

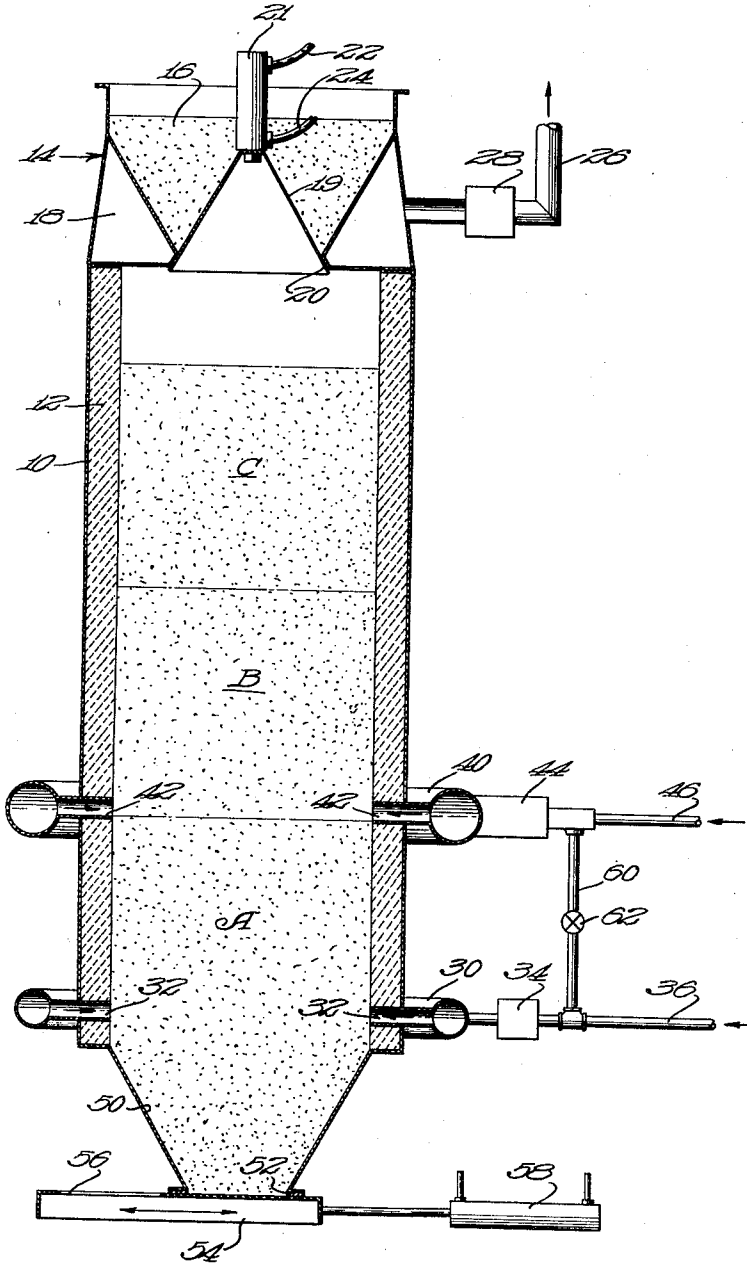
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METHOD OF RECLAIMING SAND

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METHOD OF RECLAIMING SAND

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1 Claim. (Cl. 22-217)

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This invention relates to improvements in a method of reclaiming sand. More particularly, this invention has to do with a novel method of heating sand in a furnace to remove carbonaceous material therefrom which has been deposited on the sand during a molding operation in a foundry.

In foundry work, sand is used in making molds. During the preparation of this sand, oil, cereal binders, wood flour, pitch, sea-coal and other hydro-carbons are added to the sand to give it certain desirable molding characteristics. After the casting operation is completed, some of this material will remain in the sand as carbonaceous deposits which must be removed during the re-conditioning process.

Various types of apparatus have been used with some success for removing these deposits from the sand particles. The usual process is to apply heat to the sand to burn off these carbonaceous deposits. It is an important object of this invention to provide a novel, more efficient method of burning such deposits from the sand.

Another object of this invention is to provide a novel method of bringing heated air into intimate contact with the sand grains.

A further object of this invention is to provide a method of using compressed air to transfer heated gases throughout the sand that is being processed.

A still further object of this invention is to provide a method of reclaiming sand requiring a minimum amount of equipment and floor space to carry out the operation.

A feature of this invention is the provision of a generally cylindrical vertical furnace having an upper charging door and a lower discharge opening. Three batches of sand, a lower, a middle and an upper batch, are deposited in superimposed relation in the furnace. The middle batch is disposed in a central combustion zone of the furnace, where heat is applied thereto by means of a burner until the temperature of the sand is brought up to about 1700° F. Heat from this combustion action pre-heats the upper batch of sand which is immediately above the middle batch. When the temperature of the middle batch is at about 1700° F. the burner is turned off and the lower batch of sand is discharged out the bottom discharge passage and the middle batch is moved downwardly from the combustion zone to the bottom cooling zone of the furnace while a new batch of sand is added at the top of the furnace and is deposited in the pre-heating zone. Compressed air is introduced to

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the previously processed sand which is now in the cooling zone of the furnace in a pulsating fashion created by operating an air supply valve and a discharge valve in a predetermined cycle so that the pressure in the furnace will pulsate in a wide range ultimately permeating the void spaces between the sand grains and in the sand lumps and releasing the combustion gases caused by the oxidation of the carbon on the sand grains.

By passing through the lower batch of sand, the compressed air is heated to a temperature which supports the combustion of the carbon on the sand grains. When this air reaches the middle batch in the combustion zone the carbon deposits on the sand and this zone will be burned off. The heat from this combustion pre-heats the new batch of sand in the upper pre-heating zone. When combustion is completed in the middle or combustion zone, the lower batch which has been cooled by the passage of air there-through is discharged from the bottom of the furnace permitting the batch in the combustion chamber to be dropped to the lower position. Air under pressure is then directed through the new lower batch and combustion ensues once more in the middle or combustion zone effecting the pre-heating of the new batch in the pre-heating zone.

Thus each batch is charged at ambient temperatures and pre-heated in the upper zone, carbon particles are burned off the sand in the batch in the combustion zone and the sand is cooled when the batch reaches the lower zone.

Other and further important features, objects and advantages of the present invention will be apparent to those skilled in the art from the following detailed description of the annexed sheets of drawings.

On the drawings:

Figure 1 is a more or less diagrammatic vertical sectional view taken through the center of a sand reclamation furnace constructed in accordance with the teachings of the present invention.

As shown on the drawings:

The reference numeral 10 indicates a vertical, cylindrical shell of the furnace. The shell, which is lined with refractory material 12, has an open top on which is suitably secured a bonnet 14. The bonnet 14 is partitioned to form a sand receiving or storage chamber 16 and an annular gas discharge chamber 18 which is disposed around the storage chamber 16 and is in communication with the open top of the furnace.

Delivery of sand from the storage chamber 16 to the furnace is controlled by a frusto-conical valve 19 that is arranged to open or close a frusto-conical port 20 at the lower end of the discharge chamber. The valve 19 may be conveniently operated by a double-acting fluid cylinder 21 having connections 22 and 24 to a source of fluid under pressure. The cylinder may be mounted on the frame of the furnace or on a separate support structure.

An exhaust pipe 26 is connected to the annular gas discharge chamber 18. A pulsating discharge and relief valve 28 is connected in the exhaust pipe 26 to control the discharge of gases therethrough. This valve may be of any suitable commercial type having connections for periodically opening and closing the valve.

At the lower end of the furnace an air manifold 30 is suitably supported around the shell 10 of the furnace. A plurality of discharge conduits 32 pass through the wall of the furnace connecting the manifold 30 to the interior of the furnace. A pulsating air supply and pressure reducing valve 34 is disposed in an air supply conduit 36 which is arranged to connect the manifold 30 to a source of air under pressure.

At approximately one-third of the way up the side of the furnace shell the heating manifold 40 is suitably secured therearound having discharge openings 42 which pass through the wall of the furnace and are arranged to deliver heated air to the inside of the furnace. A burner 44, connected by means of a conduit 46 to a source of fuel, is arranged to heat the manifold 40 for supplying heat to the furnace.

A funnel-shaped discharge section 50 is connected to the lower end of the furnace having a lower opening 52 which is closed by a sliding discharge door 54. An opening 56 in the discharge door 54 is arranged to be aligned with the opening 52 in the discharge funnel to permit the discharge of sand from the furnace through the discharge door. This discharge door may be conveniently operated by means of a double-acting hydraulic or pneumatic cylinder 58.

A by-pass line 60 containing a shut-off valve 62 is disposed between the burner 44 and the air supply line 36 for furnishing controlled amounts of air to the burner.

It will, of course, be understood that a suitable control mechanism such as interconnected timed electrical relays are to be furnished with this equipment for co-ordinating the operation of the valve 19 and the discharge door 54 and the pulsating valves 28 and 34.

To put the novel method of reclaiming sand in operation, three batches of sand are disposed in superimposed relation in the furnace. These batches will be indicated generally by the letters A, B and C. It will be noted that the batch A is the lowermost batch and is disposed opposite the nozzle 32 of the compressed air manifold 30. The lower end of batch B is disposed opposite the discharge nozzle 42 of the heating manifold 40. The burner 44 is turned on and the batch B in the middle or combustion zone of the furnace is heated up to approximately 1700° F. by means of the heated air and combustion gases passing from the manifold 40 into the furnace, and upwardly through the sand charges B and C. These heated gases passing up through the batch B will cause combustion of the carbonaceous materials deposited on the grains of sand in this batch and the heated combustion will cause the pre-heating of the batch C thereabove. When the batch C has

reached the temperature of approximately 1700° F., the burner 44 is turned off and the discharge door 54 is moved to the discharge position permitting the batch A to be discharged from the furnace and the batch B and C to drop down one position. Thus, batch B, which has been pre-heated by the heating manifold 40 and in which the carbonation materials have been substantially burned from the grains of sand will now assume the lowermost position in the furnace. The charge C will move into the middle or combustion zone and a new charge D (not shown) will be deposited in the upper pre-heating zone.

Compressed air is then introduced through the air manifold 30 in a pulsating fashion created by operating the discharge valves 28 and 34 in predetermined cycles, so that the pressure in the combustion chamber will pulsate through a wide range, ultimately permeating the void space between the grain sand and in the sand lumps. Thus, the combustion gases caused by the oxidation of the carbon on the sand grains will be released. By passing through the lowermost charges B, the compressed air is pre-heated to a temperature which supports combustion of the carbon on the sand grains. When the compressed air reaches the batch C in the middle combustion zone, combustion of the carbonaceous materials on the sand grains will take place. After several minutes of operation, the carbon on the sand grains will be combined with the oxygen in the air to form CO₂ and CO and will, in escaping through the charge C, have pre-heated the same. Thus, the compressed air, which was heated to a combustion temperature in the lowermost zone of the furnace as it passes through the previously heated batch B, moves into the combustion chamber C where the carbonaceous material is burned. The heat of combustion causes the sand in batch D in the pre-heating chamber to be pre-heated.

After a predetermined period, the lowermost charge B is discharged from the furnace and the batch C in the combustion chamber is dropped to the lowermost part of the furnace and the batch D is then moved into the combustion zone. The process is then repeated. Thus, each batch of sand is charged into the pre-heating zone at ambient temperatures and pre-heated therein by the gases escaping from the combustion process taking place immediately below in the combustion chamber of the furnace. When the sand reaches the combustion zone, the carbonaceous material is burned from the grains of sand due to the combining of the pre-heated sand with the charge of compressed air which is pre-heated by passing through the lower zone. When in the lowermost zone of the furnace, the sand is cooled by the passage of compressed air therethrough and is finally discharged at a cooled temperature.

The air in the air manifold 30 is charged into the furnace at ambient temperature and heated by its passage through the lowermost batch. As it passes through the combustion zone, it is broken down mainly into nitrogen, carbon dioxide and carbon monoxide, and in passing through the pre-heating zone the combustion gases exchange their heat by passing through the ports between the sand grains, thus heating up the sand. Therefore, the exhaust gas temperature will also be relatively low.

Ordinarily there will be enough combustible carbonaceous material on the grains in the sand in the combustion zone to supply sufficient heat for making up the losses in the exhaust gases, the discharge sand and through radiation. Thus,

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this process will be substantially self-sustaining.

If it is necessary to add outside heat, additional carbon in the form of coke breeze may be added directly to the sand charge or in the form of gas or oil through the pre-heat burner manifold.

While the method of this invention has been described as applying to a furnace as a batch side unit, it could also be operated continuously without difficulty.

From the foregoing description it will be recognized that there is provided in this invention a novel method for reclaiming sand by making use of a furnace constructed in such a manner that it closely approximates a perfect heat exchanger in that it works entirely on the counter-flow principle. Further, this novel method of reclaiming sand is operable with minimum fuel requirements since the principal cost of the operation will be for supplying compressed air. Similarly, the entire apparatus requires a very small floor space due to its vertical construction.

It will, of course, be understood that various details of construction may be varied through a wide range and it is not the purpose of this invention to limit the patent granted hereon otherwise than necessitated by the scope of the appended claim.

I claim as my invention:

A method of reclaiming foundry sand having carbon deposits thereon in an upright furnace including an air inlet and an air outlet and having an upper pre-heating zone, a middle combustion zone and a lower cooling zone, comprising depositing given batches of sand at am-

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bient room temperatures in said zones of said furnace, heating the sand in said combustion zone to a temperature to support combustion of the carbon deposits on said sand, directing the combustion gases through the pre-heating zone to pre-heat the sand therein, discharging the sand from said cooling zone and moving the sand from said combustion zone to said cooling zone and the sand from said pre-heating zone to said combustion zone, delivering a new batch of sand to said pre-heating zone, alternately opening and closing the furnace air inlet and outlet for directing air under pulsating pressures through said cooling zone to pre-heat the air and cool the sand therein, directing the pre-heated air through the pre-heated sand in the combustion chamber to cause burning of the carbon particles and directing the products of combustion through the sand in the pre-heating zone to pre-heat the same.

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