Jan. 9, 1945. E. W. SHALLOCK 2,367,063

SINTER TREATING MEANS

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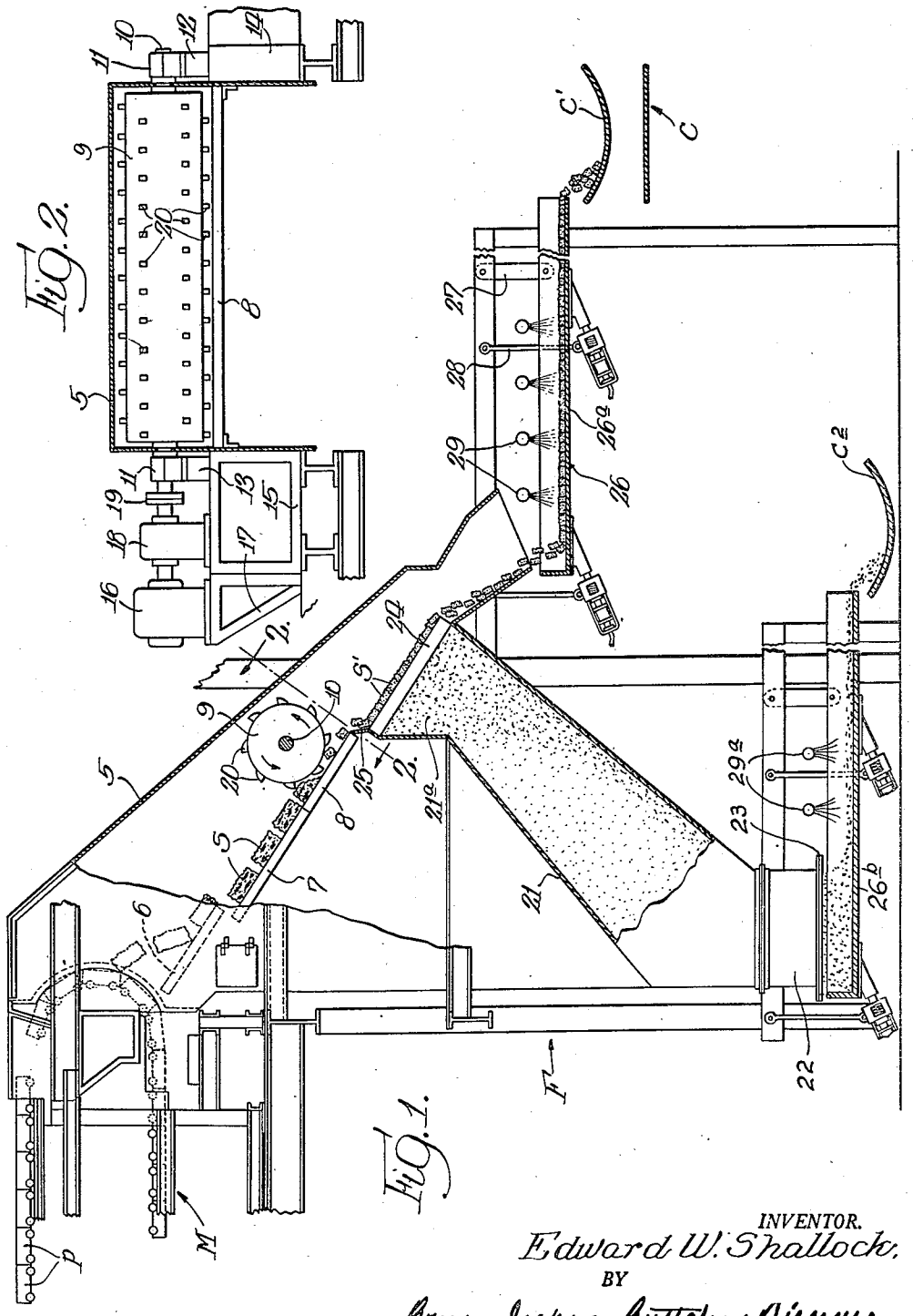


Fig. 1.

Fig. 2.

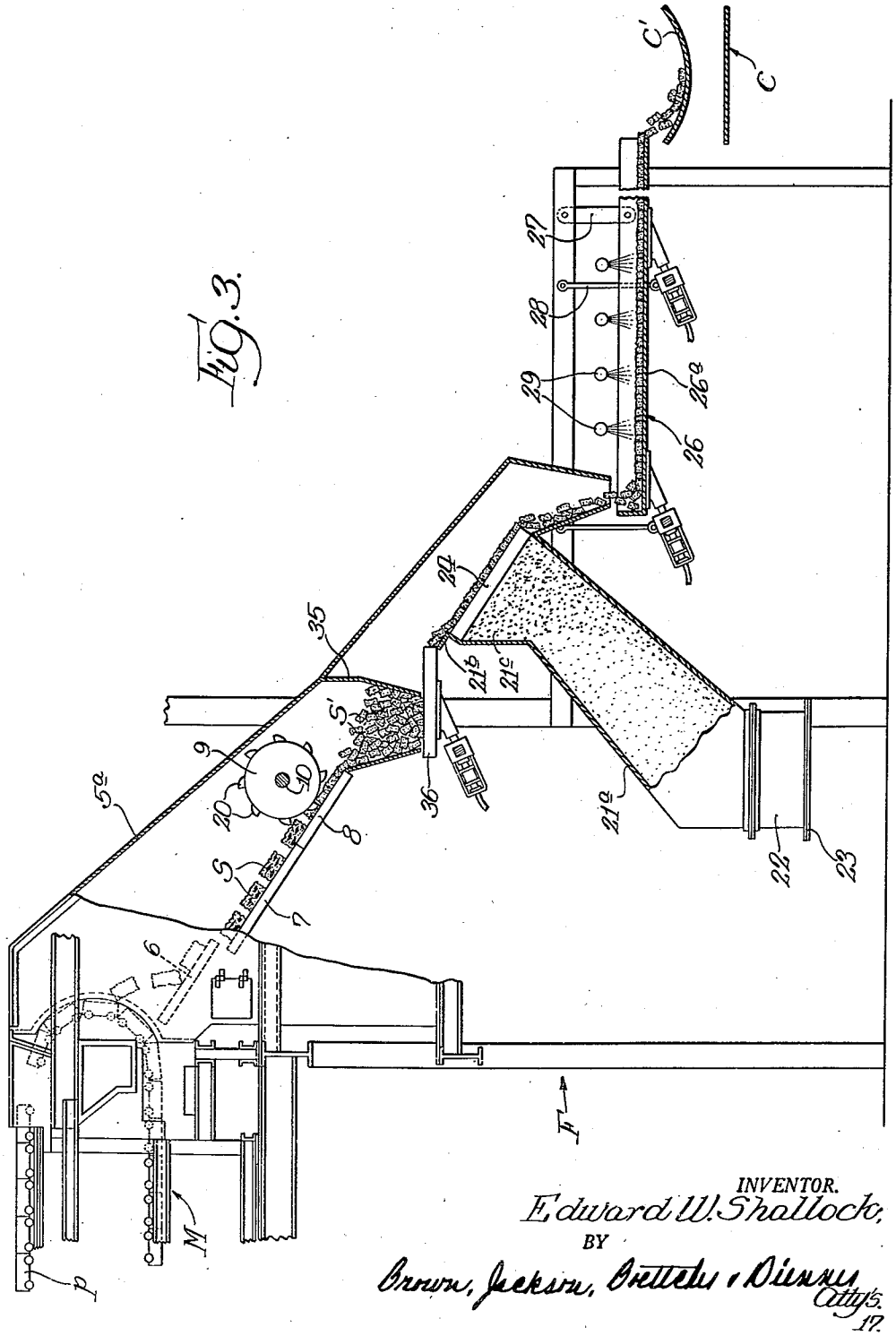
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Fig. 3.



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SINTER TREATING MEANS

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13 Claims. (Cl. 266—21)

This invention relates to sintering operations and has to do with means for and a method of treating sinter from sintering machines, particularly applicable to sintering machines of the continuously operating type.

In sintering plants handling of the sinter frequently presents a difficult problem. The sinter, in continuously operating machines, usually is discharged into a chute down which the sinter slides, passing over a grizzly bar screen for removal of the fines. The sinter is discharged from the machine more or less intermittently and much of it is in large pieces, particularly if the sinter is hard and well fused, which quickly travel down the screen. As a result, the flow of the sinter over the screen is not uniform, and the screen openings must be adequately large to assure that the small pieces of sinter or fines will pass therethrough during the rapid travel over the screen of the mixed large pieces of sinter and the smaller pieces. That means that an objectionably large amount of pieces of sinter of sufficient size for smelting or other treatment pass through the screen, which materially reduces the tonnage output of the machine. The sinter fines pass through the screen into a hopper, from which they may be delivered by a suitable conveyor to a bin or receptacle, from which the fines, mixed with other materials, may be delivered to the machine and used in the sintering operation. The sinter fines are hot when discharged from the hopper and are cooled by quenching with water, which requires an objectionably large amount of water, due to the presence in the fines of a large proportion of comparatively large pieces of sinter, caused by the necessity for having large screen openings, as above explained. The large pieces of sinter which do not pass through the screen may be discharged from the chute into cars or into a pit. This sinter is quite hot and, if discharged into cars without being cooled, it would cause burning of the paint off of the cars. In order to avoid that, the hot sinter is quenched with water, which requires a large amount of quenching water, due to the fact that the sinter is in large pieces piled indiscriminately one upon the other in the car. A further objection to such quenching, in addition to the large volume of water required, is that it causes disintegration of a certain amount of the sinter, both by the action of the water and in some cases by internal explosions in the larger pieces of sinter, which results in objectionable waste. It would be advantageous, in many sintering plants, to transfer the discharged sinter to storage bins or stock piles by means of belt conveyors. But the hot sinter must be cooled before it can be handled by belt conveyors. That necessitates quenching the pile of sinter in the pit at the discharge end of the machine, with the attendant objections to water quenching above noted. In addition, the sinter, after cooling, would have to be loaded onto the conveyor, which means further handling with corresponding increased cost. In many plants, the necessity for water quenching the sinter and loading it onto the conveyor renders the use of belt conveyors for moving the sinter impracticable.

My invention is directed to avoiding the above noted objections to the present practice and involves treating sinter delivered from a sintering machine in such manner that it may be adequately cooled by spraying with a comparatively small amount of water, as distinguished from quenching with a large volume of water, and may then be deposited, either directly or indirectly, in a suitable receptacle or at a desired location. The treating means is associated with a sintering machine, preferably a continuously operating machine, in such manner that the treatment of the discharged sinter may be carried on as a continuous operation properly timed with respect to operation of the machine and without interfering therewith. More specifically, I provide means whereby the sinter, as it is discharged from the sintering machine, is broken up into pieces of desired size and is then caused to travel at a substantially uniform rate over the screen, the uniform travel and distribution of the sinter over the screen permitting quick separation of the fines from the larger pieces and permitting the use of a screen having smaller openings than under the present practice. That effects a material saving in sinter of a size suitable for smelting or other treatment, with a corresponding increased output in tonnage of the machine, which is an important consideration. It also has the advantage that the sinter fines are of smaller and more nearly uniform size than under the present practice, and may be adequately cooled by spraying with water instead of quenching, with a resulting material saving in the water used to cool the fines. Further, in accordance with my invention, the larger pieces of sinter which pass over the screen are delivered, at a substantially uniform rate, to a suitable conveyor and are there spread in a comparatively thin and uniform layer which is subjected to a spray of a cooling fluid, conveniently water, effective for quickly cooling the sinter with the use of but a compara-

tively small amount of water or other suitable fluid. After cooling, the sinter in a substantially dry condition may be discharged into a car or other receptacle, or onto a belt or other suitable conveyor. By breaking up the sinter and controlling its flow, as stated, it may be handled at greater speed than where it is not so treated, thus rendering feasible increased speed in operation of the sintering machine, with corresponding increase in production, and distributing the broken up sinter in a thin uniform layer enables quick cooling thereof by spraying and avoids disintegration of the sinter during cooling, all to the end of avoidance of waste, saving in cooling water, and increased output of the machine. Since the treatment of the sinter is carried on as a continuous operation, no interference with the operation of the sintering machine is encountered. Other objects and advantages of my invention will appear from the detail description.

In the drawings:

Figure 1 is a semi-diagrammatic side view of the sinter treating means of my invention applied to a sintering machine, the discharge end portion only of the machine being shown, parts being broken away and other parts being shown in section;

Figure 2 is a sectional view taken substantially on line 2—2 of Figure 1; and

Figure 3 is a view on the same order as Figure 1 showing a modified form of my invention.

I have illustrated my invention as applied to a sintering machine M of known type, having associated therewith a suitable frame structure F. The machine M is of what is known as the Dwight and Lloyd continuous operating machine, and may be similar to the machine disclosed in my Patent No. 1,764,695. The discharge end of the machine is provided with a hood structure comprising a chute 5 which receives the sinter *s* as it is discharged from the pallets *p* in the travel of the latter about the return bend at the discharge end of the machine. The pieces of sinter fall upon a dead plate 6 inclined downwardly from the discharge end of the machine, and, in sintering machines of present type, pass from the dead plate 6 onto a grizzly bar screen through which the smaller particles or fines of the sinter pass, the large pieces of sinter being discharged from the lower end of the chute.

In the sinter treating means of my invention I replace the usual screen by a second dead plate 7 also inclined downward from the discharge end of the machine, and preferably, though not necessarily, spaced a short distance below the dead plate 6. A breaker plate 8 is suitably mounted in chute 5 and extends at a downward inclination from dead plate 7, providing therewith an inclined surface over which the pieces of sinter *s* travel downward toward the lower end of chute 5.

A breaker roll 9 is rotatably mounted above breaker plate 8, by means of a shaft 10 on which this roll is suitably secured, this shaft being mounted in bearing blocks 11 carried by standards 12 and 13. Standard 12 is carried by an upright 14 suitably supported by a portion of the frame structure F, and standard 13 is carried by a sub-frame 15 likewise supported by the frame structure F. Shaft 10 may be driven in any suitable manner. Conveniently, this shaft is driven by means of an electric motor 16, mounted on a bracket 17 secured to sub-frame 15, through a speed reducing unit 18 of suitable known type, mounted on sub-frame 15, this unit being coupled to shaft 10 by means of a coupling 19 of known type.

Shaft 10 extends transversely of chute 5 above and parallel with breaker plate 8, as does the breaker roll 9. The latter is provided with suitably formed teeth 20 arranged in rows lengthwise of the roll, the teeth of each row being staggered relative to the teeth of the next adjacent row, as shown. The roll 9 is rotated in counterclockwise direction as viewed in Figure 1, as indicated by the arrows, and is spaced a proper distance above breaker plate 8, with the teeth 20 properly spaced for breaking the large pieces of sinter *s* discharged from the machine M into smaller pieces of desired size.

A fines receiving hopper 21 extends downward from the bottom of chute 5 at an inclination thereto, as shown, and is provided at its lower end with a discharge spout 22 controlled by a suitable valve plate 23 in a known manner. Hopper 21 is flared at its upper end, at 21*a*, across which extends a screen 24, there being a baffle 25 extending from the lower end of breaker plate 8 to the upper end of screen 24. This screen 24 may be of any suitable known type, and is shown, for purposes of illustration, as a grizzly bar screen inclined downward toward the lower end of chute 5.

Chute 5 extends downward at an inclination beyond screen 24, as shown, with its lower end disposed a short distance above a conveyor 26, which may be of any suitable known type. Preferably, the conveyor 26 is a vibrating type of conveyor, comprising a pan 26*a* open at one end and mounted for vibratory movement, this pan having associated therewith electromagnetic and spring means for imparting desired lengthwise vibratory movement thereto, for causing the material in the pan to travel toward the open end thereof. This type of conveyor is described more in detail in my Patent No. 2,100,878, is known in the art, and requires no further detail description here. Suffice it to state that the conveyor 26 may be of any suitable known type, though I usually prefer to employ at this point a vibratory type of conveyor such as that referred to above. The pan 26*a* of conveyor 26 may be suspended by links, one of which is shown at 27, from a portion of the frame structure F, and the power unit for vibrating the pan may also be suspended from a portion of the frame structure by means of suspending rods 28 and associated parts. Suitably disposed spray pipes 29 are disposed above the pan of conveyor 26 transversely thereof for spraying a cooling fluid, conveniently water, upon the contents of the pan.

The large pieces of sinter *s* discharged from the sintering machine M slide down the dead plates 6 and 7 to the breaker plate 8 and the breaker roll 9. The latter is driven at proper speed such that it is capable of breaking the large pieces of sinter *s* into smaller pieces *s'* of desired size, at a rate somewhat greater than the rate of discharge of the sinter from the sintering machine, thus assuring that there will be no objectionable accumulation of sinter in the chute 5 above the sinter breaking means. Roll 9 cooperates with plate 8 to break the sinter to desired size, and also functions as a retarder for the sinter traveling downward upon the plates 7 and 8, and also serves, in effect, as feed means for delivering the broken sinter to the screen 24 at a substantially uniform rate, so that the pieces *s'* of broken sinter are distributed in a single layer uniformly over the screen 24. This assures that

the smaller pieces or sinter fines will pass readily through screen 24, permitting the use of a screen with smaller openings than is possible under the present practice, thereby increasing the tonnage output from the sintering machine, while assuring that the fines are of more nearly uniform and smaller size than heretofore, with the advantages above pointed out.

In sintering machines of the continuous type, such as that disclosed herein, the pieces of sinter are broken off from the sinter bed, as the pallets pass around the return bend at the discharge end of the machine, and are discharged from the pallets onto the dead plate 6, as shown. These pieces of sinter *s* are of considerable size, substantially corresponding in width and length to the pallets and in height or thickness to the depth of the pallets or the sinter bed, as is known. These large pieces of sinter can not be effectively cooled by water spraying and, if cooled, are quenched in water, which is objectionable, as and for the reasons previously stated. By breaking the large pieces *s* into the relatively small pieces *s'*, of approximately rectangular cross section and much thinner than the large pieces, as shown in the drawings, I render practicable cooling of the sinter by spraying it with water. As the pieces of broken sinter *s'* pass over the inclined screen 24 they assume a flatwise position thereon with their surfaces of greatest area resting upon screen 24, due to the inclination thereof which, in conjunction with the force of gravity, is effective to cause any of such pieces tending to stand upon one of its narrow edges to fall over flatwise onto screen 24, as will be clear from Figure 1. The broken pieces of sinter *s'* will also lie flatwise in the conveyor pan 26ª in a substantially uniform layer, as shown, so as to be acted upon to best advantage by the water spray and quickly cooled thereby.

The pieces of broken sinter *s'* are delivered from the screen 24, from the lower portion of chute 5, into pan 26*a* of the conveyor 26, this delivery of the pieces of sinter to the pan 26*a* being at a substantially uniform rate corresponding to the rate of operation of the sinter breaking means. The conveyor 26 is operated at such a rate that the pieces of broken sinter *s'* delivered to pan 26*a*, are caused to travel along this pan, toward the discharge end thereof, at a rate such that the sinter is disposed in the pan in a comparatively thin, substantially uniform layer. As this layer of the broken sinter passes beneath the spray pipes 29, it is subjected to a cooling water spray projected downward from these pipes, this spray being effective for quickly cooling the sinter, due to the fact that the sinter is disposed in a thin substantially uniform layer, as noted, and also is in sufficiently small pieces to be readily cooled. That avoids necessity of using a large volume of water for quenching the sinter, as is the present practice, while also avoiding disintegration and waste of the sinter due to water quenching, as above explained. The pan 26*a* of conveyor 26 extends a sufficient distance beyond the spray pipes 29, to assure that the sinter will be dry, or at any rate dry enough for efficient handling thereof, by the time it reaches the open or discharge end of pan 26*a*, this drying of the sinter being effected rapidly by evaporation, due to the fact that the sinter retains sufficient residual heat for that purpose after passing out of the zone of the spray means, it being particularly noted, however, that the sinter is effectively cooled to a sufficiently low temperature to be suitable for discharge into a car or other receptacle, or onto a conveyor belt. I have shown a belt conveyor C of known type, having a downwardly concave upper run *c'* disposed beneath the open end of pan 26*a*, for receiving the broken up and cooled sinter discharged therefrom.

It will be seen that I have provided means whereby the sinter, as it is discharged from the sintering machine, is broken up into pieces of desired size, is screened, and is then cooled, thereby being rendered suitable for discharge into a car or other receptacle or onto a conveyor, this operation being a continuous one and suitably timed with respect to the operation of the sintering machine M, thus avoiding interference with operation of the machine. Further, since the broken up sinter is passed over the screen 24 at substantially uniform speed, and is distributed evenly over the screen, separation of the fines from the larger pieces of the sinter is effected with a minimum of delay, rendering it feasible to operate the machine M at higher speeds than as at present, thus increasing the output of the machine, the total effective output of the machine also being increased due to the practicability of utilizing a screen 24 with smaller openings than under the present practice, as previously explained.

The fines may be conveyed from hopper 21 to a storage bin, or to any other suitable receptacle or location, by any suitable means, though I prefer to employ for that purpose a vibratory pan conveyor in conjunction with a belt conveyor, similar to the conveyor 26 and belt conveyor C for handling the larger pieces of broken up sinter discharged from the lower end of chute 5. Since the fines are of more nearly uniform and smaller size than under the present practice, they may be effectively cooled by spray means, in the same manner as the sinter passing along pan 26*a* of the vibratory conveyor 26 is cooled, thus effecting a material saving in the amount of water required for cooling the sinter fines. For that purpose, a vibratory conveyor 26*b*, similar to and supported in the same manner as conveyor 26, extends beneath hopper 21 to receive the fines discharged therefrom, and spray pipes 29*a* are suitably supported above conveyor 26*b*. This conveyor 26*b* may deliver the cooled fines to a belt conveyor C2 similar to conveyor C, or to any other suitable means for conveying the cooled fines to a storage bin, or to any other suitable receptacle or location.

In the modification illustrated in Figure 3, chute 5*a* is provided with an auxiliary hopper 35 disposed to receive the pieces of broken up sinter *s'* from the breaker roll 9 and breaker plate 8, hopper 35 delivering the broken up sinter to a conveyor 36 of suitable known type, preferably a vibratory type of conveyor. Conveyor 36 delivers the broken up sinter over a lip 21*b*, at the upper end of the upper flared portion 21*c* of hopper 21*a*, to the downwardly inclined screen 24. This screen 24 may be a grizzly bar screen, or a screen of any other suitable type. The fines pass through screen 24 into the fines hopper 21*a*, and the larger pieces of broken up sinter are discharged by hopper 5*a* into the pan 26*a* of the vibratory conveyor 26, the sinter being sprayed and cooled as before and discharged by conveyor 26 onto the belt conveyor C, as before. The provision of the hopper 35 and the vibratory conveyor 36 is advantageous in certain cases, as being conducive to increased accuracy and uniformity in delivery of the broken up sinter to the screen 24 and thence to the conveyor 26. In other respects, the operation of the

sinter treating means shown in Figure 3 is similar to that of the sinter treating means illustrated in Figure 1, and requires no further detailed description.

As above indicated, and as will be understood by those skilled in the art, changes in construction and arrangement of parts of the sinter treating means of my invention, and changes in the method practiced by such means, may be resorted to without departing from the field and scope of my invention, and I intend to include all such variations, as fall within the scope of the appended claims, in this application in which the preferred forms only of my invention have been disclosed.

I claim:

1. In sinter treating means, a continuous sintering machine, a chute at the discharge end of the machine receiving the sinter therefrom having a lower wall inclined downward away from said discharge end and including a breaker plate, a breaker roll above said plate cooperating therewith for breaking the sinter to desired size, said roll being driven at a speed sufficient to break up the sinter at least as fast as it is discharged from the machine and discharging the broken sinter at a predetermined substantially uniform rate of flow, a screen receiving the broken sinter from said roll, a cooling conveyor receiving the broken and screened sinter from said screen, the latter delivering the sinter to said conveyor at a substantially uniform rate and said conveyor operating at a rate such that the broken sinter is disposed thereon in a comparatively thin uniform layer, and spray means for spraying cooling fluid on the sinter on said conveyor.

2. In sinter treating means, a continuous sintering machine, a chute at the discharge end of the machine receiving the sinter therefrom having a lower wall inclined downward away from said discharge end and including a breaker plate, a breaker roll over said plate cooperating therewith for breaking the sinter to desired size, said roll being continuously driven at a speed sufficient to break up the sinter at a rate greater than the rate of discharge of the sinter from the machine and discharging the broken sinter downward of said chute at a predetermined substantially uniform rate of flow, a screen below said roll receiving the broken sinter therefrom, a cooling conveyor below said screen receiving the broken and screened sinter therefrom, said screen delivering the sinter to said conveyor at a substantially uniform rate and said conveyor operating at a rate such that the broken sinter is disposed thereon in a comparatively thin uniform layer, and spray means for spraying cooling fluid on the sinter on said conveyor.

3. In sinter treating means, a continuous sintering machine, a sinter cooling conveyor, means at the discharge end of the machine for receiving sinter therefrom and breaking up the sinter and delivering it at a substantially uniform rate to said conveyor, said means including a screen over which the broken sinter passes, said conveyor operating at a rate such that the broken up and screened sinter is disposed thereon in a comparatively thin substantially uniform layer, and means for projecting a cooling fluid on the sinter on said cooling conveyor.

4. In sinter treating means, a continuous sintering machine, a chute at the discharge end of the machine receiving the sinter therefrom having a lower wall inclined downward away from said discharge end and including a breaker plate, a breaker roll over said plate cooperating therewith for breaking the sinter to desired size, a hopper supplementary to said chute receiving the broken sinter from said roll, a screen below said hopper, feeder means delivering the broken sinter from said hopper to said screen at a predetermined substantially uniform rate, a cooling conveyor receiving the screened sinter from said screen at a substantially uniform rate and operated at a rate such that the sinter is disposed thereon in a comparatively thin substantially uniform layer, and means for projecting a cooling fluid on the sinter on said cooling conveyor.

5. In sinter treating means, a sintering machine in which the sinter is formed in a bed of considerable thickness too great for effective cooling of the sinter by a water spray, means for receiving the sinter discharged from said machine and breaking it into pieces of materially less thickness than the sinter bed and of a size to be effectively cooled by a water spray, and means for subjecting said broken pieces of sinter to a cooling water spray.

6. In sinter treating means, a continuous sintering machine comprising travelling pallets in which the sinter is formed in a bed of considerable thickness too great for effective cooling of the sinter by a water spray and is broken from the bed and discharged in pieces substantially conforming to the pallets, in the travel of the latter about the discharge end of the machine, means at the discharge end of the machine for receiving the pieces of sinter discharged therefrom and breaking them into pieces of materially less thickness than the sinter bed and of a size to be effectively cooled by a water spray, water spray means, and means for passing the broken pieces of sinter beneath said spray means and there subjecting them to a cooling water spray.

7. In sinter treating means, a continuous sintering machine comprising travelling pallets in which the sinter is formed in a bed of considerable thickness too great for effective cooling of the sinter by a water spray and is broken from the bed and discharged in pieces substantially conforming to the pallets, in the travel of the latter about the discharge end of the machine, means at the discharge end of the machine for receiving the pieces of sinter discharged therefrom, means for breaking the sinter into pieces of materially less thickness than the sinter bed and of a size to be effectively cooled by a water spray, water spray means, and means for disposing the broken pieces of sinter in substantially a single uniform layer and passing them beneath said spray means and there subjecting them to a cooling water spray.

8. In sinter treating means, a continuous sintering machine comprising travelling pallets in which the sinter is formed in a bed of considerable thickness too great for effective cooling of the sinter by a water spray and is broken from the bed and discharged in pieces substantially conforming to the pallets, in the travel of the latter about the discharge end of the machine, means at the discharge end of the machine for receiving the pieces of sinter discharged therefrom, means for breaking the sinter into pieces of substantially rectangular cross-section and materially less thickness than the sinter bed and of a size to be effectively cooled by a water spray, water spray means, a conveyor beneath said spray means, and means for conducting the broken pieces of sinter to said conveyor comprising

downwardly inclined surfaces leading from said breaking means to said conveyor.

9. In sinter treating means, a continuous sintering machine comprising travelling pallets in which the sinter is formed in a bed of considerable thickness too great for effective cooling of the sinter by a water spray and is broken from the bed and discharged in pieces substantially conforming to the pallets, in the travel of the latter about the discharge end of the machine, means at the discharge end of the machine for receiving the pieces of sinter discharged therefrom, means for breaking the sinter into pieces of substantially rectangular cross-section and materially less thickness than the sinter bed and of a size to be effectively cooled by a water spray, water spray means, a vibrating conveyor beneath said spray means, and means for conducting the broken pieces of sinter to said conveyor comprising downwardly inclined surfaces leading from said breaking means to said conveyor.

10. In sinter treating means, a continuous sintering machine comprising travelling pallets in which the sinter is formed in a bed of considerable thickness too great for effective cooling of the sinter by a water spray and is broken from the bed and discharged in pieces substantially conforming to the pallets, in the travel of the latter about the discharge end of the machine, means at the discharge end of the machine for receiving the pieces of sinter discharged therefrom, means for breaking the sinter into pieces of a size to be effectively cooled by a water spray, a conveyor receiving the broken pieces of sinter from said breaking means, and means for spraying cooling water onto the broken sinter on said conveyor.

11. In sinter treating means, a continuous sintering machine comprising travelling pallets in which the sinter is formed in a bed of considerable thickness too great for effective cooling of the sinter by a spray and is broken from the bed and discharged in pieces substantially conforming to the pallets, in the travel of the latter about the discharge end of the machine, means at the discharge end of the machine for receiving the pieces of sinter discharged therefrom, means for breaking the sinter into pieces of substantially rectangular cross-section and materially less thickness than the sinter bed having relatively narrow edges, water spray means, a conveyor beneath said spray means, and means for delivering the broken pieces of sinter from said breaking means flatwise onto said conveyor.

12. In sinter treating means, a continuous sintering machine comprising travelling pallets in which the sinter is formed in a bed of considerable thickness too great for effective cooling of the sinter by a spray and is broken from the bed and discharged in pieces substantially conforming to the pallets, in the travel of the latter about the discharge end of the machine, means at the discharge end of the machine for receiving the pieces of sinter discharged therefrom, means for breaking the sinter into pieces of substantially uniform size capable of being effectively cooled by a water spray, water spray means, and means for conveying the broken pieces of sinter from said breaking means to said spray means and there subjecting them to a cooling water spray.

13. In sinter treating means, a continuous sintering machine comprising travelling pallets in which the sinter is formed in a bed of considerable thickness too great for effective cooling of the sinter by a spray and is broken from the bed and discharged in pieces substantially conforming to the pallets, in the travel of the latter about the discharge end of the machine, means at the discharge end of the machine for receiving the pieces of sinter discharged therefrom, means for breaking the sinter into pieces of substantially uniform size capable of being effectively cooled by a water spray, water spray means, and means for conveying the broken pieces of sinter from said breaking means and disposing them substantially in a single layer and then passing the broken pieces of sinter while so disposed beneath said spray means and there subjecting them to a cooling water spray.

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