. Fig. 5 is a sectional plan taken on the line V—V of Fig. 3, showing the construction of the means employed in regulating and controlling ingress of air to the firing chamber. Fig. 6 is a longitudinal sectional elevation showing the construction of the cars and the air chambers thereon, with the means employed in supporting the grate bars mounted in said cars, and forming part of this invention. Fig. 7 is a detail sectional elevation on an enlarged scale, showing the construction of the bin or hopper and gate by which the flow of materials from the bin to the cars is regulated and controlled.

In the accompanying drawings, the numeral 2 designates the rails of an elevated track, supported upon columns 3 and connected by transfer tracks 4 and 5 having transfer cars 6 or 7 arranged to travel thereon.

The tracks 4 and 5 are located at the ends of the elevated track 2 and extend lengthwise at right angles to the lengthwise center of the track 2.

The track 4 is employed to transfer empty cars from the track 8 to the sintering track 2 and the track 5 to transfer cars of sintered material from the track 2 to the track 9.

Mounted upon the sintering track 2 is a series of sintering cars 10. These cars, as will be clearly seen in Figs. 3 and 6, comprise a body having side members 11 and end members 12 formed of rolled metal plates.

Removably secured in the box adjacent to the upper edge of the side and end plates is a series of grate bars 13 these bars being supported within the body of the cars at an

intermediate point in the height of the car body by a girder or beam 14 which extends lengthwise from end to end of the car body.

The extensions 15 and 16 on the sides and ends of the body of the cars are preferably formed of cast metal and are provided with outwardly extending marginal flanges or ribs 17 to strengthen and prevent warping of the extensions by the action of the heat to which they are subjected in the sintering operations.

The bottom plates 18 on each of the cars 10 have rectangular slots 19 therein which extend lengthwise parallel with the length of the cars, and secured on the under side of each car bottom 18 is a wearing or friction plate 20.

A downwardly extending flange 21 is provided on each of the longitudinal side edges of these plates 20 and in each plate is a rectangular opening 22 which registers with the slot 19 in the bottom 18 of the car to which the wearing plate 20 is secured. The length of the wearing plates 20 on the car bottoms is made equal to or slightly greater than the overall length of the cars 10 so that these wearing plates determine the distance, center to center, of the cars 10 on the track 2.

Suspended beneath the sintering track 2 is a dust catcher 23 having vertical sides and oppositely inclined lengthwise sloping bottom portions, the sloping bottom portions being connected to a hopper 24 forming a dust outlet which is normally closed by means of a conical bell 25. The bells are mounted in position by means of the bent levers 26, and the counterweight 27 on one end of these levers acts to normally hold the bells 25 seated in the outlets 24 in closing position.

The dust catcher 23 which extends lengthwise parallel with the lengthwise center of the track 2 is provided on its upper side with a narrow throat 28 forming a passage thereinto and on the upper side of this throat is a flanged wearing plate 29 having a long narrow slot 30 therein which registers with the shorter slots 22 in the wearing plates 20 on the bottoms of the car bodies. The width of the plate 29 is such that its upper face enters the recess or groove formed in the lower side of the slotted wearing plates 20 on the bottoms of the cars so as to form a sliding fit with these wearing plates. The dust catcher 23 is suspended beneath the track 2 by means of rods 31, the cross beams 32 being supported from the rods 31 and springs 33 being interposed between the rods and beams. The length of the rods 31 is made adjustable to vary the amount of compression upon the springs 33 and in this way cause the contacting faces of the wearing plates 20 and 29 on top of the throat 28 and on the bottoms 18 of the cars to be held in close engagement.

The gas flue 34 which extends lengthwise parallel with the dust catcher 23 at one side thereof, has branches 35, 35, connecting into the sides of the dust catcher and the gas flue 34 is connected to the inlet side of the exhaust fan or blower 36. The blower may be of any of the various known types and is conveniently driven by means of an electric motor 37 mounted on the foundation 38 provided for that purpose at one side of the blower.

The sintering cars 10, (seven being shown in the apparatus shown) are positioned on the sintering track 2. An empty car, when moved from the transfer car on the transfer track 4 to the sintering track 2 displaces a car 10 which is caused to move from the other end of the track 2 to the transfer car on the other transfer track 5.

At an intermediate point in the length of the sintering track an ignition or firing furnace 39 is formed, the cars 10 successively acting to form the bottom of this furnace. As will be seen from Figs. 3 and 6 this furnace 39 comprises sides and ends, with a flat arched roof 40 of refractory material and a refractory lining 41 being provided for the sides and ends of the furnace. The sides of the furnace are provided with a series of brackets 42 which engage with the series of supporting stands or columns 43 located on each side of the furnace, and on each side of the furnace is a series of openings through which burners 44 project into the furnace. These burners may be for oil or gas as is desired.

The lower edges of the ends and sides of the furnace 39 adjoin, but are not in close engagement with the upper edges or top of the cars 10, and to prevent an excess of air entering or being drawn into the furnace between the adjoining side edges of the furnace and the cars forming temporarily the bottom thereof, an angle 45 is movably secured on the flanged lower edge of the furnace shell, this angle being yieldingly held in engagement with the longitudinal side edges of the cars 10 by means of helical springs 46 which are secured at one end to brackets 47 fastened to the brackets 42 forming part of the furnace.

The ends 48 of the movable or adjustable angles 45 are bent outwardly, (as is shown in Fig. 5) so that the cars 10, as successively moved into position between the angles, will be automatically engaged thereby.

Conveniently located between the entering end of the furnace 39 and the transfer track 4 by which empty cars are positioned upon the sintering track 2, and above the sintering track, is a hopper or bin 49 having its discharge end at about the level of the top of the car. Positioned within the lower end of this hopper is an adjustable gate 50, this gate being vertically movable

and having an angularly extending bottom portion 51, the lower edge of which defines one side of the opening through which the materials to be sintered pass in being discharged from the hopper 49 to the sintering cars 10.

In the operation of my improved apparatus, with the parts thereof assembled as shown, cars 10 are placed on the sintering track 2 so as to cover the part of the track above the dust catcher 23 and also the portion of the track between the transfer track 4 and the entrance end of the ignition or firing chamber 39. The firing chamber or furnace is heated and a supply of ore, flue dust or other finely divided material to be sintered is placed in the hopper or bin 49. The gate 50 on the hopper or bin 49 is adjusted so as to feed sufficient materials through the discharge outlet to the bottom thereof and to fill a car 10 as it is moved from one end to the other, past the opening, the weight of the materials in the bin acting to pack the materials with the desired density in the body of the car. Another car 10 is then moved from the transfer track 4 to the receiving end of the sintering track 2, its movement on the sintering track pushing the car just filled with materials from the hopper or bin, into position beneath the furnace or igniting chamber 39. The motor 37 is then started so as to actuate the blower 36, and the blower, when in operation, exhausts the air or other gaseous fluid from the gas main 34 and dust catcher 23 to which the gas main is connected by the branches 35. In starting the sintering operation, care will be taken to substantially close the openings between the grate bars in any of the cars which are empty. When the blower 37 is started to operate, the suction created in the gas main and dust catcher will draw air or products of combustion from the firing chamber 39 downwardly through the body of the materials being sintered on the cars beneath the firing chamber. After the upper surface of the materials to be sintered on the car beneath the furnace 39 is thoroughly ignited, which operation will take but a short time, another car 10 is transferred from the track 4 to the entrance end of the sintering track 2. The movement of the empty car to the sintering track will move the car between the bin and receiving end of the sintering track beneath the discharge outlet of the bin or hopper 49, and this car will be filled with materials to be sintered while passing lengthwise beneath the bin. The movement of this car moves the last filled car into position beneath the firing chamber 39 and moves the car, whose charge has just been ignited on its upper surface, from beneath the firing chamber. The suction or down draft created by the blower 36 causes a current of air to pass downwardly through the body of the burning materials being sintered on the cars and supplies the oxygen necessary to support combustion, the carbon, sulfur or other combustible element, in the form of a solid, being in the materials being sintered. The above described operations are then repeated until, with the apparatus as shown, there are seven of the cars 10 with their adjacent ends abutting and in engagement. When this number of cars is on the sintering track the car nearest the discharge end of the sintering track 2 will be filled with sintered material. In the next three cars the sintering operation, at different stages of completion, will be performed, and the fifth car, the one positioned beneath the firing chamber 39 will be having its charge ignited. The next car will have just been filled with material from the bin or hopper, and the seventh car or the one at the receiving end of the sintering track 2, will be empty. While the upper surface of the materials in each car is being fired or ignited and during the time this car is traversing the length of the sintering track 2 from the firing chamber 39 until it is clear of the dust catcher 23, beneath the sintering track, or until it reaches the position of the car shown in dotted lines in Fig. 1, the sintering operation is being carried out, the suction of the blower drawing air downwardly through the bed of the burning sintering material and the burned gases, or products of combustion passing from the chamber in the bottom of these cars through the throat 28 on the top of the dust catcher 23 into the dust catcher. The dust and any finely divided solids passing from the bottom of the cars into the dust catcher will be collected in the bottom of the dust catcher 23. The sloping bottom portions of the dust catcher, being at an angle greater than the angle of repose, will cause the collected dust to slide to the bottom and out of the dust catcher by gravity when the cleaning bells 25 are lowered so as to open the cleaning doors 24 on the bottom of the dust catcher. The waste gases of products of combustion are drawn through the waste gas main 34 into and through the blower 36 and are discharged into a suitably located stack (not shown).

The above described operations are then repeated, the cars being successively moved from the transfer track to the sintering track, and being progressively moved across the sintering track from end to end thereof, finally being moved from the sintering track to the transfer track at the discharge end of this track.

In passing across the length of the sintering track the cars are provided with a body of materials to be sintered, which is supplied from the bin or hopper, then pass beneath the firing chamber, by which the sintering

operation is started and, after first being thoroughly ignited while in the igniting furnace, the sintering operation is continued while the cars are passing over the sintering track.

The advantages of my invention will be apparent to those skilled in the art. The apparatus is simple and is easily kept in repair. By its use the ores or other materials are rapidly and thoroughly sintered.

Modifications in the construction and arrangement of the parts may be made without departing from my invention as defined in the claims.

I claim:—

1. Sintering apparatus comprising, in combination, a sintering track, sintering cars movably mounted thereon, said cars having openings in the bottom thereof for the passage of waste gases, an ignition furnace above the sintering track, the cars in passing over the sintering track successively forming the bottom of said ignition furnace, means for firing said furnace, means at the sides of the furnace engaging the sides of the cars to form a seal and limit ingress of air passing between the adjacent side edges of the furnace and cars beneath the furnace, into the furnace, and means for withdrawing waste gases from the furnace through the successive cars beneath the furnace.

2. Sintering apparatus comprising, in combination, a sintering track, sintering cars movably mounted thereon, said cars having openings in the bottom thereof for the passage of waste gases, an ignition furnace above the sintering track, the cars, in passing over the sintering track, successively forming the bottom of said ignition furnace, means for firing said furnace, yielding means at the sides of the furnace mechanically engaging the sides of the cars to form a seal and limit ingress of air passing between the adjacent side edges of the furnace and cars beneath the furnace, into the furnace, and means for withdrawing waste gases from the furnace through the successive cars beneath the furnace.

In testimony whereof, I have hereunto set my hand.

ALBERT F. PLOCK.

Witnesses:
F. E. GAITHER,
D. S. GAITHER.