July 3, 1934. E. W. SHALLOCK 1,965,320

SINTERING METHOD

Original Filed March 21, 1930 2 Sheets-Sheet 1

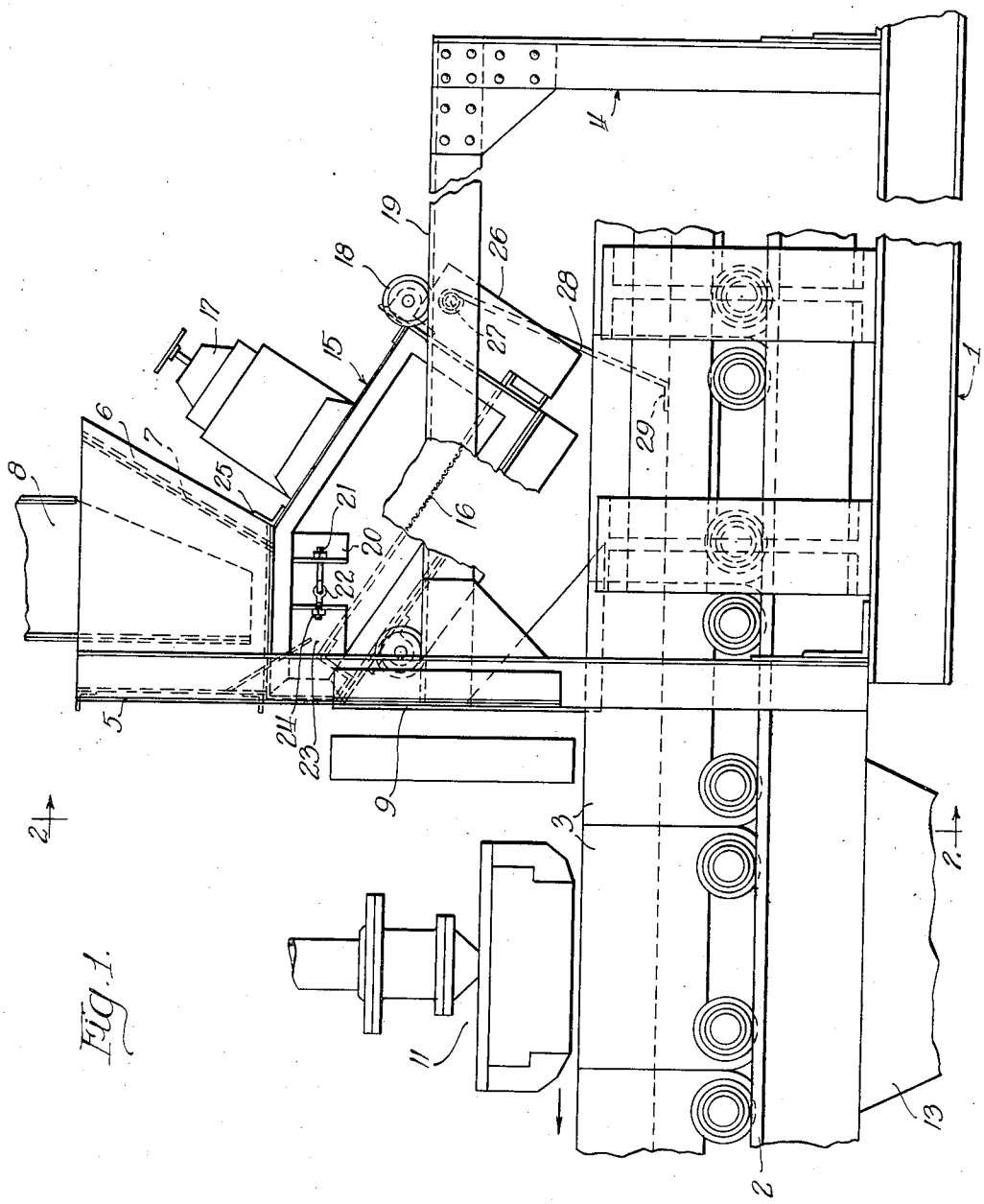


Fig. 1.

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Fig. 2.

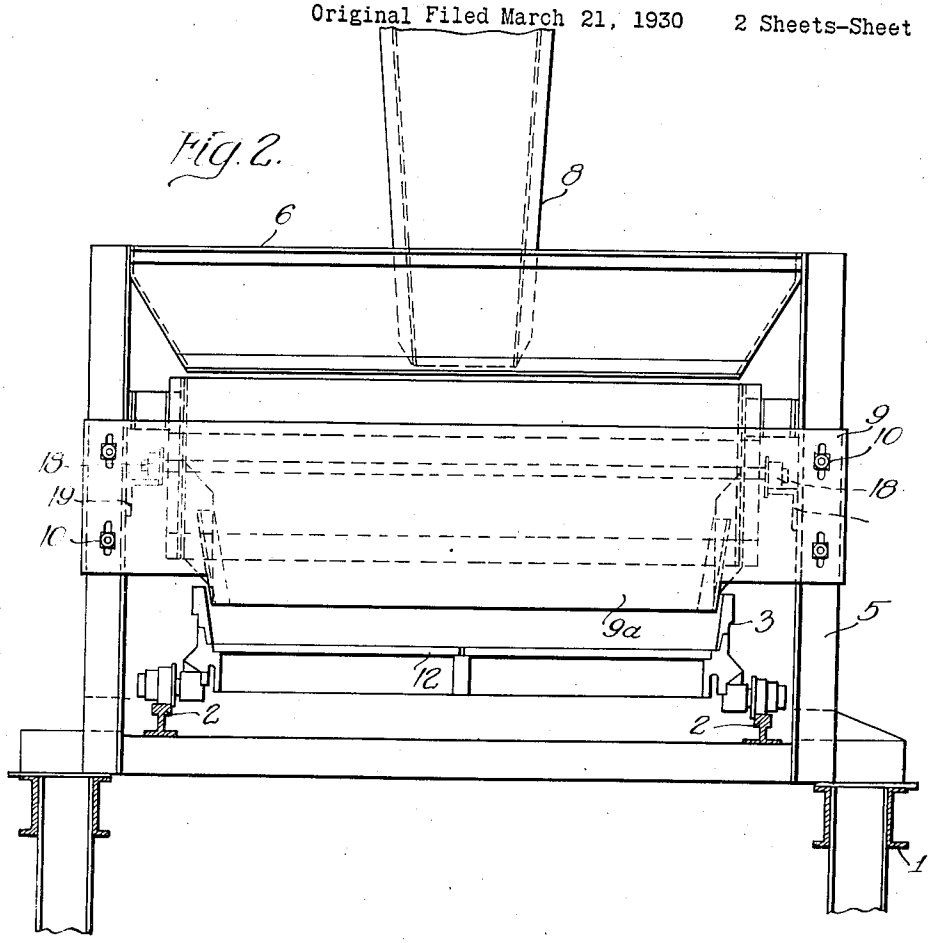


Fig. 3

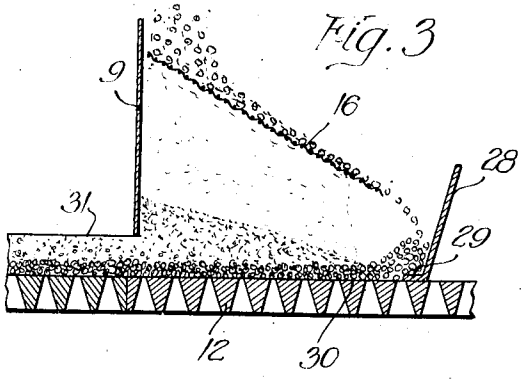
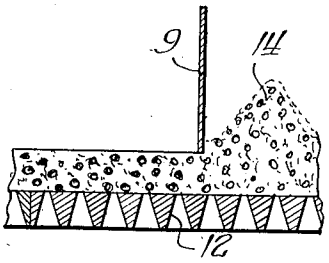


Fig. 4.



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UNITED STATES PATENT OFFICE

1,965,320

SINTERING METHOD

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Original application March 21, 1930, Serial No. 437,649. Divided and this application October 3, 1932, Serial No. 635,885

1 Claim. (Cl. 266—21)

This invention relates to the sintering of ores, flue dust, and other materials containing combustible ingredients, and has to do more particularly with a method for sintering such materials.

Ores and other materials to be sintered are not uniform and frequently contain large proportions of relatively large particles, which may be considered as aggregates, as well as considerable proportions of relatively small particles, which may be considered as fines. In sintering materials which are composed either entirely or to a considerable extent of fines, when the sintering operation is conducted in machines known as the Dwight and Lloyd type, in which the material to be sintered is deposited in a layer upon a perforated grate, the fine material has a tendency to stop up or clog, more or less, the perforations of the grate with the result that it is frequently quite difficult to obtain the proper down-draft through the mass to assure proper sintering thereof during travel of the grate to the delivery or discharge end of the machine. Under such conditions, either the material is not properly sintered, or the output of the machine is greatly curtailed due to the necessity of slowing down the speed of operation. The great majority, and in fact practically all, of the materials treated in sintering machines contain an appreciable amount of relatively large particles or aggregates. It is the present practice, when sintering such materials in continuously operating machines, such as machines of the Dwight and Lloyd type, to deposit the material upon the moving grate with the coarse particles or aggregates and the relatively small particles or fines intermixed indiscriminately, with the result that a certain amount of stoppage of the perforations of the grate occurs with resultant slowing down in the sintering operation.

I have found that this objection can be avoided, and the output of a given machine greatly increased, by separating the fines and aggregates of the material to be sintered and forming upon the grate a lower layer of aggregates, and then depositing upon this lower layer an upper layer of fines. The lower layer of aggregates is loose and porous and will not clog the openings of the grates so that air will readily pass downwardly through both layers of material, after the upper layer of fines has been ignited, and combustion throughout the mass is rapidly propagated with the result that the sintering operation can be quickly and satisfactorily accomplished in much less time than is now possible under present practice. One of the main objects of my invention is to provide a method whereby the material to be sintered is separated into aggregates and fines and disposed in a lower layer of aggregates and an upper layer of fines, this separation of the material and disposition thereof in different layers being accomplished as a continuous operation.

A further object of my invention is to dispose the material to be sintered in a layer or bed which increases in porosity from the top to the bottom thereof so that, as the depth of the bed increases, the resistance to downward flow of air therethrough decreases, rendering possible rapid and complete sintering of the material by downdraft combustion thereof.

Further objects and advantages of my invention will appear from the detailed description.

In the drawings:

Figure 1 is a fragmentary side view of the feed end of a sintering machine of the Dwight and Lloyd type, partly broken away, to which the method of my invention is applicable;

Figure 2 is a section taken substantially on line 2—2 of Figure 1, looking in the direction of the arrows, the wind box and the shield in front of the feed hopper and screen being omitted for clearness of illustration;

Figure 3 is a semi-diagrammatic section through the screen and grate structure and associated parts illustrating the method of my invention and the resulting bed of material to be sintered; and

Figure 4 is a semi-diagrammatic sectional view through the feed hopper and associated parts illustrating the present practice in depositing the material upon the grate surface.

This application is a division of my copending application for Sintering machine, filed March 21, 1930, Serial No. 437,649.

I have illustrated the method of my invention as used with a sintering machine of the Dwight and Lloyd type, by way of example, for which it is particularly well adapted though it may be used with other types of machines, in its broader aspects. The sintering machine comprises a main frame 1 of suitable construction carrying tracks 2 upon which travel pallets 3 of known type. This machine has an endless track, comprising an upper run and a lower run, and is provided with suitable means, such as sprocket wheels, for elevating the pallets from the lower run to the upper run and propelling them along the latter. The pallets are provided with grates and the pallets of the train on the upper run of the machine are in contact so as to provide a continuous traveling grate structure. As the pal-

lets travel along the upper run of the track they first pass beneath a feed hopper by means of which the material to be sintered is delivered to the pallets and is leveled off by a gate member in the continued travel of the pallets, after which the pallets pass beneath a suitable device for igniting the material and then, in their continued travel, the pallets pass over wind boxes which are connected to suitable suction means for creating a down-draft through the mass or layer of material on the pallets whereby combustion is propagated downwardly therethrough.

When the pallets reach the delivery or discharge end of the track they pass downwardly about the same and sinter is discharged from the pallets. The construction and operation of machines of this type are well known in the art and need not be illustrated or described here in detail.

A supplemental frame 4 is suitably secured to the main frame 1 and projects upwardly therefrom. This supplemental frame is provided, at its forward end, with uprights 5 which support a feed hopper 6 provided with a downwardly and forwardly inclined rear deflecting wall or plate 7. The material to be sintered is delivered to this hopper 6 by means of a swinging spout 8 which swings transversely of the hopper so as to distribute the material the full width thereof, this spout swinging on an axis extending lengthwise of the machine. Swinging spouts of this type, and means for operating the same are well known in the art. It is the present practice to dispose the hopper 6 somewhat closer to the pallets 3 than in Figure 1, the material being discharged from the hopper onto the pallets, after which the pallets pass beneath a gate plate 9 adjustably mounted, as by slot and bolt means 10, upon the uprights 5.

This plate has a central extension 9*a* which projects downwardly a suitable distance beyond the top of the pallets and serves to level off and remove the upper portion of the material upon the pallet so as to provide a layer of uniform thickness. The pallet then passes beneath an ignition device 11, commonly termed an ignition furnace, which serves to ignite the material upon the pallet. Each pallet is provided with a grate structure 12 (Figure 3) provided with suitable openings for the flow of air and products of combustion therethrough. After the charge of material has been ignited, the pallet passes over a series of wind boxes 3, in succession, these boxes being connected to suitable means for creating a suction effect therein which serves to draw air downwardly through the material upon grate 12 so as to propagate combustion downwardly through such material. This method of sintering is in accordance with present practice and is well understood in the art.

The method of disposing the material to be sintered upon the grate surface, in accordance with present practice, is illustrated in Figure 4. As previously pointed out, it is the present practice to discharge the material from spout 8 into the feed hopper 6, this material being then discharged from the feed hopper directly onto the moving grates of the pallets. The material is discharged upon the grates in the form of a pile or ridge which is of approximately conical cross section, as indicated at 14 in Figure 4. In this pile or ridge of material, the coarser particles of aggregates, and the relatively minute particles or fines, are mixed indiscriminately and, as the pallets travel beneath the gate plate 9 the pile of material is leveled off to provide a layer of substantially uniform thickness. In the layer of material thus produced, however, the fines and the aggregates are not segregated but, on the contrary, are mixed together indiscriminately and a considerable portion of the fines rest directly upon the grate surface and act to stop up or clog the openings of the grate with the result that the air and products of combustion cannot readily be drawn therethrough. In consequence, the rate of combustion of the material is retarded with a resultant curtailment in the production of the machine. I avoid this objection by providing means for separating the fines and the aggregates of the material and then disposing the material in two layers upon the grate, the lower layer consisting of the aggregates and the upper layer consisting of the fines.

For this purpose I provide a screen structure and means for supporting the same for movement into and out of operative relation to the feed hopper 6.

In Figure 1 I have shown a screen structure 15 which comprises a suitable frame and casing and a screen 16 disposed within the casing. This screen is operated by an electric motor 17, carried by the screen structure, so as to facilitate passage of material over and through the screen. The screen structure 15 is provided with mounting rollers 18 which travel upon tracks 19 carried by the supplemental frame 4, the tracks and the rollers providing convenient means for moving the screen structure into and out of operative relation to the feed hopper 6. Structure 15 is provided, at each side thereof, with an angle bracket 20 suitably secured thereto, this bracket receiving an eye bolt 21 secured therethrough. The eye of bolt 21 receives the eye of a second eye bolt 22 adapted to be swung into and out of a slot in the outwardly projecting arm of an angle bracket 23 suitably secured to upright 5. A nut 24 screws onto eye bolt 22 and bears against the outwardly projecting arm of bracket 23 for holding the screen structure 15 in operative relation to the hopper.

An angle strip 25, secured to the top of the casing of screen structure 15, is disposed closely adjacent the rear wall of hopper 6 when the screen structure is in the position illustrated. The casing of structure 15 is provided with an opening through its top which, when the screen structure is in operative position, registers with the lower end of hopper 6.

The screen 16 is inclined downwardly and oppositely to the direction of travel of the pallets 3. Wing members 26 project rearwardly from the screen structure 15 and support a rod 27 upon which is mounted a curtain structure. This curtain structure comprises a plurality of flat strips 28 mounted at their upper ends upon the rod 27 for free swinging movement about the same. Each of these strips is bent, at its lower portion, to provide an angularly disposed finger 29 which rests loosely upon the upper face of grates 12 of the pallets, as in Figure 3. The material to be sintered is discharged from spout 8 into the hopper 6 from which it passes onto the upper portion of the screen 16. This screen acts to separate the material into fines and aggregates. The fines pass through the screen and the aggregates are discharged from the lower end thereof. These aggregates are deflected by the curtain structure onto the upper face of the traveling grate structure so as to form thereon a lower loose and porous layer 30. This layer travels

with the grate and, in the continued travel thereof, the fines are deposited directly upon the lower layer 30 to form a superposed layer 31 of fines. It is to be noted that these fines are deposited upon the lower layer 30 as separation of the material occurs and, as the pallets pass beneath the gate plate 9, the upper layer 31 is leveled off to uniform depth. By depositing the fines upon the lower layer, immediately after separation of the fines from the aggregates, packing of the upper layer is prevented and this upper layer 31 of fines is in a loose and fluffy condition so that passage of air therethrough, with resulting combustion after ignition of the upper layer, is greatly facilitated. A further advantage of my invention is that the material is separated into fines and aggregates and disposed in a lower layer of aggregates and an upper layer of fines, as a continuous operation and during travel of the grate structure. By thus conditioning the material to be sintered, I render it possible to operate the sintering machine at higher speed and obtain more complete sintering of the material, than is possible under present practice. This has the great advantage of both increasing the output of the machine and obtaining more complete sintering of the material.

Since the screen 16 is inclined downwardly and contra to the direction of travel of the pallets, and the material, including both fines and aggregates, is delivered onto the upper face of the screen adjacent the upper end thereof, as clearly shown in Figs. 1 and 3, the fines which pass through the screen will increase in size or coarseness toward the lower end of the screen. This means that the layer of fines which is deposited upon the lower layer of aggregates will be of progressively increasing fineness from the bottom of the layer of fines to the top thereof, the fines having the greatest degree of fineness being at the top of the layer. The plate 9 levels off the layer or bed of material so as to assure uniform thickness thereof, and this bed of material is composed of particles which increase in degree of fineness from the bottom of the bed to the top thereof. This graduated bed of material, while in a light and fluffy and unpacked condition, passes beneath the ignition device 11 where the top of the layer or bed is ignited. By having the bed of uniform thickness and in a light and fluffy and unpacked condition, with the particles of the bed graduated and increasing in degree of fineness from the bottom to the top of the bed, I assure rapid and uniform sintering of the entire bed for the full thickness thereof, thus rendering it possible to perform the sintering operation continuously and at appreciably higher speed than where the material to be sintered is not deposited upon the pallet grate in this light and fluffy and unpacked condition and with the material of the bed graduated and increasing in fineness from the top to the bottom thereof.

In the treatment of certain materials it may be found desirable to deliver such materials directly from the hopper 6 onto the pallet grates. To do this, it is only necessary to release the eye bolts 22 and roll the screen structure 15 rearwardly along the tracks 19 into a position completely withdrawn from beneath the hopper 6. During this movement of the screen structure, the strips 28 of the curtain drag along the grates of the pallet and do not interfere in any way with movement of the screen structure into inoperative position. With the screen structure 15 disposed in inoperative position, the material delivered to hopper 6 is discharged therefrom directly onto the pallet grates, the operation of the machine, in all other respects, being the same as above set forth, with the exception that the material is not separated into fines and aggregates and disposed upon the pallet grates in separate layers.

The screen structure 15 is of known type and need not be illustrated nor described in greater detail, it being sufficient that a suitable screen is provided for separating the material into fines and aggregates, and has associated therewith means for disposing the aggregates in a lower layer upon the pallet grates, the fines being then disposed in a layer superposed upon such lower layer. There are a number of screen structures which may be adapted for use on sintering machines, and any suitable screen structure may be employed for this purpose.

The spout 8 delivers the material to be sintered, which material includes intermixed fines and aggregates, to the screen 16 at the upper end thereof. This material passes downwardly over the screen, the finer particles passing through the upper portion of the screen, the particles which pass through the screen increasing in coarseness or size toward the lower end of the screen. The coarsest particles or aggregates are delivered from the lower end of the screen onto the grate surface, as above described. In this manner, the material to be sintered is deposited upon the grate structure in a bed of predetermined depth, and the particles of material increase in degree of fineness from the bottom of this bed to the top thereof, the coarsest particles or aggregates being at the bottom and the finest particles being at the top. The material is thus graded throughout the depth of the bed, which assures both rapid and thorough sintering of the material.

What I claim is:

The method of sintering material containing particles of varying degrees of fineness, which comprises passing the material downward over an inclined screen and thereby separating and graduating the particles in accordance with differences in degree of fineness thereof, depositing the graduated particles of material from the screen directly upon a grate while maintaining undisturbed the graduation by the screen of the material particles and during relative movement between the screen and the grate, thereby depositing the material upon the grate in a bed with the largest particles at the bottom of the bed and the particles graduated as to degree of fineness and increasing in fineness throughout the entire depth of the bed and from the bottom to the top thereof, and sintering the resultant bed of material by downdraft combustion initiated at the top surface of the bed.

EDWARD W. SHALLOCK.