Aug. 14, 1928. 1,680,345

H. J. STEHLI

METHOD OF AND APPARATUS FOR SINTERING

Filed Nov. 19, 1926 2 Sheets-Sheet 1

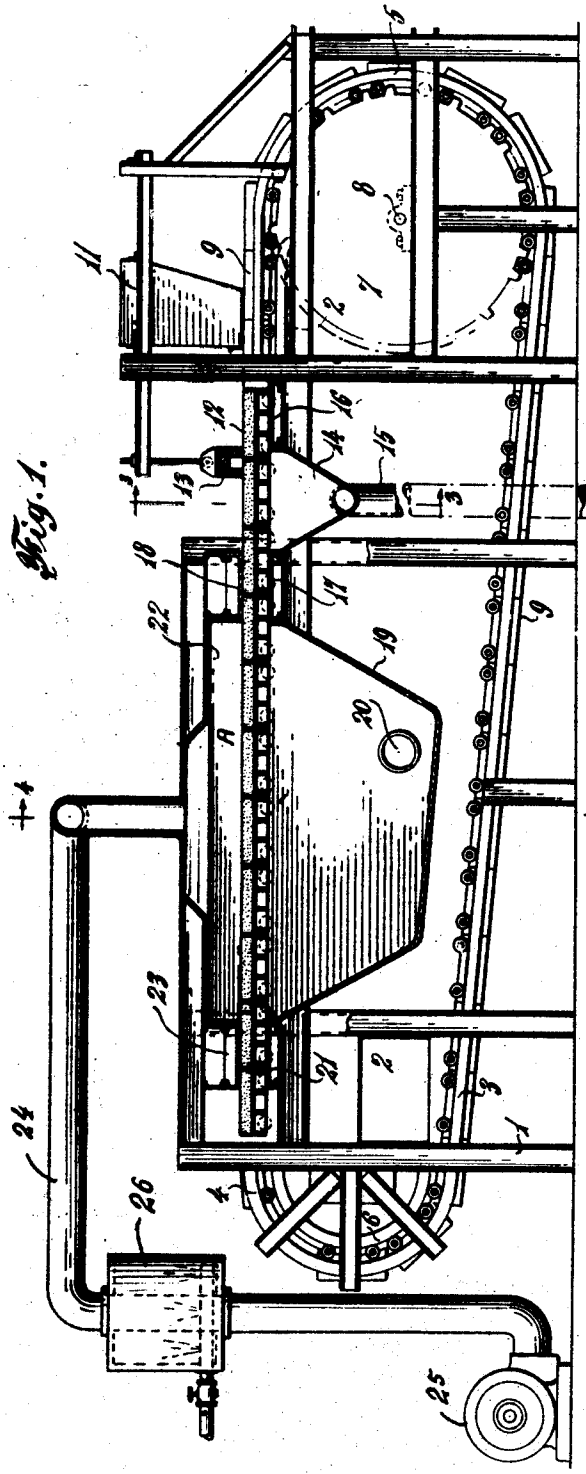


Fig. 1.

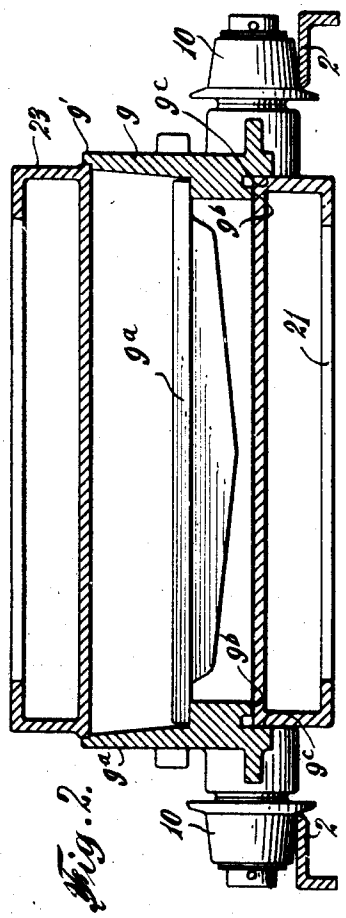


Fig. 2.

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Fig. 4.

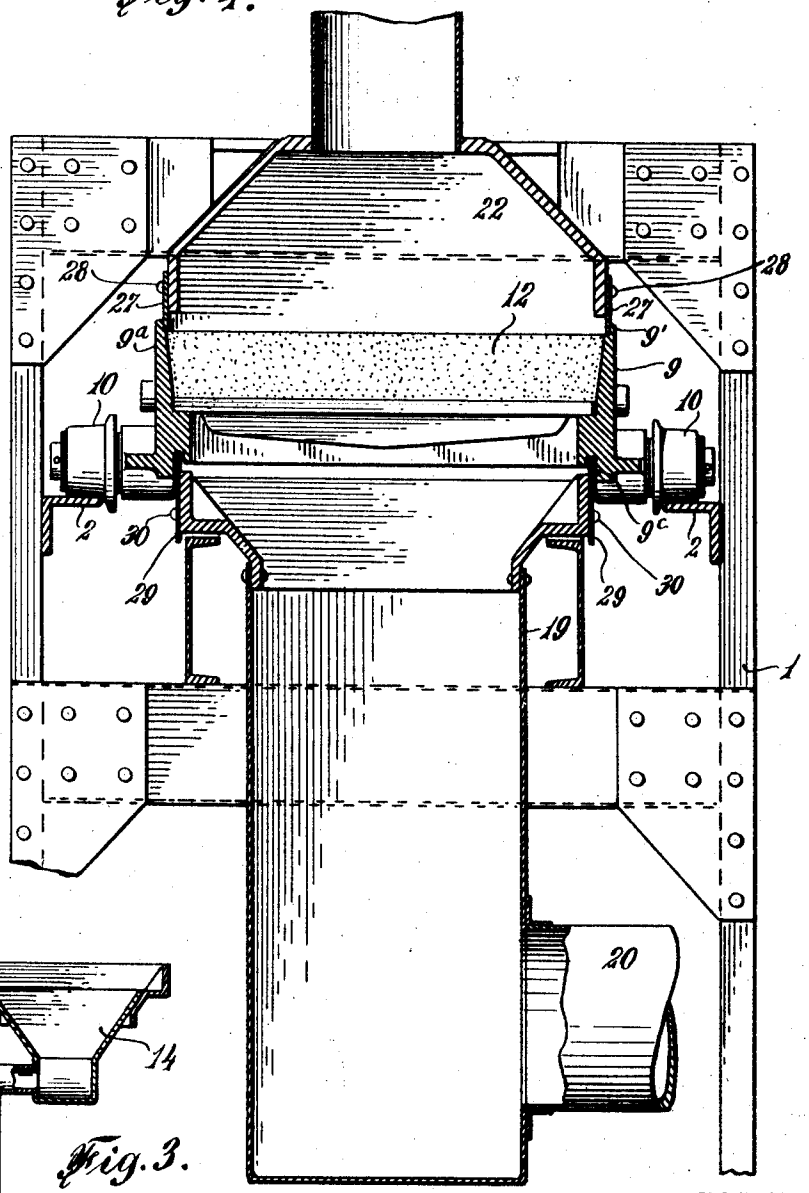


Fig. 3.

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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR SINTERING.

Application filed November 19, 1926. Serial No. 149,337.

My invention relates to the treatment of materials for sintering them and for obtaining gases therefrom, such as materials containing a combustible element in themselves, or materials in which a combustible element may have been mixed, and whose nature is such that when the combustible element has been ignited the combustion may be carried on by means of a blast of air or other suitable gas for causing the particles to be sintered together and to form an agglomerated mass for subsequent treatment in metallurgical or other furnaces. An example of an ore containing its combustible element in combination is a sulphide concentrate of copper, lead or zinc, and an example of material to which the combustible element has been added is a magnetite iron concentrate with coke screenings mixed therewith.

In well known forms of sintering machines a down-draft through the ignited materials has been caused by an exhaust fan for drawing the combustion supporting air through the bed after the material has been ignited. There are numerous disadvantages incident to the use of such sintering machines for different purposes, among which are low mechanical efficiency of an exhaust fan, particularly when operating under high vacuum required to draw air through a bed of fine ore and the relatively low vacuum obtainable with an exhaust fan; rapid wear of the impellers of such exhaust fans because of the abrasive dust carried through by the gases which strike the impeller blades at a relatively high velocity causing a sort of sand-blasting action on the impellers, increasing the cost of maintenance; and the volumes of the hot gases to be handled are much greater than they would be in case the same amount of gases were handled in a cold condition. In the case of sulphide ores it is desirable to utilize the sulphur and the gases therefrom for the purpose of making sulphuric acid, and where air is drawn through the bed of material by means of a vacuum leakages that occur in the fan casing, in the connections between the fan and the vacuum boxes of the sintering machine, and between the vacuum boxes and the ore carriers permits air to be drawn in which dilutes the strength of the gases, frequently to such an extent as to make the gases unsuitable for the manufacture of acid by any of the commercial acid-making processes. Said gases are also diluted by the combustible gases from the igniter burner which have been drawn through the bed of material by the fan to effect an ignition of the ore to be sintered. In the treatment of some materials containing sulphates, such, for instance, as iron pyrites residue, the gases given off contain sulphuric anhydride, and as these pyrites frequently are wet the temperature of the gases falls below their condensation point of sulphuric acid and the acid contained in the gases condenses and rapidly attacks the fan impellers.

The nature of the exhaust fan handling dusty gases is such as to require very liberal clearance between the rotating impeller and the housing in which it runs. When operating at a low vacuum the efficiency of such fan is fairly good, but the higher the vacuum to be produced the greater the slippage of air becomes due to the large clearances, and hence when operating at high vacuums the mechanical efficiency of the fan is exceedingly low. It has been proposed to overcome the difficulty of limiting the vacuum obtainable by the use of positive blowers operating as exhausters, but even with the most thorough cleaning of the gases the amount of dust carried into the exhausters is such as to rapidly fill up the very small clearances and cause injury to or destruction of the blower. A further disadvantage of using exhaust fans is that though a given size fan operating at a given speed will set up a certain vacuum, yet if the resistance of the bed of material in the sintering machine offers a greater resistance to the air than the vacuum the fan sets up practically no air will be drawn through the bed and at all times the amount of air passing through the bed depends entirely upon the resistance of the bed.

Objects of my invention are to ignite combustible materials in a bed of moving material to be sintered and to carry off the products of combustion from the igniter before the materials are subjected to the sintering process to prevent such products of combustion from becoming mingled with gases from the sintering operation; to cause combustion of the materials for sintering at a location remote from the ignition burner; to force air or other gases downwardly through the bed of burning material for sintering it in such a way as to prevent dilution of the combustible products on the sinter bed with excess of air or false air, and

to carry out the sintering operation within a closed chamber from which the external atmosphere is excluded.

My invention comprises novel details of improvement and combinations of parts hereinafter set forth and then more fully pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part hereof, wherein

Fig. 1 is a side elevation, partly in section, of a sintering machine embodying my invention;

Fig. 2 is an enlarged cross section substantially on the plane of line 2, 2, in Fig. 1;

Fig. 3 is a section on line 3, 3, in Fig. 1, and

Fig. 4 is an enlarged cross section substantially on the plane of line 4, 4, in Fig. 1.

Similar numerals of reference indicate corresponding parts in the several views.

The numeral 1 indicates the main frame of a sintering machine which may be of any usual or desired construction provided with upper substantially horizontally disposed spaced tracks 2 and lower spaced tracks 3, shown inclined downwardly from the delivery end of the machine toward the charging end of the machine, said tracks being connected by curved portions 4, 5 at the opposite ends of the frame, the latter being provided with a curved track 6 adjacent to the track portion 4 at the delivery end of the machine. A drive sprocket 7 is journaled in the machine at 8 to be driven in any desired way to operate receptacles or pallets 9 which have wheels or rollers 10 to travel along the tracks, the sprocket 7 being adapted to operate the receptacles for pushing them successively into engagement with one another along the upper tracks 2. A hopper 11 is secured upon the frame above the receptacles at the charging end of the machine, whereby the material 12 to be treated or sintered may be charged into the receptacles to rest upon the grate bars 9^a or other base of the receptacles. The foregoing parts may be of any well known construction in sintering machines.

At 13 is indicated an igniter of any desired variety, such as a gas burner, or one adapted for burning charcoal, coke, gas, oil or the like for igniting the material 12. On the under side of the receptacles opposite or below the igniter is a wind box or chamber 14 adapted to fit closely along the sides of the moving receptacles or pallets 9, which wind box is shown connected to an exhaust pipe 15 which may be connected to any suitable exhaust or vacuum apparatus, such as a suction fan or blower 15^a for drawing atmospheric air through the material 12 to support combustion of the ignited material. Dead plates 16 and 17 are secured to frame 1 on opposite sides of the upper open end of wind box 14, over which dead plates the lower flat surfaces 9^b of the receptacles slide to exclude air. As the receptacles travel, toward the left in Fig. 1, the ignited material 12 passes under a dead plate 18, shown above the dead plate 17, (Fig. 1). At 19 is an air box or chamber, commonly called a wind box, suitably supported upon the main frame beneath the traveling receptacles, and provided with an outlet pipe or passage 20 for gases and the like. One end of the wind box is attached to the dead plate 17 and the other end is attached to a dead plate 21 at the opposite end of the wind box, over which dead plate the receptacles travel or slide to exclude air thereat from the wind box. Above the wind box 20 is another air box 22, beneath which the charged receptacles travel. The upper air box 22 is connected tightly with the dead plate 18 and at its opposite end box 22 is connected with another dead plate 23 that is shown located over the dead plate 21, so that as the charged receptacles travel under the dead plates 18 and 23 air will be excluded from entering box 22. The respective upper edges of the wind box 19 and the lower edges of the box 22 are so spaced that the charged pallets may pass therebetween. The two boxes 19 and 20 together form a chamber A through which the charged receptacles travel. The upper portion of said chamber is supplied with air or other gases under pressure through an inlet pipe at 24, which may be forced into the chamber by means of any suitable blowing device, indicated at 25. The air or gases may be heated in the passage to the box 22 by any suitable means, such as indicated at 26, in the nature of a heating chamber.

When the air or gas is forced into the box 22 it will be forced through the burning material 12 on the receptacles, (within the chamber A), into the box 19, whence it will pass through the outlet pipe 20, thereby causing combustion of the materials for sintering the same. The engagement of the dead plates 17, 18, 21 and 23 with the receptacles 9, and appropriately the dead plates 18 and 23 with the material 12 on the receptacles, resists the outflow of air or gases under pressure from the chamber A. The gases and products of combustion caused by the burning of the material 12 within chamber A, the combustion being supported by the flow of air or gases through the material, will be undiluted from any products of combustion from the igniter 13, which will previously have been drawn off through the wind box 14.

In order to resist leakage of air or gases (that are forced into chamber A) from between the receptacles or pallets 9 and the box 22 I provide flexible material 27 depending from the upper wind box 22 into

contact with the inner surfaces of the side walls 9a of the receptacles 9, as indicated in Fig. 4 at 9'. The material 27 may be in the form of any suitable flexible strips which are relatively soft and of such character as to resist the flow of air and at the same time bear flexibly against the adjacent sealing surfaces of the receptacles or pallets, such as of hemp or asbestos cloth preferably impregnated with lubricating substances, such as graphite or similar material, the strips thereby being made self-lubricating, and which will not wear the metal of the receptacles and is cheap and easy to replace when worn. The strips 27 may be secured to the lower portion of wind box 22 by any suitable means, such as by rivets or screws at 28, so as to be replaceable. The pressure within the box 22 will cause the flexible strips 27 to be forced against the side walls of the receptacles above the material or charge 12 therein as the receptacles travel. Also, flexible strips 29 of the character set forth regarding the strips 27 are secured to the upper portion of the wind box 19 and below the receptacles, as by means of screws or rivets 30, whereby the strips may be readily replaced. The lower portions of the receptacles 9, on opposite sides, are provided with smooth longitudinal surfaces at 9c against which the outer upper surfaces of the flexible strips 29 are adapted to bear, particularly when forced against said surfaces by pressure from within the chamber A. The nature of the strips 27 and 29 and their functions are substantially the same as respects the flexible strips 16 in cooperation with the receptacles and wind boxes, as set forth in Letters Patent No. 1,491,778, granted to me April 22, 1924, in the present instance the strips resisting outward air or gas pressure from within the chamber A.

A great advantage of my improvement is that by means of the flexible strips 27 and 29 bearing against the traveling receptacles 9 desired pressure of air or gases within chamber A may be maintained with relatively small leakage of said air or gases from the chamber to atmosphere, and a further advantage is attained by reason of forcing air or gases into chamber A and through the bed of material 12 upon the receptacles so that leakage of false air into the chamber is obviated, which would tend to dilute the gases and products of combustion passing from the material 12 being sintered in chamber A.

Having now described my invention what I claim is:—

1. A sintering machine comprising means to support and operate movable receptacles, an igniter for igniting combustible material on the receptacles, a wind box in position to receive products of combustion from the igniter drawn through said material, means to induce suction through the wind box, a substantially closed chamber spaced from the igniter having means to permit the travel of the charged receptacles therethrough, and means independent of said suction inducing means for blowing air or other gases free from initial combustion products from the igniter through said chamber for passage through the material on the receptacles.

2. The method of treating material containing a combustible element consisting in applying ignited combustible gases to said element to ignite it to generate heat within said material, conducting from said material the products of combustion from the ignited combustible gases, passing the ignited material through a closed chamber, blowing combustion supporting gases free from products of the ignited combustible gases, into the upper portion of the chamber and into the ignited material and forcing the products of combustion into the lower portion of the chamber, and conducting away the products of combustion from the chamber.

HENRY J. STEHLI.