

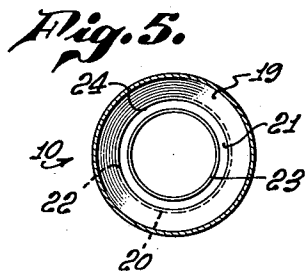
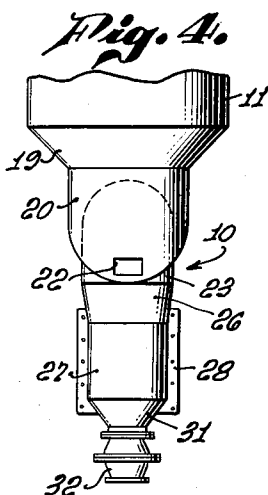
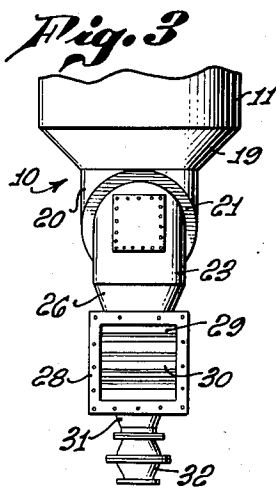
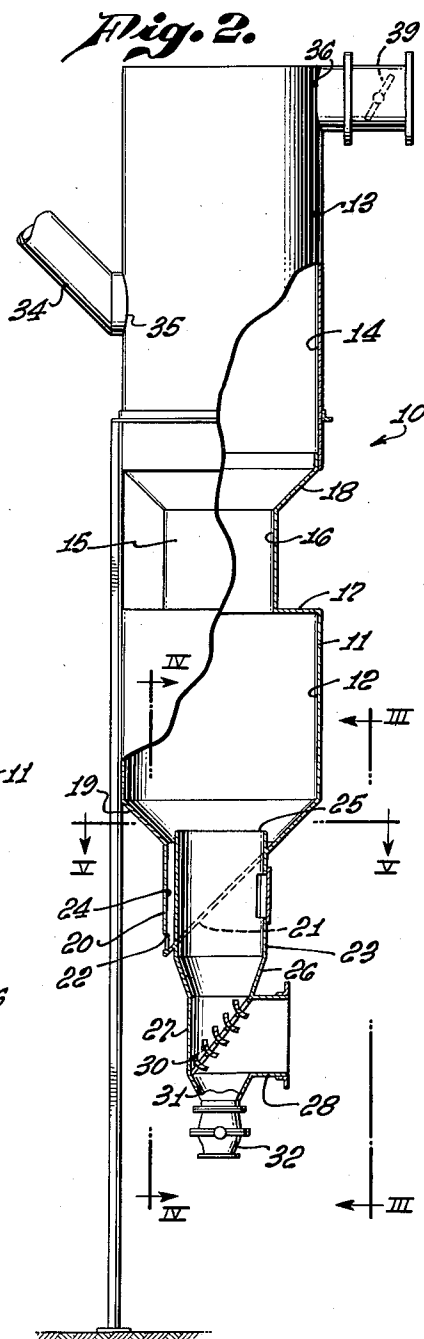
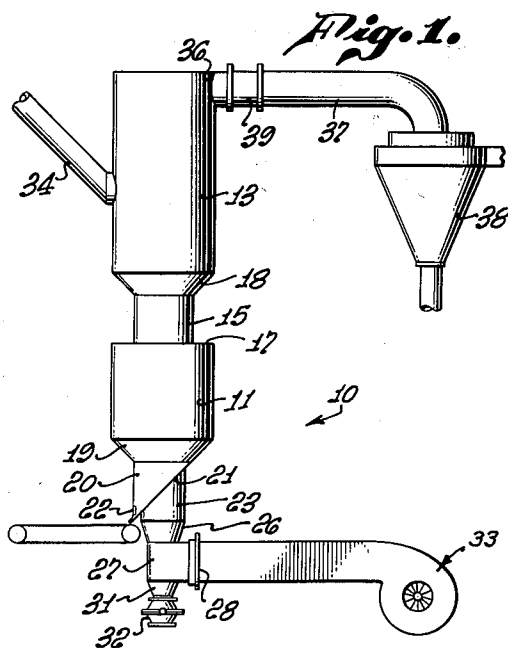
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H. DOK

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FOUNDRY SAND COOLER

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INVENTOR.
HARRY DOK,
BY 
ATTORNEY.

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FOUNDRY SAND COOLER

Harry Dok, Burbank, Calif., assignor to Los Angeles Steel Casting Co., Los Angeles, Calif., a corporation of California

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4 Claims. (Cl. 34-57)

1

This invention relates to an improved apparatus for cooling molding sand or foundry sand and other granulated material.

Sand molds used in foundry practice for the purpose of casting various metals are usually composed of carefully preselected sand particles which have been processed so that they are clean, have a selected proportion of fines and a minimum of foreign residues, a desired grain structure, and have been bonded together by means of soluble, gummy carbohydrates, such as dextrin or other glutinous material. It is economically desirable to reclaim and re-use the sand in such molds because of an appreciable saving in shipping, testing, and storing of sand.

In normal foundry practice, the same sand may be used several times in one day for casting purposes. Since the re-used sand must be carefully processed and handled so that the sand molds made therefrom will have the desired and necessary refractoriness, strength and permeability, a quick, effective and satisfactory method of processing and cooling used sand is essential in order to repeatedly place it in proper condition for re-use. Foundry sand from the molds is at a temperature of well over the boiling point of water, say temperatures on the order of 230°-260° F. and since during casting many of the soluble bonding materials have been carbonized, it is necessary to re-mix the sand with new bonding agents in order to produce the desired porosity, strength and permeability in the sand. It is not possible to introduce these bonding agents into a hot sand since this tends to produce steaming which drives off the bonding agents and makes it impossible to control the quantity of bonding agent remaining in the sand. Furthermore, before the sand is re-used, it is necessary to remove a large proportion at least of the carbonized material which is in the form of extremely fine particles. The presence of these excessive fines would impair the permeability and other desired characteristics of the sand.

This invention is directed primarily to apparatus which is capable of quickly, effectively and accurately cooling and cleaning used molding sand so that it may be introduced into a rolling mill or muller at a desired, relatively cool temperature.

An object of this invention is to design and provide an apparatus for cooling and cleaning used molding sand whereby the cleaning and cooling operation is substantially a continuous process so that sand may be quickly reclaimed and re-used.

2

Another object of this invention is to provide an apparatus employing a high velocity air stream for the purpose of breaking up conglomerates or particles, removing excessive fines and cooling individual sand grains to a desired temperature below 200° F. whereupon the sand is in condition for re-use.

Still another object of this invention is to design and provide an apparatus for cooling and cleaning used molding sand wherein the amount of fines and residues in cooled sand are readily controlled.

Generally speaking, this invention contemplates the provision of two vertically spaced, axially aligned cylinders connected by a narrow throat, an upwardly directed stream of air passing through said cylinders and through the throat with high velocity means for introducing sand particles into the upper cylinder for agitation therein, whereby conglomerate particles of sand are separated into individual sand grains, said sand falling through the narrow throat where the upwardly directed high velocity air stream effectively cools each individual sand grain, the cooled sand falling through the bottom cylinder upon an inclined annular surface surrounding an air inlet for flowing by gravity to a discharge outlet. Sand flowing from the discharge outlet may then be transported to a muller or to storage by any convenient means. The proportion of fines and residues carried by the air stream out of the top of the upper cylinder is controlled by a regulatable damper or valve mounted in a top air outlet communicating with a dust separator.

Other objects and advantages of this invention will be readily apparent from the following description of the drawings.

In the drawings:

Fig. 1 is a schematic view illustrating the use of a cooler embodying this invention in a process for reclaiming foundry sand.

Fig. 2 is a side elevation of a cooler embodying this invention, the side elevation being partly in section, the plane of the section being taken in a vertical transverse plane passing through the axis of the cooler.

Fig. 3 is a fragmentary side view of the cooler shown in Fig. 2, the view being taken in the plane indicated by the line III-III of Fig. 2.

Fig. 4 is a fragmentary side elevation of the cooler shown in Fig. 2, the view being taken from the plane indicated by the line IV-IV of Fig. 2.

Fig. 5 is a sectional view taken in a plane transverse to the axis of the cooler as indicated by line V-V of Fig. 2.

3

In general, after a metal casting is made and removed from the sand molds, the molded sand is usually broken up into small conglomerate particles by passing the molded sand through a grizzly, processing the sand in a hammer mill, and then screening the particles of molded sand through a mesh of desired size. The screened sand particles may include separate individual grains of sand and also conglomerated sand particles (composed of several grains of sand still held together by the bonding agent used in preparation of the sand mold) as well as carbonized residues of bonding agents. The interior of such a conglomerate sand particle retains its heat until the grains are separated.

During the above handling of the foundry sand temperature reduction of the sand particles, especially the interior thereof is not materially reduced. Hot sand may be introduced to a cooler embodying this invention at a temperature of about 225°-250° F. The cooler preferably reduces the temperature of the sand particles to 150°-170° F., at which temperature the sand is suitable for introduction into a mixer for mixing with other sand and a bonding agent in preparation for use in sand molds.

The cooler generally indicated at 10 comprises a vertical, axially aligned assemblage including a bottom cylinder 11 defining a lower cylindrical chamber 12, and an upper cylinder 13 defining an upper, elongated cylindrical chamber 14 as compared with the bottom chamber 12. The upper and lower cylinders are vertically spaced from one another a suitable distance and may be connected by a narrow, axially aligned tubular neck 15. The neck 15 defines a throat 16 of a diameter substantially less than the diameters of the upper and lower cylinders which may be approximately the same. The neck 15 may be joined with the lower cylinder by a horizontal, annular wall 17 and with the upper cylinder by means of a diagonally disposed upwardly directed annular wall 18.

Joined to the lower annular edge of the bottom cylinder 11 may be an inwardly and downwardly inclined annular wall 19. Connected to the inner circumferential edge of wall 19 may be a vertically depending truncated cylinder 20, the truncation of said cylinder being in an inclined plane including an element of wall 19 disposed diametrically opposite the vertical dimension of truncated cylinder 20 of greatest length.

An inclined annular bottom wall 21 lies in said inclined plane and is suitably joined to said truncated cylinder. Adjacent the low point of said wall 21 and in the portion of the truncated cylinder of greatest depth may be provided a rectangular outlet 22 for discharge of cooled sand collected on inclined annular wall 21. The angle of inclination of said wall 21 may be sufficient to produce rapid gravitational flow of sand from the surface of said wall through outlet 22.

Extending upwardly through the inclined wall 21 may be a generally cylindrical air duct 23 having a diameter less than the diameter of the truncated cylinder 20 so as to provide an annular space or recess 24 surrounding the upstanding air duct 23. The top 25 of duct 23 may project upwardly beyond the line of juncture of the diagonal wall 19 and the truncated cylinder.

The lower end of air duct 23 may be suitably tapered at 26 so as to provide an inwardly flaring funnel, and the lower edge of said funnel may communicate with a suitable T 27 provided with an air intake duct 28 disposed at right angles to the axis of the funnel 26. The interior of the T

4

may be provided with a plurality of transverse, upwardly curved louvers 30 arranged in parallel relation and lying in a planar zone inclined to the direction of air flow for directing a current of air upwardly through the funnel and through the air duct 23. The louvers 30 may be mounted in a suitable frame secured within the T or may be welded directly to the T in selected arrangement. At the bottom of the T 27 and axially aligned with the funnel 26 may be provided an inwardly flared discharge duct 31 for the purpose of collecting a few particles of sand which may fall through the air duct 23. A suitable discharge valve 32 may be provided at the bottom of the discharge duct 31 in order to permit periodic cleaning of sand particles from duct 31. The air intake 28 may be suitably connected by means of ducts to any suitable air-blowing apparatus such as is generally indicated at 33 in Fig. 1.

The upper cylinder 13 is provided with a diagonal, downwardly directed, hot sand chute 34 communicating with chamber 14 at a point above throat 16 and below the top of cylinder 13 for permitting sand particles which have been processed through the grizzly, hammer mill, and screen to flow by gravity through the hot sand intake port 35 into said chamber 14.

Adjacent the top of cylinder 13 and at one side thereof is provided an air outlet port 36 connected to a duct 37 which extends to the inlet side of a suitable cyclone dust collector generally indicated at 38 of any well known make and manufacture. In duct 37 may be provided a butterfly-type damper 39 which may be selectively adjusted to control the quantity of fines and carbonaceous residues carried by the upwardly directed current of air into the discharge duct 37. It will be also apparent that damper 39 regulates the air pressure created within the cooling assemblage.

In operation after sand has been processed through the grizzly, hammer mill, and screening operations, the air blower 33 may be started to provide a current of upwardly directed air through the air duct 23 and through the bottom chamber, throat and upper chamber of the cooling assemblage. Since the bottom chamber 12 has a greater dimension than the throat 16, air pressure is built up in chamber 12 in order to provide an air stream of high velocity through the throat 16. Hot sand introduced into the upper chamber 14 through the intake port 35 is picked up by said air stream and held in suspension in the upper chamber for a short period of time. As a result of the high velocity of the air stream leaving throat 16, the air in chamber 14 is provided a turbulent action which tends to break up conglomerate particles of sand so that the sand becomes finely divided into individual grains of sand. The agitation of the sand particles in suspension in the upper chamber also separates fines and residues from the sand which are carried upwardly and into the air discharge duct 37.

The individual grains of sand, after being held in suspension for a short time, fall by gravity through the throat 16 where each individual grain is subjected to cooling action of the high velocity air stream. Since the lower chamber 12 is of greater diameter than the throat 16, as the falling particles of sand enter chamber 12 they tend to move adjacent the outer circumferential margins of the chamber 12 and fall upon the diagonal wall 19 and thus are collected on the transverse diagonal wall 21 in the annular space

5

24 between air duct 23 and truncated cylinder 20. The cooled sand particles are discharged by gravity through the cooled sand outlet and may be discharged into any suitable conveying means for carrying the sand to the muller for re-mixing the cooled sand with a quantity of new sand and glutinous material in preparation for new molding sand. As illustrated a conveyor belt is shown disposed beneath the cooled sand outlet for conveying said sand to a suitable point.

It should be particularly noted that the turbulent action of the air in the upper cylinder tends to massage and rub the individual particles of sand so as to remove any fines and residues carried into the upper cylinder through the hot sand intake. These fines and residues are discharged into the cyclone where they may be separated from the air stream and relatively clean and dust-free air discharged into the atmosphere. Periodically, the velocity of the air stream may be reduced by control of the air blower to permit a certain controlled amount of fines and residues to drop into the throat 26 for discharge with cooled sand collected in the bottom of the lower cylinder 12.

It will thus be readily apparent that hot foundry sand is cooled by operation of the cooler described above in an efficient, continuous, and effective manner. During operation of the cooler hot sand particles may be continuously fed into the cooler, are rapidly cooled by action of the air stream of high velocity passing through throat 16, and are rapidly removed from the cooler by continuous flow of sand from the inclined wall 21 through the sand outlet 22. The cooled reclaimed sand may then be preferably transported to a muller for mixing with other sand in preparation for molding.

All changes and modifications coming within the scope of the appended claims are embraced thereby.

I claim:

1. In a foundry sand cooler, the combination of: an upper vertically disposed cylindrical member providing an upper elongated chamber adapted to receive sand to be cooled; a lower cylindrical member axially aligned with said upper member, spaced therefrom, and providing a lower chamber; said upper and lower members each being provided with a bottom inwardly inclined wall; an open ended cylindrical throat member of smaller diameter than that of said members extending between said upper and lower members and connected to the inclined wall of the upper member; a transverse annular wall connecting the lower member to the throat member; a truncated cylindrical portion depending from the inclined wall of the lower member; a cylindrical air inlet duct concentrically positioned within said truncated cylindrical portion and coaxially aligned with said throat member, said duct being of smaller diameter than the throat member and having an upper portion extending into the lower chamber; a downwardly inclined annular wall encircling said duct and connected to the truncated cylindrical portion for defining an annular collecting chamber for cooled sand particles; a valved outlet in the upper member for controlling pressure within said chambers; an outlet port in said truncated cylindrical portion for discharge of collected cooled sand; said air inlet duct providing means for introducing a high velocity stream of air therethrough and into said lower chamber for moving falling sand particles radially outwardly, through said throat member

6

and into said upper chamber for holding sand particles in agitated suspension for selected time intervals.

2. In a foundry sand cooler, the combination of: an upper member defining an upper chamber adapted to receive sand to be cooled; a lower member spaced from said upper member and defining a lower chamber; means connecting said upper and lower members, including a throat member providing a restricted passageway between said chambers; said connecting means including an annular wall lying in a plane transverse to the axis of the throat member for joining the throat member to the lower member; a truncated cylindrical portion depending from said lower member; an air inlet duct of smaller diameter than the throat member coaxially aligned therewith, positioned within said truncated portion and projecting within the lower chamber; an inclined annular wall encircling said duct and closing the lower end of the truncated portion; a discharge port in said truncated portion; a valved outlet in the upper member; said inlet duct being adapted to introduce a stream of air there-through and into and through said lower chamber, throat member, and upper chamber, whereby sand introduced in said upper chamber may be held in agitated suspension, cooled as it falls through said throat member and displaced radially outwardly as it falls through said lower chamber.

3. In an apparatus for cooling particles of foundry sand, the combination of: a pair of vertically arranged spaced upper and lower members, each having a virtually cylindrical chamber of uniform cross-sectional area, the upper chamber being elongated and adapted to receive hot sand introduced from the side thereof; means connecting said members and providing communication therebetween including a cylindrical throat member defining a passageway of less cross-sectional area than said chambers, the throat member and the lower member being joined by an annular wall lying transversely to the axis of the throat member; a depending partially cylindrical portion connected to said lower member and in communication with said lower chamber; an air inlet duct concentrically positioned within the portion and extending upwardly therefrom into said lower chamber; an inclined wall encircling said duct and connected to said portion for collecting sand falling from said lower chamber; said duct being of smaller diameter than said throat member and coaxially aligned therewith, whereby a high velocity stream of air emitted from said air duct urges falling sand particles in the lower chamber radially outwardly for collection on said inclined wall and agitates said sand particles in the upper chamber for cooling thereof; a valved outlet on said upper chamber; and a sand outlet on the depending portion to discharge sand collected on the inclined wall.

4. In an apparatus for cooling particles of foundry sand, the combination of: a pair of vertically arranged spaced upper and lower members each having a cylindrical chamber of virtually uniform cross-sectional area, the upper chamber being adapted to receive hot sand; means connecting said members and providing communication between said chambers including a cylindrical throat member defining a passageway of less cross-sectional area than said chambers, said throat member and lower member being connected by an annular transverse wall lying in a plane perpendicular to the axis of the throat

7

member; a depending cylindrical portion of less diameter than said lower member connected thereto and in communication with said lower chamber; an air inlet duct concentrically positioned within the depending portion and projecting upwardly into said lower chamber; an inclined wall encircling said duct and connected to said portion for defining a sand collecting chamber; said duct being of smaller diameter than said throat member and coaxially aligned therewith; a valved outlet on said upper chamber; and a sand outlet on the depending portion.

HARRY DOK.

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