METHOD FOR RECLAIMING USED FOUNDRY SAND

Phillip C. Will, Oak Park, and Roy L. Luce, Chicago, Ill., assignors to The Hydro-Blast Corporation, Chicago, Ill., a corporation of Illinois

Application February 1, 1954, Serial No. 407,446

3 Claims. (Cl. 22—217)

This invention relates to a method for reclaiming used foundry sand, such as core sand. This sand is mixed with a suitable binder consisting of clay and/or organic material to form a plastic mixture that is capable of being formed into, and retaining shapes imparted thereto. In making foundry cores such mixtures are shaped and then baked to increase their strength so that they are capable of withstanding any force to which they might be subjected during casting. The binders used for these mixtures are usually drying oils, but also include organic materials such as cereals, asphalt compounds, lignin derivatives and the like. A part of the organic binder burns out shortly after contact with the molten metal and the core collapses or crumbles up, thus facilitating its removal from the casting in the form of granulated sand and sand lumps. Each grain of this used sand has a black carbonaceous coating of oxidized core oil which adheres tenaciously to the surface of the grain and renders the sand useless in manufacturing cores.

In addition to this troublesome coating, the used foundry sand is further contaminated with sand fines, clay, metal and other foreign materials, all of which must be removed before the sand is suitable for re-use.

It is an object of this invention to provide an efficient and economical continuous process for converting used foundry sand into relatively clean sand, free of contaminants and suitable for use alone or with virgin sand for making foundry cores and molds.

Another object is to provide an improved process for reclaiming used foundry sand which includes a novel method for scrubbing the sand particles to remove the coating of binder deposited on the surface thereof.

It is a further object to provide a process in which the scrubbing of the used sand is accomplished by abrasion of a slurry of said sand in admixture with a portion of reclaimed sand which has been recycled through the scrubber.

Another object is to provide an efficient method for continuously scrubbing used sand which comprises employing as an abrasive in the scrubber recycled sand from which fines, clay and carbonaceous surface films, which normally function as a lubricant between sand particles, have been removed.

Other objects and advantages of our process will become apparent from the following description of our invention taken in conjunction with the accompanying drawings in which:

Figure 1 is a diagrammatic representation of apparatus suitable for practicing the continuous process of the invention.

Figure 2 shows a portion of the apparatus of Figure 1, which has been somewhat modified.

Mold and core sand which has been previously broken up to granular size and from which tramp metal has been removed by conventional magnetic means is charged continuously into primary classifier 10, together with water supplied through pipe 12. The classifier 10 consists of a cylindrical vessel having a conical bottom with a discharge opening therein connecting to pipe 20 containing a valve 18. A funnel 14 is centrally disposed within the cylinder near the upper open end thereof with its restricted end connected with a drain conduit 16 extending in a generally downward direction and piercing the wall of the vessel 10. The used sand and water introduced into the classifier forms a slurry or flowable mixture. The sand fines, clay, and other more buoyant foreign materials float to the surface and are carried by the overflow stream into the funnel 14 and are discharged from the conduit 16 to waste. The slurry of the heavier sand particles flows by gravity from the primary classifier 10, through conduit 20 and into a scrubber 22. The scrubber consists of a tank or container 24 having an impeller 28 driven by a motor 26 disposed in the lower central part of the tank. An overflow spout or chute 30 located in the wall of the tank near the top thereof provides a conduit 32 for the scrubbed sand. Reference is hereby made to Patent No. 2,637,330 for a further detailed description of this apparatus and its function.

Up to this point the process is similar to those known and previously disclosed. However, instead of following the usual procedure of agitating the used sand alone we depart from standard practice by recycling to the slurry in the scrubber, a portion of the partially scrubbed (reclaimed) sand which has been discharged from the terminal point of the apparatus. The source of this sand and its treatment prior to discharge into the scrubber will be explained hereinbelow. We have found that by vigorously agitating the used sand slurry in the presence of added reclaimed sand, the greater proportion of which is sharp and free of surface coating, the contaminating coating of carbon, clay, fines and organic binder remaining adhered to the used sand delivered from the primary classifier is much more effectively removed in considerably shorter time. Adhered contaminating coatings function as a lubricant between the grains and reduce the effectiveness of the sand grains as an abrasive. Hence, reclaimed sand, from which the coating has been at least partially removed, is superior in abrasive action to sand which still contains the contaminating coating.

Circulation of the slurry within the scrubber due to agitation by the impeller 28 causes discharge of sand particles, free of contaminating coating, from a spout or chute 30 into pumping tank 32. Make up water may be added to tank 32 as required to reduce the sand to pumping consistency, through water line 34. The sand pump 36 in line 38, which connects the primary classifier 10 to the secondary classifier 40, lifts the slurry of cleaned sand grains, together with the loose particles of contaminating coating removed therefrom, to the secondary classifier.

This classifier is of the hydraulic counterflow type and comprises a cylindrical tank 41 terminating in a tapered discharge tube 44. A spreader flume 42 over the entrance opening of the tank 41 causes the incoming material to be distributed evenly over the surface of the tank. The lower end of the tapered tube 44 is surrounded by an annular ring 46 which is adapted to direct jets of water from valved supply line 48 into the tube. The water flows upwardly continuously, counter to the slurry of incoming sand particles, and contaminating particles and other foreign material removed therefrom in the scrubber. The velocity of the upwardly flowing stream is adjusted so as to carry the lighter contaminating particles and foreign material to the surface from which they flow to waste through spillway 50. Only cleaned sand grains larger than a predetermined size are permitted to discharge by gravity through the tapered tube 44. The opening in the end of tube 44 is relatively small in cross section so that the flow of water and sand therethrough is less than the flow of material into the classifier; thus a substantially constant rate of overflow of water and
3. contaminating material into the spillway 50 is assured. The lower end of the discharge tube 44 connects to a closed reservoir or container 60 having a conical bottom and two valved discharge conduits 62 and 64 leading therefrom. Conduit 62 delivers reclaimed sand slurry to the scrubber 24 for purposes previously pointed out. The remainder of the output of reclaimed sand slurry is delivered to a centrifuge 66 or other dewatering device for removal of most of the water, and then to a drier in which the balance of the water is evaporated. Dry, cleaned sand discharged from the drier is ready for use in preparing foundry cores and molds.

If, for some reason, the valves in outlet conduits 62 and 64 must be closed temporarily, and the incoming material more than fills the reservoir 60, water will rise in the pipe 63 and be discharged into the trough 50 to waste.

In a modification of the invention shown in Figure 2 the top of the reservoir 60 is open. The discharge tube 44 from classifier 40 is equipped with a valve 45. In this embodiment, the flow of material into the reservoir 60 may be controlled by adjusting the valve 45 anywhere from fully open to fully closed.

Hence, slurries of incoming material normally discharged from classifier 40 in volume sufficient to overflow reservoir 60 may be held back by means of valve 45, with the overflow being discharged through the trough 50.

It will be noted that recycled sand is being continuously separated from the fine particles of adhered coating removed therewith as the sand moves from the scrubber to the secondary classifier, and back to the scrubber. We have found that for efficient continuous operation of the process it is desirable to discharge a major proportion of the scrubbed sand slurry back into the scrubber, preferably from 70 to 90%, with the remainder being removed for use. The amount of sand recycled will vary with the source of the used sand, some being more difficult to scrub than others. For example, sand used with iron castings requires about 87 to 88% recycle for effective scrubbing, while that used for steel requires only about 75% recycle sand. The formulation of the core or mold sand compound will also affect the amount of recycling necessary. Generally, the more tenaciously the contaminating coating is adhered to the used sand, the longer it will have to be scrubbed; and consequently, the larger the proportion of sand that must be recycled.

4. The flow of sand and water mixture through the apparatus is rapid and continuous, thus keeping the sand in suspension at all times so that it can be handled efficiently in the various pieces of equipment comprising the present apparatus.

It will be understood that the embodiments of the invention shown in detail herein are illustrative only and are not intended as a definition of the scope of the invention, reference being had for this purpose to the appended claims.

What is claimed is:

1. A process for reclaiming used foundry sand which comprises forming a flowable slurry of said sand in water, separating the more buoyant sand fines and contaminants from the heavier sand particles in the slurry, adding cleaned reclaimed sand to said slurry and agitating the resulting mixture to scrub said heavier sand particles free of the contaminating coating thereon, separating the freed coating from the slurry and evaporating the water from the slurry to provide dry clean sand.

2. A continuous process for reclaiming used foundry sand which comprises charging said sand and water into a primary classifier to form a flowable slurry and to separate the more buoyant sand fines and contaminants from the heavier sand particles, passing the slurry of heavier particles through a scrubber to separate by abrasion from said particles the contaminating coating adhered thereto, passing the slurry mixture of scrubbed sand and freed contaminating particles into a secondary classifier for removing the contaminating particles therefrom, collecting the slurry of scrubbed sand in a reservoir, recycling a major proportion of said sand through said scrubber to serve as the abrasive in scrubbing the contaminated sand, and discharging a minor proportion of said sand to a drier to dry the sand for reuse.

3. The process of claim 2 in which 70 to 90% of the reclaimed sand is recycled through said scrubber.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Invention</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,383,045</td>
<td>Den Breejen et al.</td>
<td>Aug. 21, 1945</td>
</tr>
<tr>
<td>2,477,948</td>
<td>Allen</td>
<td>Aug. 2, 1949</td>
</tr>
<tr>
<td>2,478,461</td>
<td>Connolly</td>
<td>Aug. 9, 1949</td>
</tr>
<tr>
<td>2,480,748</td>
<td>Luce et al.</td>
<td>Aug. 30, 1949</td>
</tr>
<tr>
<td>2,637,330</td>
<td>Webster</td>
<td>May 5, 1953</td>
</tr>
</tbody>
</table>