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FOUNDRY PRACTICE

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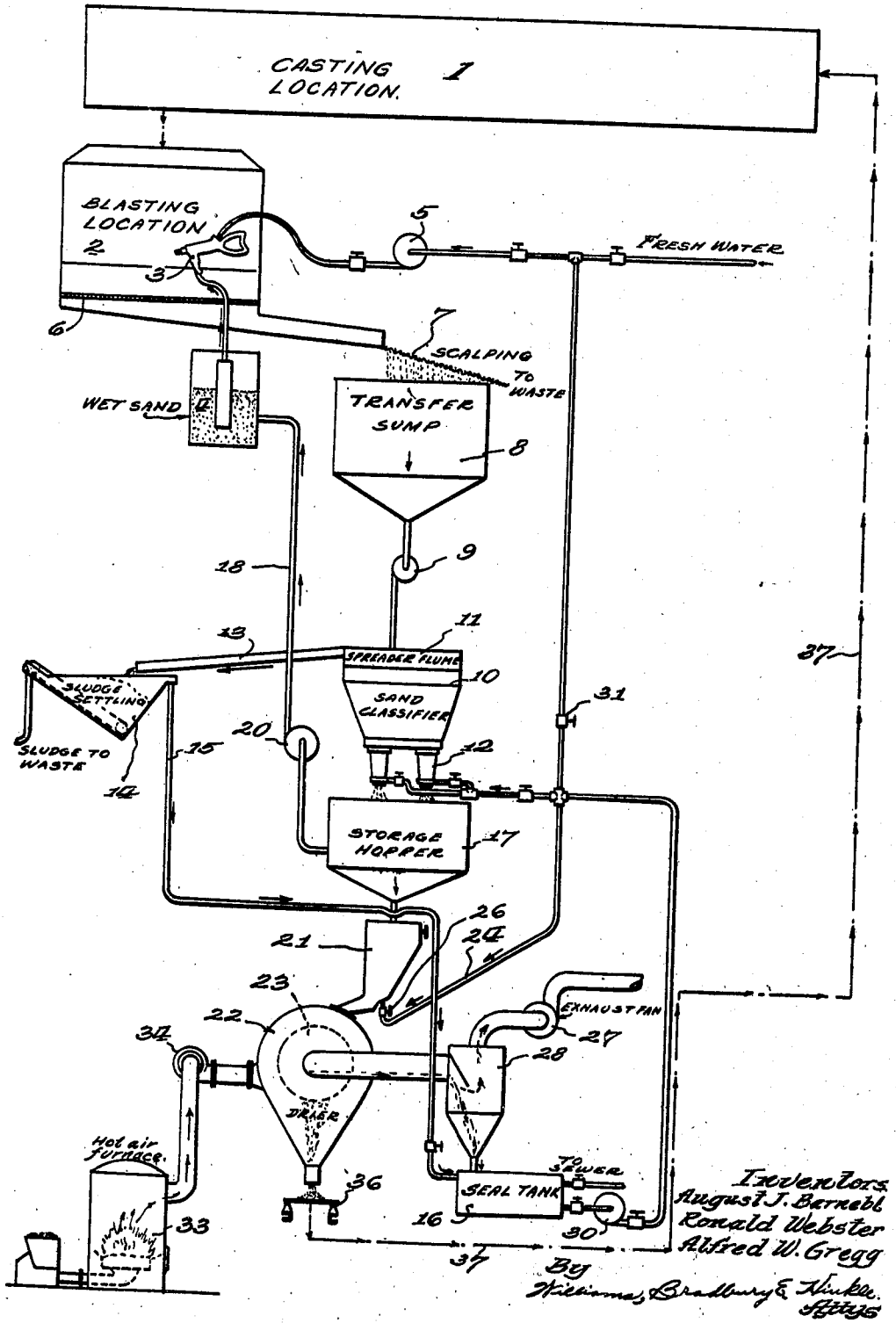

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FOUNDRY PRACTICE

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Our invention relates to foundry practice.

Heretofore in foundry practice it has been feasible to re-employ only to a limited extent the sand from used casting-molds and cores. Good molds and cores can be produced only from a base of clean, highly refractory graded sand which is. within rather narrow limits, free from undersize particles or "fines." Best results are secured when sand of the proper character is available to the molders and core makers in what is termed "bone dry" condition, i. e., containing not to exceed 2% of moisture. However, the disintegration of sand particles by heat of the molten metal, by abrasion and other causes and the coating of sand particles with various substances such as clay, oil, molasses and other ingredients used principally for bonding in the production of cores—and with heat derivatives of such bonding materials—results in the production of fines being increased and the cleanliness of the sand being reduced.

In order to compensate for and minimize the deleterious effects of the increasing fines and the decreasing cleanliness, it has been the customary practice to add new sand, having the proper characteristics, to the old or used sand in quantities from a few hundred pounds to one and one-half tons for each ton of castings produced. Probably the most common practice is to add the new sand by first using it in the production of cores and for mold facings, at least to the extent that it can be so added. Of course, this repeated addition of new sand usually requires the discarding of used sand in substantially the amounts of the additions.

For many years attempts have been made, and with some success, to remove fines by means of air currents and dust collectors, but the mere removal of fines by no means solves the foundry sand problem. Sand so cleaned of fines may possess satisfactory permeability qualities—i. e., the ability properly to permit escape of gases from the molds during pouring; but it does not possess the refractory characteristics of new sand. Thus, the particles of used sand—even when of satisfactory sizes—become coated with films of the bonding material used in mold and core production and of heat derivatives of such materials, with the result that the resistance of the particles to high temperatures such as obtain in casting is lowered. In other words, the used sand becomes less refractory than the original, new sand. And this problem of refractability has become more acute in recent years, because of the extensive use of alloy metals, the satisfactory pouring temperatures of which in many instances have well nigh approached the limit which even clean, pure, silica sand can withstand.

It has been known for many years that sand cleaned or "scrubbed" in water would be cleaner and more resistant to high temperatures than either sand as it comes from the pit or sand that has been treated by so-called "dry cleaning" processes. However, the addition of the quantities of water required for scrubbing, and which was utilized for no other purpose, presented problems of dewatering and drying in order to reduce the water content of the scrubbed sand to produce bone dry sand and was entirely too expensive to be practicable.

Very recently there has been developed and commercially employed a process of cleaning castings and of removing and disintegrating cores from castings by a high pressure jet of water and wet sand. United States Patent No. 2,200,587 granted May 14, 1940, discloses such a system.

The combination of this high pressure blast water and sand removal of mold sand adhering to castings and of core sand (which will be generally termed "casting cleaning"), with classification, water scrubbing, the return of some sand to the blast, the dewatering and drying of other parts of the sand, and the return of the dried sand to the molding floor for re-use in making molds and cores, which is the gist of our invention, is now for the first time advanced.

One of the objects of our invention is to provide a process of casting cleaning with sand recovery which is economical, clean, and effective.

Another object is to provide a method whereby the sand used in cleaning castings and that removed from the castings in the cleaning operation is water-cleaned and classified and then in part returned for re-use in cleaning and in part dried and returned for re-use in molds and cores.

In the high pressure water and sand blasting operation, the sand particles adhering to the castings and comprising the cores, and also those constituting the blast sand, are, by the very nature of this operation—principally the abrasive action—scrubbed to remove or to facilitate the subsequent removal of the films of adhering material which, as heretofore mentioned, tend to decrease the refractory qualities and usefulness of the sand. The impacts, and also probably the abrading action, are in a sense and to a degree selective of sand particles since those particles that may have been cracked or otherwise weak-

ened by the high temperatures obtaining in the molds during casting or from other causes are broken down into fines and as such removed before re-use, either in the blast or in the molds and cores. Thus, the water blasting operation in effect helps to remove film from, scour and clean the sand particles and also facilitates the subsequent selection and retention of the stronger particles for re-use and the discard of the weaker particles.

Our invention is illustrated diagrammatically in the accompanying drawing which is a route diagram for core and molding sand, water, waste material, and reclaimed sand—some of which reclaimed sand is re-used in the cleaning operation and some in the molding room for making molds and cores.

In the particular embodiment here shown, cores and molding sand adhering to castings pass from the molding room 1 to the blasting room or location 2. This movement may be through mechanical devices, such as traveling belts, moving platforms, cranes, and the like, or by cars or even by manual portage.

In the blasting room 2, the castings are cleaned and the cores are removed therefrom by means of a high pressure stream of water and sand projected from guns 3, which are supplied with wet and flowable sand from the basin 4 and with fresh water at high pressure from the pump 5.

The floor of the blasting room 2 slopes to a coarse grating 6 through which all of the material blasted from the castings passes under the influence of the water from the blast gun. This material is made up largely of sand, but also contains nails, wire and other objects used to strengthen the cores and molds; clay, used as a binder for the foundry sand; scale, fines; and coke and other coarse materials used to make up the interior of cores; oil, molasses, pitch, bentonite, and like material used as binders in making cores, some of which is burned or heat affected.

The material passing through the grating 6 is carried by gravity onto a vibrating screen 7 of such mesh as to permit the passage of sand of the size desired for molding and to reject all coarser materials which are carried to waste or to further classification for recovery of the metal parts as may be desired.

The good sand, water, clay, soluble material, and fines fall into the transfer sump 8, from which this material flows by gravity or is pumped by a pump 9 to a classifier 10.

This classifier comprises a spreader flume 11 for causing the material to fall substantially evenly over the surface of the hopper. Extending downwardly from the bottom of the hopper are a plurality of tapering sand discharge chutes 12, each restricted to such an extent as to permit a discharge under the head of the classifier just sufficient to cause some water continuously to flow from the top of the classifier down the spillway 13. Near the bottoms of the chutes 12, water is continuously supplied from rings surrounding the bottoms of the chutes, the water being supplied in such quantity that it continuously flows upwardly through the sand in the classifier, carrying with it the more buoyant fines, clay or soluble materials which, because of the up current, flow off the surface of the classifier and down the spillway 13. The size of the sand grains retained in the classifier may be predetermined by the velocity of flow of water up the chutes 12. The heavy material which passes down the spillway 13 is separated from the water in the sludge settling tank 14, overflowing through the pipe 15 to the seal tank 16 hereinafter described.

The thin mixture of sand and water which passes out of the bottoms of the chutes 12 enters the storage hopper 17, from which a part, usually about one-half, is returned through pipe 18 to the wet sand basin 4, to be used as hereinabove described as the abrasive for the blasting gun 3. The passage of sand and water from the storage hopper 17 to the wet sand basin 4 may be by gravity or by pump 20, as conditions require.

All of the sand and water not required by the sand blasting guns 3 passes out of the storage hopper 17 into the feed hopper 21 of the dryer 22. In order to keep the sand which passes into the dryer 22 at requisite dilution with water so that it will spread properly upon the dryer drum 23, additional water is supplied through the pipe 24 and regulated by the valve 26. The dryer here shown may be of the type illustrated in the application of August J. Barnebl and Howard D. Grant and August C. Barnebl, Serial No. 257,922, filed February 23, 1939, and will not be hereindescribed in detail. Suffice it to say that the sand is first dewatered by very rapidly removing water therefrom by means of suction applied within the drum 23, as the layer of sand is rotated on the surface of the drum.

The suction or reduced pressure within the drum 23 is maintained by an exhauster 27 which not only draws water out of the sand very rapidly, but also aids the flow of heated air through the sand. The water and air pass into a separator 28 from the bottom of which the water is drawn into the seal tank 16 and from the top of which the hot air and vapor pass off through the exhauster 27. It has been found that this rapid removal of water from the sand results in the further removal of films from the sand particles and of fines released by the removal of such films and also fines which may not have been removed by the classifier.

Thus, it will be apparent that the fines, resulting from the removal of films from sand particles and otherwise, may be removed in part at the classifier and in part at the dewatering dryer, and that by controlling the amount of fines taken at these locations the amount of fines remaining in the reclaimed sand returned to the molding room can be varied to regulate the permeability and refractory quality of the reclaimed sand.

The water from the seal tank containing some fines is recirculated by means of a water pump 30, the excess being allowed periodically to flow to waste. The undesirable fines removed in the dryer are eventually discharged from the top of the classifier.

Valves are provided in the water lines so that the supply may be regulated and so that various pieces of apparatus may be shut off temporarily, as for repairs or cleaning, without interruption of the entire system. Ordinarily the water brought to the system by the guns 3 and the water seals, not shown, for the various pumps is sufficient for the entire system, but should the sludge discharging from the settling tank be of such character as to retain an excessive amount of water, additional water may be admitted by opening the valve 31 which will ordinarily be left closed.

After the removal of the major part of the water in dryer 22, hot air supplied by a hot air furnace

33 is forced by a blower 34 through the sand upon the dryer drum 23 to evaporate additional amounts of water until the sand finally leaves the dryer in what is called "bone dry" condition, that is to say, with a moisture content of not more than 2%. The sand leaving the dryer is deposited upon a traveling belt 36 which moves along a path indicated by the dotted arrows 37 to carry the dry sand back to the molding room 1, where it is again made into cores and used in the molds, after which it again enters the cycle hereinbefore described. Of course, instead of employing a conveyor belt to convey the classified, washed and dried sand back to the molding floor, this transfer may be accomplished by cars, wheelbarrows, or in any other appropriate manner, and the sand may be passed to bins from which it may be removed as needed in the molding room.

Having thus illustrated and explained a typical embodiment of our invention, what we claim and desire to secure by United States Letters Patent is as follows:

1. The foundry method comprising removing from a casting location to a cleaning location castings containing sand cores and adhering sand from the molds, removing from the castings at the cleaning location and by means of a stream of high pressure water and wet sand the adhering sand, scale and cores, separating out the bulky material from the sand, fine scale and water, flowing the wet sand and fine scale to a classifier for removal of superbuoyant sand particles from the heavier particles, returning part of the heavier sand to the high pressure water streams, passing the remainder of the heavier sand through a dewaterer and dryer, and returning the dried sand for re-use in making molds and cores.

2. The foundry method comprising removing from a casting location to a cleaning location the castings containing sand cores and adhering sand from the molds, removing from the castings at the cleaning location and by means of a stream of high pressure water and wet sand the adhering sand, scale and cores, separating out the bulky material from the sand, fine scale and water, flowing the wet sand and fine scale to a classifier for removal of superbuoyant sand particles from the heavier particles, returning part of the heavier sand to the high pressure water streams, passing the remainder of the heavier sand and water through a dewaterer and dryer, returning the dried sand for re-use in making molds and cores, and returning water and solids removed with it to the classifier.

3. The foundry method comprising removing core and molding sand from castings, treating the used mold and core sand which includes the steps of separating smaller lighter particles from the larger heavier particles by hydraulic classification with a continuous upward flow of water, continuously removing the smaller lighter particles by overflow of the water carrying them upward, passing through a dewaterer and dryer the separated larger heavier particles which settle against the upward flow of the water, and reusing the dried sand to produce molds and cores for additional castings.

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