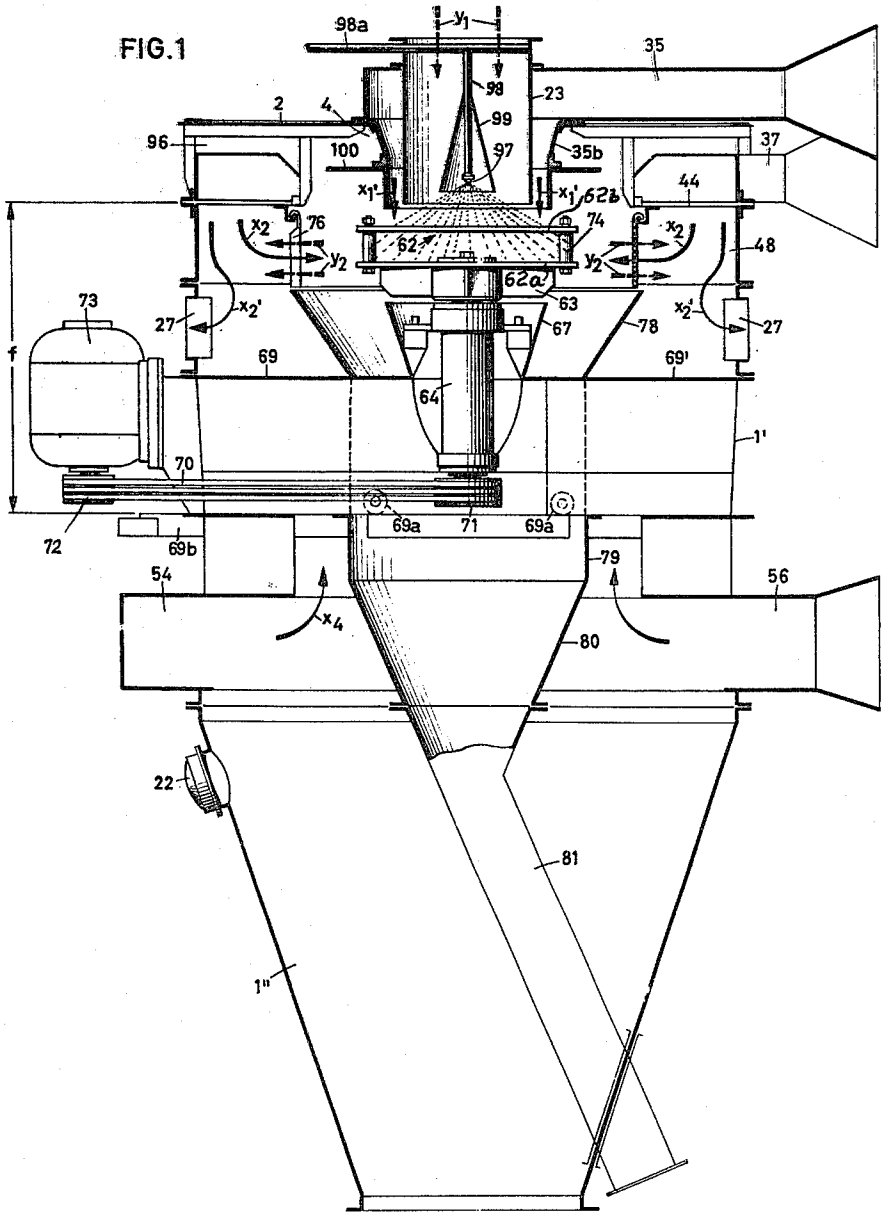
March 30, 1965 H. RIETH 3,175,686

METHOD AND APPARATUS FOR COOLING AND RECONDITIONING MOLDING SAND

Filed Oct. 3, 1961 2 Sheets-Sheet 1

FIG.1



INVENTOR
Hans Rieth

BY Michael S. Striker

ATTORNEY

March 30, 1965 H. RIETH 3,175,686

METHOD AND APPARATUS FOR COOLING AND RECONDITIONING MOLDING SAND

Filed Oct. 3, 1961 2 Sheets-Sheet 2

FIG. 2

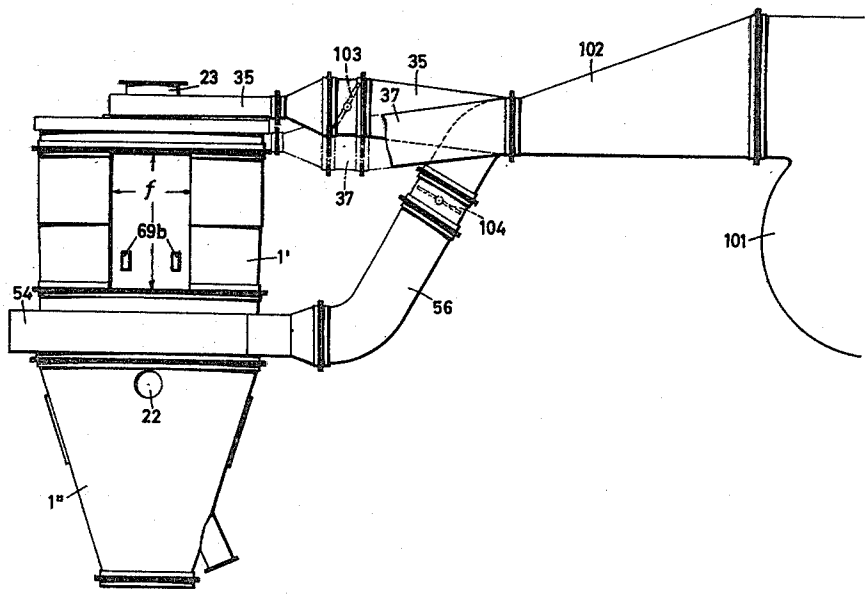
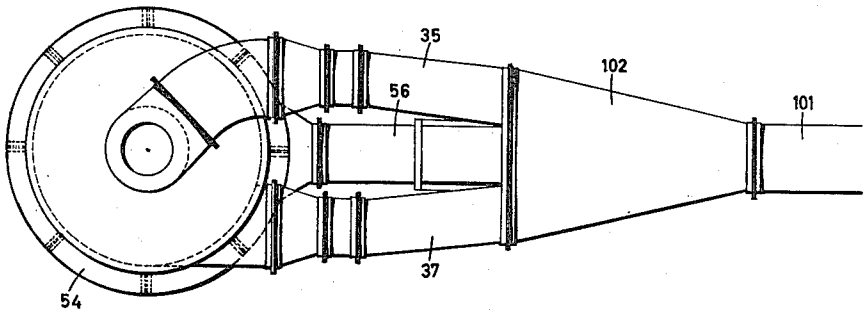


FIG. 3



INVENTOR
Hans Rieth

BY Richard S. Striker

ATTORNEY

United States Patent Office 3,175,686 Patented Mar. 30, 1965

3,175,686

METHOD AND APPARATUS FOR COOLING AND RECONDITIONING MOLDING SAND

Hans Rieth, Rielasingerstrasse 46a, Singen-Hohentwiel, Germany

Filed Oct. 3, 1961, Ser. No. 142,586
Claims priority, application Germany, Oct. 8, 1960, R 28,859
6 Claims. (Cl. 209—3)

The present invention relates to a method and an apparatus for cooling and reconditioning molding sand by means of air.

It is the principal object of the invention to provide a method for mixing air and used holding sand as thoroughly as possible for cooling, reconditioning and refining such sand which after being previously used usually has a very high temperature.

Another object of the invention is to provide a method for subjecting the molding sand while being mixed with air to a revolving movement or to centrifugal force so as to provide it with a high kinetic energy and to insure that the sand which is usually baked together into lumps by its previous use will be broken up and divided into fine particles, especially by subjecting it to the combined action of air and centrifugal force.

A further object of the invention resides in providing a suitable apparatus for carrying out the above-mentioned method, and particularly in providing suitable means for conducting air in the form of several separate currents to the molding sand or to a mixture thereof with air, and in conducting such air currents to the sand in the direction of flow of the sand and both in front of and behind a centrifugal wheel which is employed for mixing, breaking up, and distributing the sand.

An important feature of the invention therefore consists in a method of conducting molding sand and cooling air in separate currents to a revolving centrifugal apparatus and in a substantially axial direction thereto, and to mix the molding sand and cooling air and divert it in a radially outward direction by the centrifugal action of the apparatus. The molding sand while falling downwardly is preferably hit by two air currents in such a manner that it surrounds one air current like a jacket and is, in turn, similarly surrounded by the other air current.

A further important feature of the inventive method consists in feeding the inner air current by passing it through a nozzle and in diverting the surrounding sand jacket by the action of the centrifugal apparatus along an umbrellalike path in the outward direction and against the outer air current. The sand falling upon the centrifugal apparatus will thus be very intimately mixed with air whereby the sand will be strongly cooled and smaller lumps of sand will be broken up into individual grains.

These and further objects, features, and advantages of the present invention will become more clearly apparent from the following detailed description thereof which is to be read with reference to the accompanying drawings of one preferred embodiment of the invention, in which—

FIGURE 1 shows a diagrammatic general view of the main apparatus according to the invention partly in a longitudinal section;

FIGURE 2 shows a reduced side view of the apparatus according to FIGURE 1 together with air inlet pipes thereof; while.

FIGURE 3 shows a top view of FIGURE 2.

The molding sand which after being used is to be cooled, reconditioned and refined in the apparatus according to the invention may be supplied thereto in any suitable manner. Thus, for example, the sand may be passed into the apparatus through one or more funnels with a fishmouth shaped closure which may also serve as a dust remover

or through a cascade distributor or through both kinds of devices. It is also advisable to provide a spraying system for moistening the dry sand before conducting it to the centrifugal apparatus as subsequently described. In this manner it is possible to prevent substantial losses in material.

As illustrated in the dawings, the housing of the apparatus consists of an upper part 1′ and a lower part 1″. This lower part 1″ forms a funnel-shaped outlet of the housing leading, for example, to a conveyor belt, while the upper housing 1′ is closed by a cover 2 which has a central opening 4 in which by means of a pipe socket 35*b* the inlet pipe or shaft 23 for the molding sand and a pipe line 35 are mounted through which the cold air is supplied from the blower. Pipe socket 35*b* surrounds pipe 23 like a jacket, and the lower ends of these pipes terminate substantially at the same level and at a short distance above a centrifugal wheel 62 which is rotatable about a perpendicular axis and on the lower side of which the fan blades of a blower wheel 63 are mounted. The centrifugal wheel and the blower wheel are both mounted in a bearing 64 which is secured, for example, by several brackets on a conical wall 67 which surrounds the bearing and is spaced therefrom. This conical wall 67 is, in turn, supported by the walls of two channels 69 and 69′ which may be, for example, of a roofiike shape in cross section and are open toward the outside. Channel 69 serves for the passage of V-belts which run over two pulleys 71 and 72 on the shaft carring the centrifugal and blower wheels 62 and 63 and on the shaft of an electric motor 73 which drives the two wheels.

Channel 69 together with bearing 64, the centrifugal and blower wheels 62 and 63, motor 73, and the belt drive 70, 71, 72, as well as with the upper left housing parts up to the level of slide valve 44, that is, the various elements contained within the area *f*, as indicated in FIGURE 1, may be withdrawn from the stationary remainder of the housing, for example, on rollers 69*a* which are movable along rails 69*b* which may be extended toward the outside of the housing. Such a withdrawal may be carried out mechanically, by means of compressed air, or in any other suitable manner. It is thus easily possible to remove the centrifugal wheel with the blower and motor for repairs and cleaning purposes or for exchanging them. The channel 69′ at the right side of FIGURE 1 preferably forms a part of the stationary housing.

The centrifugal wheel 62 includes a lower disc 62*a* and an upper ring 62*b*; and a circular row of beating pins 74 which extend spaced from each other between plate 62*a* and ring 62*b* form together with the centrifugal wheel combined centrifugal and beater means. The centrifugal wheel and the beating pins thereon, as well as all of those metallic surfaces of the apparatus upon which wet molding sand might be propelled at a high velocity are preferably covered with a suitable protective coating, for example, of rubber, plastic, or the like, in order to prevent the molding sand from sticking or even compacting thereon as the result of the strong adhesion between the sand and such iron or other metal surfaces. The annular chamber 48 in the upper part 1′ of the housing which is connected by a pipe 37 to the cold-air blower 101 as shown in FIGURE 2 has a curtainlike screen 76 suspended therein which is made of a plurality of individual rods which are provided with transverse slots. A cylindrical or disk-shaped control slide 44 which extends around housing 1′ or a throttle valve in the inlet pipe 37 permits the cold air supply to be regulated. Directly below the curtainlike screen 76 a conical jacket 78 is provided which surrounds the conical wall 67 and continues downwardly in a cylindrical jacket 79 which is either secured to jacket 78 or to channel 69 and terminates in a funnel portion 80

which is connected to a pipe 81 which leads downwardly at an oblique angle and out of the apparatus.

The upper part of the funnel-shaped housing 1'' contains an inspection window 22 which is provided with several transparent panes of glass or the like and permits the amount of sand which is collected in housing 1'' to be checked.

Underneath the annular chamber 48, the wall of housing 1' is further provided with equally spaced peripheral openings 27 through which the air may escape from the housing, especially also the cold air from the blower which is supplied through an inlet pipe 56 in the lower part of housing 1', then flows through an annular chamber 54 and upwardly through housing 1' in the direction shown by the arrow x_4, and which is heated during this flow. The openings 27 may also be provided with pivotable flaps.

Further outlet slots 96 are provided above the annular chamber 48 and serve primarily for the escape of the air which is supplied through the ventilating line in the direction of arrow x_1' and through an air jet nozzle 97, and also of the air which is supplied, for example, through the line 37 and passes through the screen 76 in the direction of arrow x_2. The air flowing to the outlet slots 96 then passes along air deflectors 100 which are mounted on the pipe socket 35*b* and extend in a horizontal direction. Nozzle 97 is mounted on the lower end of a pressure pipe 98 of a small cross section which preferably extends along the longitudinal axis of pipe 23 and which is supplied with compressed air, for example, through a transverse pipe 98*a* which passes horizontally through pipe 23. The vertical pipe 98 is protected from the sand falling from above into pipe 23 by a hollow conical jacket 99 which is slipped over and secured to pipe 98. If desired, the air passing through nozzle 97 may also be mixed with water or water may be separately injected into the nozzle, provided that the sand is not already moistened previously, for example, within a cascade distributor when entering pipe 23 or at any other suitable place.

FIGURES 2 and 3 show in addition the arrangement of the pipe lines which are required for the air mixture and lead from the blower 101 to housing 1' of the main apparatus according to the invention. The cold air from blower 101 is divided in a branch 102 and passed through pipes 35, 37, and 56 to the above-mentioned mixing stages at x_1, x_2, and x_4. Each of these pipes may be equipped with throttle valves 103 or 104 to permit the amount of cooling air for each of the three stages which is preferably supplied in a very large volume to be individually regulated.

After the hot old molding sand has been subjected to a preliminary treatment by being cleaned of dust and possibly also by being mixed with water in a cascade distributor, whereby it is cooled off to some extent but is still partly baked together into lumps, it falls through the shaft 23 in the direction of the arrow y_1 upon the centrifugal wheel 62 which, by means of its spokes and its beating pins 74 revolving at a high speed, crushes the moistened lumps to the largest extent.

While the sand falls upon the centrifugal wheel 62, it is also thoroughly mixed with air which is ejected from the jet nozzle 97 and diverts the sand along an umbrella-like path against the outer jacket of cold air entering at 35*b* in the direction of arrow x_1', whereby the sand is further cooled. The air which is thereby heated then passes along the deflectors 100 and most of it escapes to the outside through the slots 96. Due to the fact that at the same time the old molding sand, while being guided by two air jets, hits approximately vertically upon the centrifugal wheel, the reconditioning of the sand is especially effective at this point.

As illustrated in FIGURE 1, the finely crushed sand is then thrown by the centrifugal wheel 62 through the curtainlike screen 76 in a countercurrent to the air entering in the direction x_2, and it then hits upon the very strong air current x_2' which flows from pipe 37 downwardly toward the outlet openings 27 and diverts the sand current which is directed against the wall of housing 1' also in the downward direction. This is especially of importance when treating synthetic molding sand, for example, bentonite, since such sand has the tendency toward sticking and to be deposited on the wall. Smaller lumps remaining in the current y_2 rebound from the screen 76 and fall down through the upper funnel 78 into the lower funnel 80 where they are discharged from the apparatus through pipe 81 and are passed, for example, to a grinding mill.

After the molding sand has been thrown outwardly through screen 76 and has thus been reconditioned to fine grains, it is further cooled while falling down along the walls of housing 1' by the air current from the annular chamber 54 which passes through the housing in the direction of arrow x_4 in a countercurrent to the sand. The removal of the molding sand which collects in the lower housing funnel 1'' may be carried out in a conventional manner.

Depending upon the prevailing conditions, for example, the condition of the sand, and providing that no residue of sand is to be discharged, funnels 78, 80 together with pipe 81 and blower 63 may be omitted. The curtainlike screen 76, 76' then may also be omitted. This screen is preferably made so as to be easily unhooked. If necessary, a separation of the sand into its components may then be carried out at a different place.

Although my invention has been illustrated and described with reference to the preferred embodiment thereof, I wish to have it understood that it is in no way limited to the details of such embodiment, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed my invention, what I claim is:

1. A method of cooling and reconditioning molding sand comprising the steps of dropping hot molding sand in a jacket-like substantially vertically downwardly directed stream; feeding a stream of compressed air along a substantially conical downwardly directed path into the interior of said jacket-like sand stream while the latter moves downwardly under the influence of gravity so that the air stream will intersect said sand stream at a lower portion thereof; and subjecting the thus combined streams to a combined centrifugal and beating action so that the molding sand and the air will be thoroughly mixed with each other.

2. A method of cooling and reconditioning molding sand comprising the steps of dropping hot molding sand in a jacket-like substantially vertically downwardly directed stream; surrounding said stream of sand with a downwardly directed stream of compressed air; feeding a further stream of compressed air along a substantially conical downwardly directed path into the interior of said jacket-like sand stream while the latter moves downwardly under the influence of gravity so that said further stream of air will intersect said sand stream in a lower portion thereof and drive said sand stream against said outer air stream whereby said streams will combine; and subjecting the combined streams to a combined centrifugal and beating action so that the molding sand and the air will be thoroughly mixed with each other.

3. A method of cooling and reconditioning molding sand as set forth in claim 2 and including the step of spraying liquid into said streams to increase the cooling action of the air stream on the stream of sand.

4. Apparatus for cooling and reconditioning molding sand comprising, in combination, a support; combined centrifugal and beater means mounted on said support turnable about a substantially vertical axis and including a disc extending transverse to said axis and a plurality of beater members distributed spaced from each other along the periphery of said disc; drive means connected to and extending downwardly from said disc and cooperating

with said combined centrifugal and beater means for driving the same about said axis; first conduit means concentric with said axis and adapted to be connected at an upper end thereof to a supply of compressed air having an open lower end adjacent said disc; second conduit means surrounding said first conduit means substantially concentric therewith and adapted to be connected at an upper end thereof to a supply of sand to be reconditioned and having an open lower end adjacent said disc and within the area defined by said beating members on the periphery of the latter; third conduit means surrounding said second conduit means substantially concentric therewith and adapted to be connected at an upper end thereof to a supply of compressed air and having a lower open end adjacent said disc and within said area; and means at said lower end of said first conduit means for causing the compressed air emanating therefrom to spread in a substantially conical stream so that the latter will drive the stream of sand emanating from said second conduit means against the stream of air emanating from said third conduit means and surrounding said stream of sand so that said streams will intermix and impinge on said disc to pass in radial direction through said beating members on the periphery of said disc while the latter rotates about said axis.

5. Apparatus for cooling and reconditioning molding sand comprising, in combination, a support; combined centrifugal and beater means mounted on said support turnable about a substantially vertical axis and including a disc extending transverse to said axis and a plurality of beater members distributed spaced from each other along the periphery of said disc; drive means connected to and cooperating with said combined centrifugal and beater means for driving the same about said axis; a pair of conduit means substantially concentric to each other and to said axis and having each an open lower end adjacent said disc and within the periphery of the latter, one of said conduit means adapted to be connected at an upper end thereof to the supply of sand to be reconditioned and the other adapted to be connected at an upper end thereof to a supply of compressed air so that two substantially concentric streams of air and sand may emanate from said lower ends of said pair of conduit means; means in the region of the lower end of said other conduit means to direct the stream of air passing therethrough against the concentric sand stream passing through the other of said conduit means so that the air and sand streams will intersect each other within the periphery of said disc and the thus combined air-sand stream will impinge on the latter to be subjected to centrifugal action and to be driven in radially outward direction through said beating members on the periphery of said disc; cylindrical screen means mounted on said support and surrounding said combined centrifugal and beater means radially spaced therefrom for intercepting coarse particles contained in said stream and thrown by centrifugal action against said screen means while permitting fine particles to pass through said screen means; first annular wall means beneath said screen means for receiving the coarse particles intercepted by said screen means; and second annular wall means having an upper portion surrounding said screen means for receiving the fine particles passing through the latter and said second annular wall means having a lower portion surrounding said first annular wall means and forming an annular space therewith.

6. An apparatus as set forth in claim 5 and including a pair of additional conduit means for feeding additional cooling air respectively from above in the space between said screen means and said upper portion of said second annular wall means and from below into said annular space between said first and said second annular wall means.

References Cited by the Examiner

UNITED STATES PATENTS

1,469,993	10/23	Carrier	34—10 X
1,478,526	12/23	Merrell.	
1,989,406	1/35	Doolittle	34—57 X
2,004,840	6/35	Van Suchtelen.	
2,199,015	4/40	Toensfeldt	34—57 X
2,309,036	1/43	Beardsley.	
2,658,615	11/53	Ebersole	34—57 X
2,683,938	7/54	Gustavsson	34—57
2,913,109	11/59	Williams	209—148 X
2,921,383	1/60	Morris.	

FOREIGN PATENTS

1,006,420	1/52	France.
1,095,582	12/54	France.
326,149	9/20	Germany.
530,613	12/40	Great Britain.

NORMAN YUDKOFF, *Primary Examiner.*