A. F. PLOCK.

APPARATUS FOR SINTERING ORES.

APPLICATION FILED MAR. 20, 1913.

1,089,153.

Patented Mar. 3, 1914.

3 SHEETS—SHEET 1.

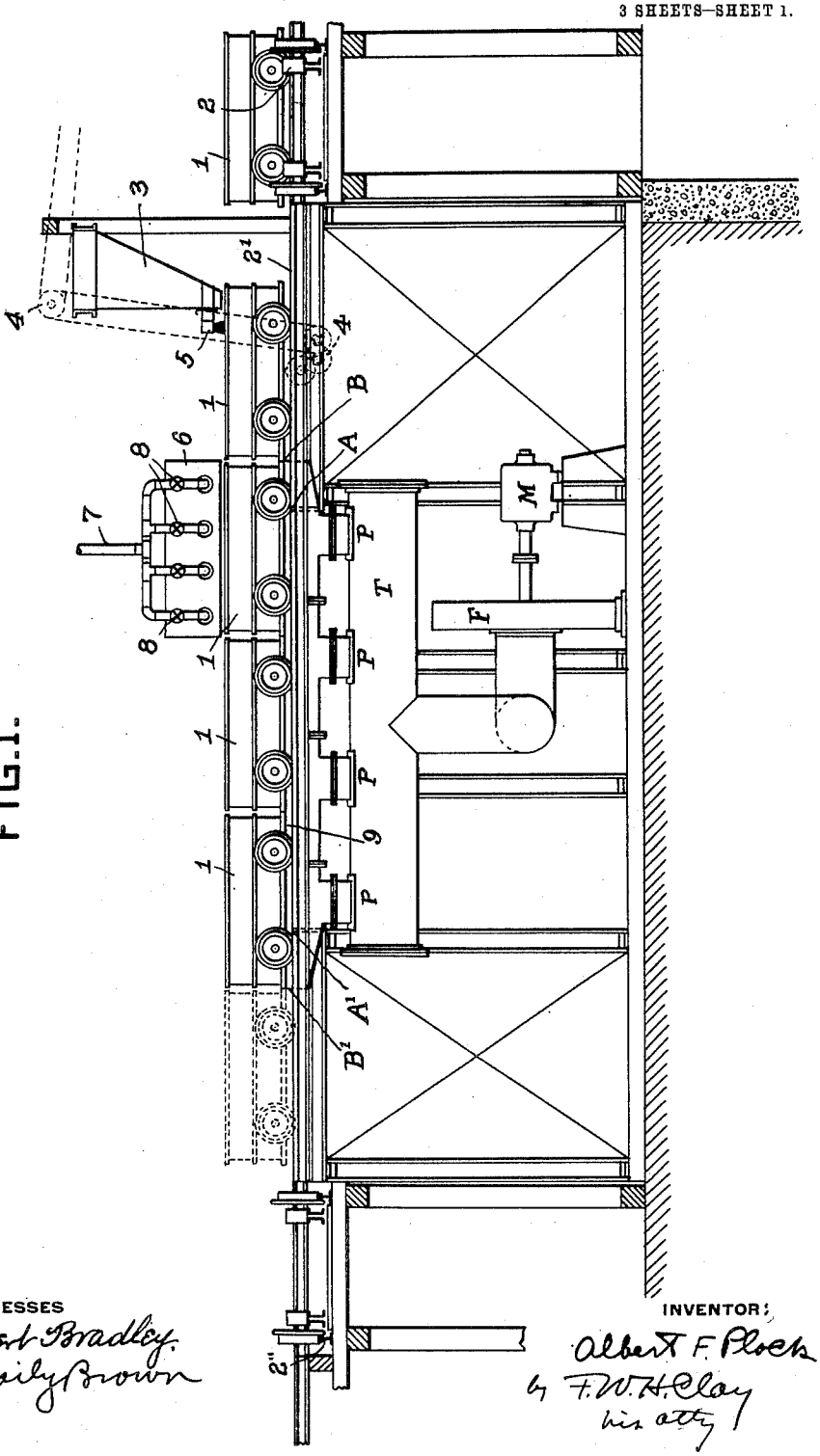


FIG. 1.

WITNESSES

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3 SHEETS—SHEET 2.

FIG.2.

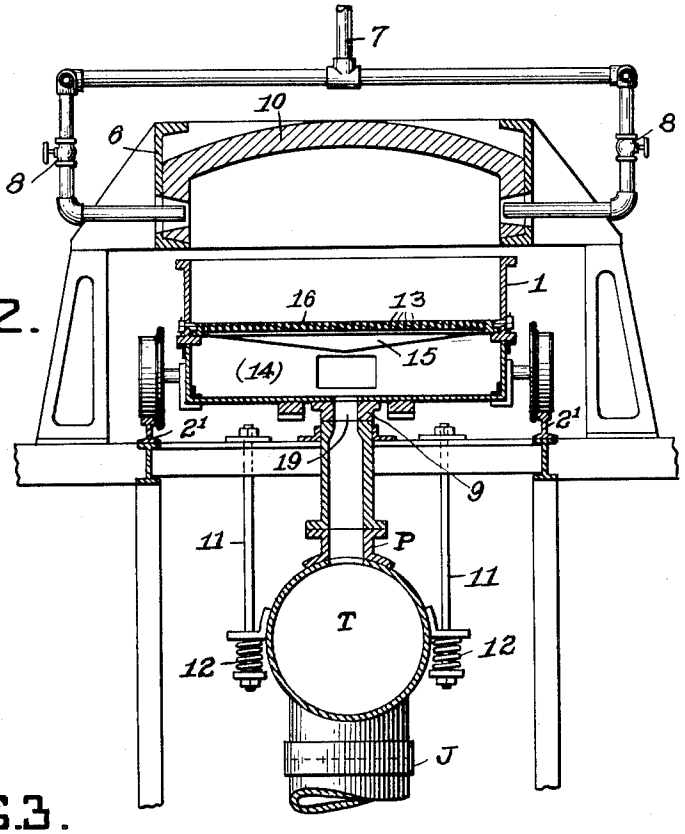


FIG.3.

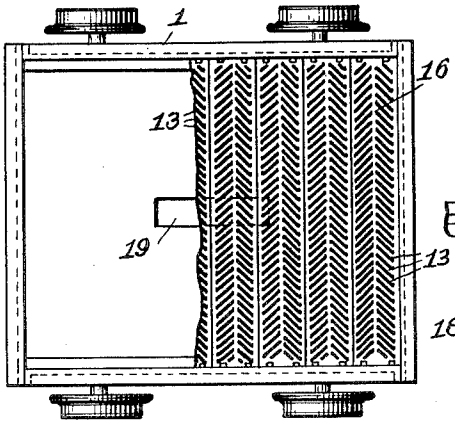


FIG.4.

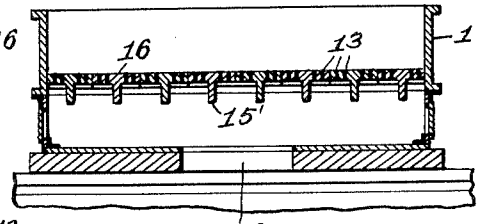


FIG.6.

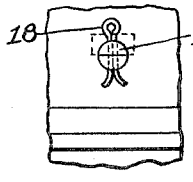
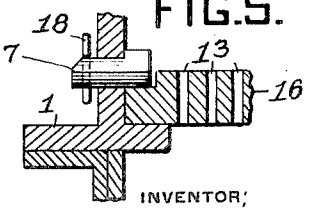


FIG.5.



WITNESSES

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3 SHEETS—SHEET 3.

FIG. 7.

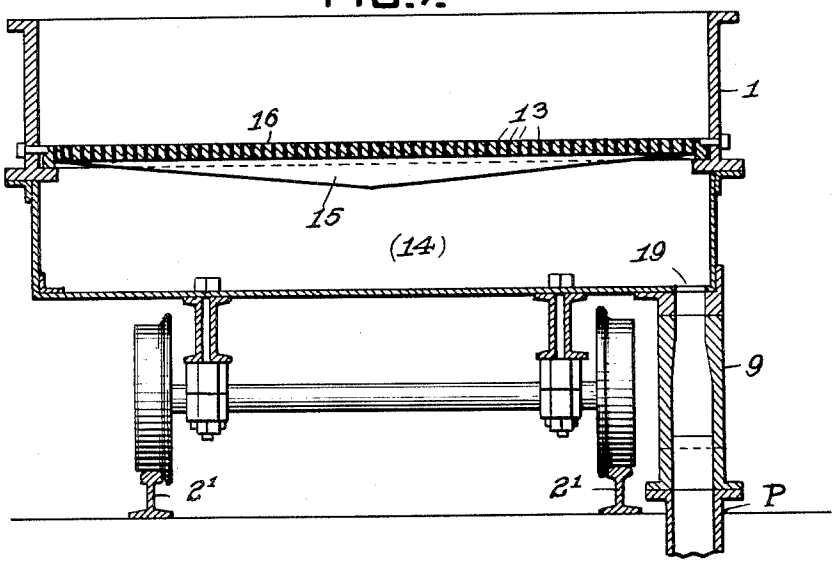
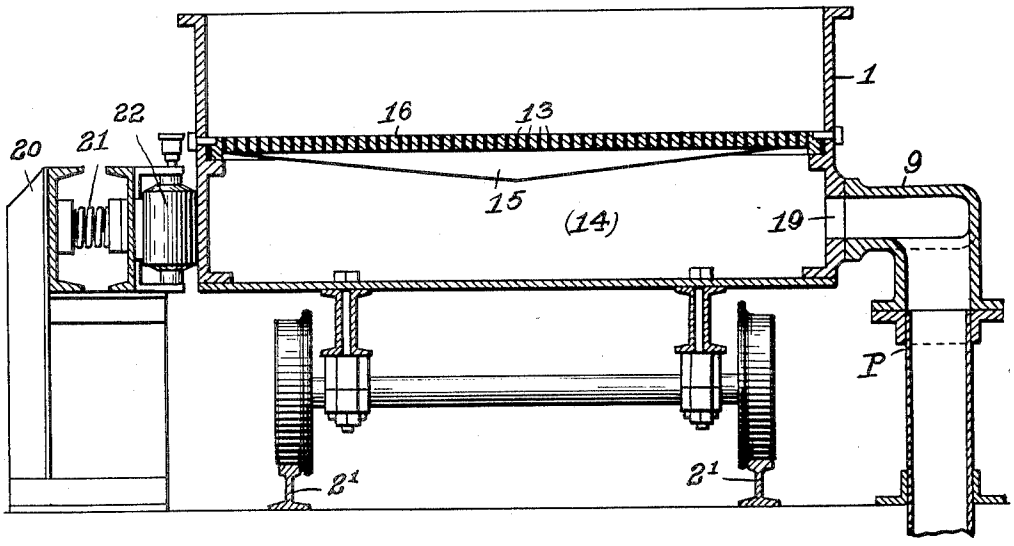


FIG. 8.



WITNESSES

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UNITED STATES PATENT OFFICE

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

APPARATUS FOR SINTERING ORES.

1,089,153. Specification of Letters Patent. Patented Mar. 3, 1914.

Application filed March 20, 1913. Serial No. 755,642.

To all whom it may concern:

Be it known that I, ALBERT F. PLOCK, a citizen of the United States, residing at Pittsburgh, in the 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 for treating such metal ores as are in a pulverized condition, and which contain, or have added to them, combustible material in some form, such as carbon or sulfur. It is advantageous to ignite such ore dusts and to partly reduce them, while at the same time the powdered ore is reduced to the form of a solid cake and so may be more easily handled and removed to a furnace for complete reduction.

My object is to provide an apparatus which may be either intermittent or continuous in its operation, according to the character and composition of the ores to be sinterd; which will allow the removal to any distance of the ore carrying units after their load is sintered; which will secure a uniform ignition and reduction of the ore by means of a constant, evenly distributed down draft of air through the sintering mass; and generally to make a sintering apparatus more efficient and more economical than that now in use. I attain these objects by means of apparatus similar to that illustrated in the accompanying drawings, wherein—

Figure 1 is a diagrammatic side elevation of my apparatus as a whole in operative position; Fig. 2 is a vertical cross section through the ignition hood, one of my cars, and the air exhaust attachment; Fig. 3 is a plan view of the car, with the grating broken away to show the air exhaust opening in the bottom; Fig. 4 is a longitudinal vertical section of a car body, showing details of the grating; Figs. 5 and 6 show details of attachment of the grating sections to the car body; while Figs. 7 and 8 show modified forms of means for coupling the air exhaust to the car.

The general idea of my apparatus is the use of a series of independent cars, each separated horizontally by a grating adapted to support fine ore dust, passing loaded under a hot flame ignition hood and remaining thereunder for a time sufficient to ignite the combustible material in the surface of the ore dust, then for a regulable distance being moved over an open connection to an air exhaust, which is connected to the lower compartment of my car, whereby a continuous evenly distributed down draft of air through the mass of ore is created. This causes the combustion started at the top of the load to continue throughout the mass until the combustible portion thereof is consumed. When this stage is reached, of course the combustion ceases. At the end of its travel the car is removed to a transfer car and so may be taken to any distance for unloading, then returned for reloading and repassage over the sintering track. I use cars of a special construction and use them in a special manner, as hereinafter more fully described.

Referring to Fig. 1, the general operation of my apparatus is clearly shown. The cars, 1, are passed empty from the transfer track 2 to the sintering track 2′. They pass under ore hopper 3, and are filled with ore dust. The mechanism 4 is provided for propelling the cars while on the sintering track by frictional engagement with the bottoms. Its particular form is unimportant. The brush 5 levels the load as the car passes from under the hopper. Next the loaded car passes under the ignition hood 6, which is fed with gas, oil, or any proper fuel, by pipe 7, the distribution being regulated by valved pipes 8. This ignition hood, in connection with the down draft hereinafter described, produces an intense heat over the entire surface of the load of ore. The car is allowed to stand under the hood until the combustible material of the surface of the load is thoroughly ignited. It is then moved on by propelling forward the loaded car behind it. This, in turn advances all the other cars on the sintering track a car length, and forces off a car at the other end, with its load sintered. As above explained, as soon as the ore mass is sintered throughout, there is no more combustible material, and there is no further effect of leaving the load over the draft. Since ores vary in their percentage of combustible elements, and so in the time necessary for the sintering process, my apparatus is particularly adapted

for varying the time of exposure of the mass of ore to the flame for ignition, and to the draft for sintering.

By means of motor M operating fan F, air is exhausted from tank T. I use a large tank from which the air is exhausted so that the suction through the ore mass may be uniform and not directly dependent on the speed of the fan. Tank T is connected by pipes P to an open trough 9, over which the cars pass. This trough has a continuous opening extending from A to A′, adapted to fit closely to a part of the car body which has an opening into the lower compartment of the car. Therefore there is a constant down draft of air through the ore mass so long as the car is on the sintering track 2′ between the points A and A′. In my apparatus as here shown this distance is approximately three car lengths, but this may be varied or adjusted, according to the needs of each ore. The bottoms of my cars and the part of the trough upon which they fit are machined so as to make a tight joint. This is to prevent leakage into the exhaust tank of air not coming through the ore mass. My sintering track is straight and the ends of my cars fit closely so as to prevent leakage between them. Between points A and B, and between A′ and B′, the exhaust trough is closed, and a plate is made to fit tightly against the bottom of the cars, so that there is no leakage just before or just after the car opening connects with the exhaust trough.

Referring to Fig. 2, which shows a cross section through a car, and details of the burner, fuel is supplied through pipe 7, distributed and regulated by pipes 8. A lining of fire brick 10 is provided for the ignition hood. As the car passes under this ignition hood the opening in the bottom compartment connects with the exhaust trough 9. The strong down draft through the mass of ore secures the thorough ignition of the surface of the load while the car remains under the ignition hood. It will be noted that the trough 9 is continuously open from A to A′ so that there is a constant suction of air through the load of ore from the time that it passes under the ignition hood 6 until after it passes the point A′ on the sintering track. This distance and the rate of travel is so regulated as to secure the thorough sintering of the load before the car passes the point A′. It is desirable to secure a tight contact of the trough 9 and the bottom of the car, to prevent air leakage, and therefore I may provide resilient means, as supporting bars 11 and springs 12, for holding the trough close to the bottom of the cars. For supplementing this means I may make an expansion or slip joint J in the pipes P.

The car itself, Figs. 3 and 4, is made with a grating 13 parallel to the bottom, and far enough above the bottom to leave an air chamber (14) below the load. The function of this chamber is to make each car a unitary furnace, by securing an evenly distributed down draft throughout the entire surface of the ore load, and throughout the mass thereof. The grating is made with supporting ribs 15, with fine slits 16 between. It is made in sections for ready removal and renewal. I prefer to use ordinary "herringbone grate bars", which may be readily obtained from stock. Figs. 5 and 6 shows a means of fastening in the grating sections by use of a split pin 17 and key 18.

The restricted opening 19 in the bottom of the car (Fig. 3) is adapted to pass over open trough 9, and through it the exhaust creates the desired down draft through the sintering mass of ore.

In Fig. 7, I show a modification of my apparatus by way of making the exhaust opening 19 in the bottom of the car but outside the track. The same function is attained by attaching the exhaust connection to chamber (14) at any point. In Fig. 8, I show the exhaust trough 9 applied to the side of a car. By means of an abutment 20, spring 21, and roller 22, the car is kept constantly pressed against the trough 9 and leakage prevented.

It will be seen that by reason of the intermittent operation I am enabled to treat each carful of dust independently and in accordance with the composition of the dust to be sintered. Each car is a complete furnace in itself and may be taken to any place desired. In emptying, the car may be turned upside down in any convenient manner, and any loose dust which has escaped into the air chamber (14) will be discharged through grating 16. Such grate bars are easily renewed. Furthermore, the provision of separate cars, with means for moving them intermittently, allows of operating with any desired thickness of dust on the grating, and changing the time of operation to suit the fineness of the dust, thus avoiding the necessity of screening and grading. By providing each car with its own independent air chamber, I make the operation much more uniform. Other advantages will readily occur to those familiar with the art.

Having thus described my invention and illustrated its use, what I claim is the following:

1. In sintering apparatus, the combination with suitable transfer tracks, an ignition device, a suction fan and exhaust pipes, of an ore car having a body closed on four sides and having a grated bottom, a separate and approximately closed air box under the grate, having a restricted air outlet connected by a slot to the exhaust pipes, substantially as described.

2. A sintering car comprising a box with four complete sides and a bottom, a dividing horizontal grated intermediate partition and a restricted opening from the lower chamber to air exhaust passages, substantially as described.

3. The combination of a series of sintering cars, each comprising a box receptacle having a grated bottom and an approximately closed separate air box under the grate, an exhaust device, a restricted air outlet in said air box connected to said exhaust device, an ignition hood, a supporting track holding the cars in connected relation to the exhaust device, and lateral transfer tracks whereby each car may be independently and entirely removed from the series, substantially as described.

In testimony whereof I have hereunto set my signature this 19th day of March, 1913, in the presence of the subscribed witnesses.

ALBERT F. PLOCK.

Witnesses:
Jo. Baily Brown,
Fredk. Staub.