Aug. 28, 1962 H. W. DIETERT 3,050,795

CONTINUOUS TYPE SAND MIXER

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FIG. 3.

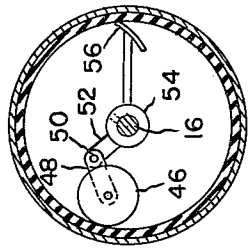

FIG. 1.

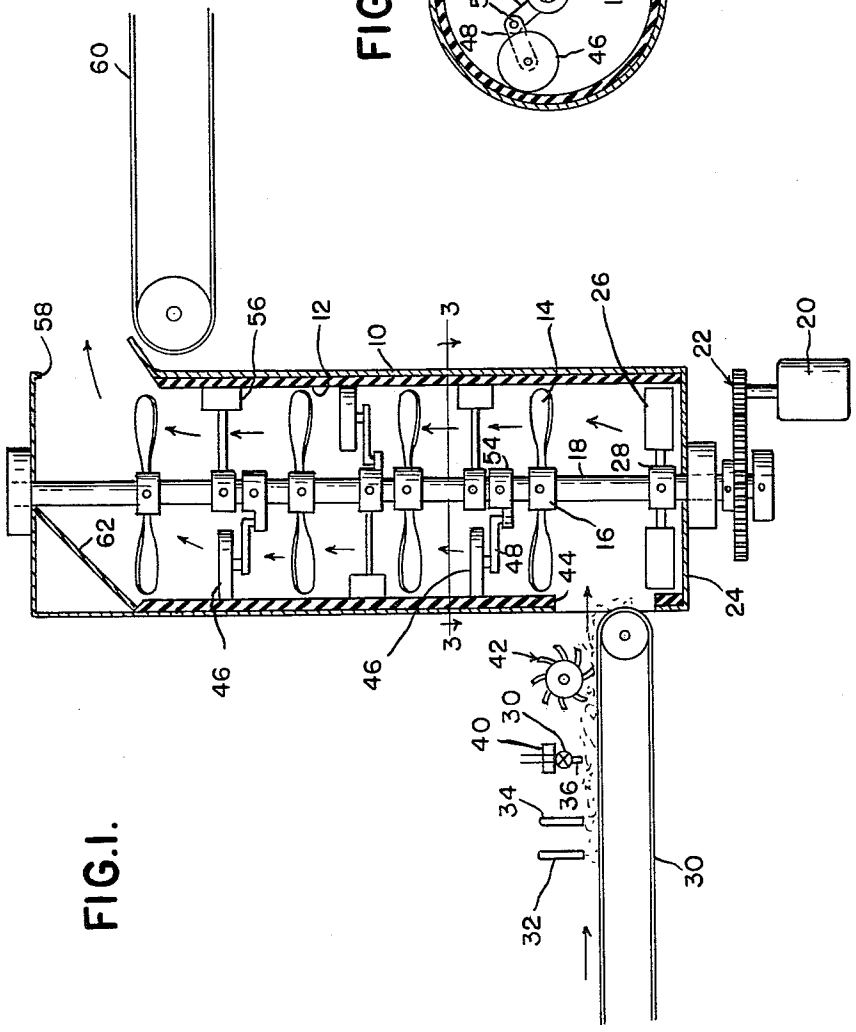

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FIG. 2.

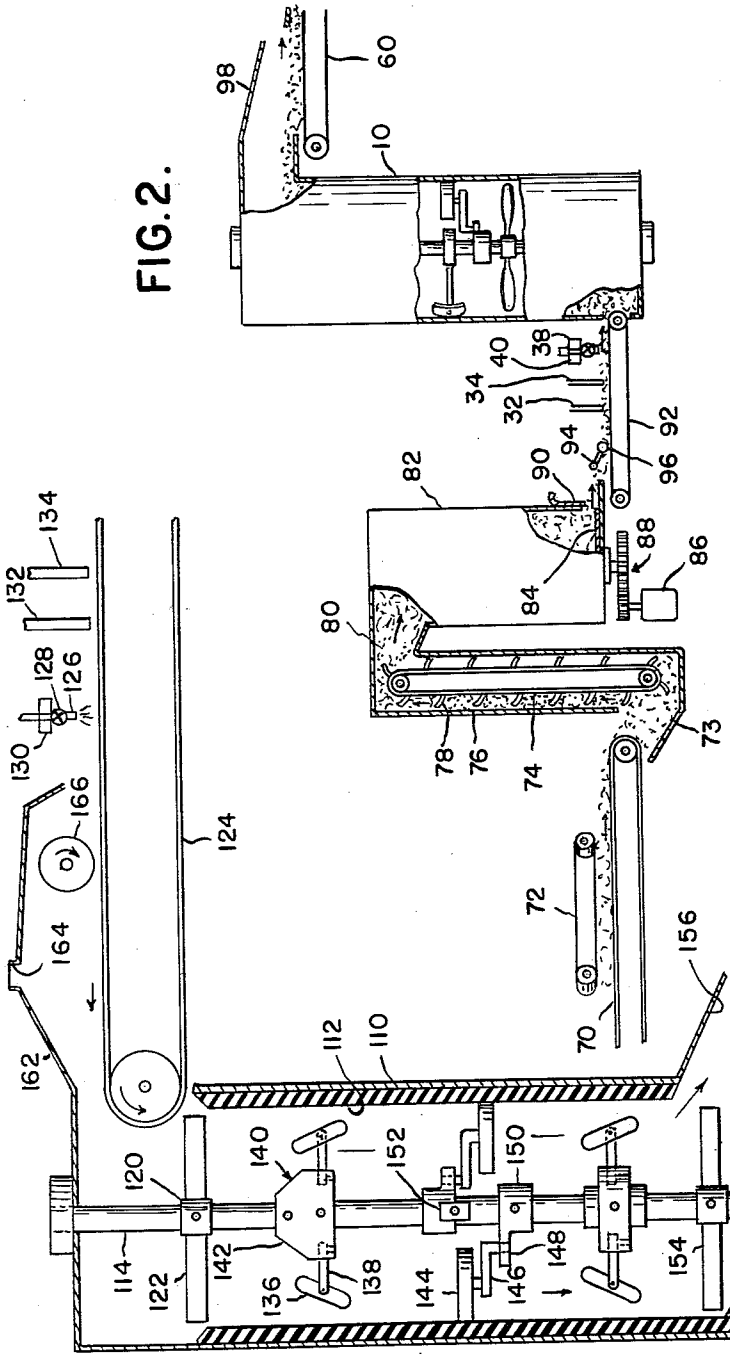

FIG. 4.

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CONTINUOUS TYPE SAND MIXER

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4 Claims. (Cl. 22—89)

The present invention relates to a continuous type sand mixer.

It is an object of the present invention to provide a continuous sand mixer comprising an elongated enclosed casing through which the sand is advanced in the form of substantially separated particles.

It is a further object of the present inventon to provide a continuous type sand mixer as described in the preceding paragraph in which the casing extends vertically.

It is a further object of the present invention to provide apparatus as described in the foregoing including means for effecting vertically upward movement of the sand particles through the casing.

It is a further object of the present invention to provide apparatus as described in the foregoing in which the sand particles are caused to move downwardly through the casing.

It is a further object of the present invention to provide a continuous type sand mixer including an elongated cylindrical casing through which the sand is advanced, and rollers within said casing mounted for orbital movement to compress the sand against the inner surface of the casing.

It is a further object of the present invention to provide apparatus as described in the preceding paragraph which comprises scrapers associated with the orbitally movable rollers to remove sand compressed against the inner surface of the casing by the rollers.

It is a further object of the present invention to provide apparatus of the character described comprising a cylindrical casing, inclined blades rotatable within the casing and adapted to control movement of the sand particles longitudinally of the casing.

It is a further object of the present invention to provide apparatus as described in the preceding paragraph in which said inclined blades are rotated at substantial speeds and effect mechanical movement of sand particles in addition to inducing a supporting draft of air through the casing.

It is a further object of the present invention to provide a continuous type sand mixer including an elongated casing, means for moving the sand in substantially separated particle form through the casing, conveyor means for advancing sand to the casing, means for measuring the temperature and moisture content of the sand on said conveyor, and means for adding water to the sand on the conveyor in accordance with its measured temperature and moisture content.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, illustrating preferred embodiments of the invention, wherein:

FIGURE 1 is a vertical section through a sand mixer constructed in accordance with the present invention.

FIGURE 2 is a side elevational view with parts broken away, showing the sand mixer of FIGURE 1 incorporated into a sand handling system.

FIGURE 3 is a section on the line 3—3, FIGURE 1.

FIGURE 4 is a vertical sectional view through a sand mixer constituting a second embodiment of the present invention.

In FIGURE 1 there is shown an elongated casing 10 disposed with its axis vertical and provided with an internal liner 12 of wear resistant material which may be rubber, a suitable plastic, a ceramic, or a metal. The lined casing is intended to pass sand and accordingly its inner surface must be strongly resistant to the abrasive action of the sand. In this embodiment of the invention it is intended that the sand shall move through the casing 10 in a vertically upwardly direction as indicated by the arrows shown in the figure. This upward movement of sand and air is accomplished by the action of a plurality of inclined blades or paddles 14 carried by collars 16 fixed to a vertical shaft 18, the shaft being driven in rotation from a motor 20 through suitable gearing indicated at 22. The lower end of the casing is enclosed by a wall 24 and just above this wall are a pair of paddles 26 carried by a collar 28 fixed to the shaft 18. The paddles 26 are preferably adjustable as to inclination and serve as means for initiating upward movement of sand. For this purpose the paddles 26 as well as the blades 14 will be rotated at substantial speeds.

The means for supplying sand to the casing 10 comprises a conveyor belt 30 along which moist sand is advanced toward the casing. Suitable means are provided for measuring the temperature of the sand as it advances and for measuring its moisture content. These means are indicated diagrammatically as comprising the temperature measuring device 32 and the moisture measuring device 34. Purely by way of example, the temperature measuring device may comprise a thermocouple, a temperature variable ressitance or capacitance, or even a fluid containing bulb. Similarly, the moisture measuring device 34 may comprise a probe including a pair of spaced electrodes or contact elements adapted to engage or be immersed in the moving sand and connected into a circuit adapted to measure the electrical impedance such for example as resistance, capacitance, or a combination of the two, between the electrodes. This impedance will vary in accordance with the moisture content of the sand.

Suitable means, details of which form no part of the present invention, are provided for integrating the measurements of temperature and moisture content and for using this integrated resultant to control the addition of water. The addition of water may conveniently comprise a spray head 36, a valve 38, and electromechanical valve actuating means 40 responsive jointly to temperature and moisture content of the sand.

It will be understood that foundry sand may be used over and over again and that under certain operating conditions the sand as it is advanced to the mixer to be milled preparatory for re-use may be at a relatively elevated temperature. Accordingly, after the milling operation, the moist sand may undergo evaporation of the moisture which will be variable in accordance with its temperature. For this reason it is desirable to provide additional moisture if the sand is at an elevated temperature.

Means are provided for continuously distributing the sand into the mixer in a broken up and finely divided condition. For this purpose a rotary brush indicated at 42 is provided, rotating in the direction of the arrow shown, which operates to pick up the sand as it is advanced relatively slowly along the conveyor and to feed it into the lower portion of the casing through an opening 44 formed therein. The opening is relatively large to permit the admission of air so that some of the finely divided sand as it enters the casing will be borne upwardly by the current of air. The remainder of the sand as it is brushed into the opening will be thrown upwardly by the inclined paddles 26.

The inclined blades 14 operate to mechanically project the sand upwardly and also to induce and maintain a substantial current of air through the casing sufficient in conjunction with the mechanical action on the sand

particles, to produce progressive upward movement thereof.

Also carried by the vertical shaft **18** are a plurality of rollers **46** which as best seen in FIGURE 3, are carried by arms **48** which in turn are pivoted as indicated at **50** to radially extending arms **52** fixedly secured to collars **54** secured to the shaft **18**. As the shaft **18** rotates at substantial speed, centrifugal force urges the rollers **46** outwardly and continuously compresses portions of the moist sand against the inner surface of the casing. A scraper blade **56** is provided in the same horizontal plane with each of the rollers **46** and moves in contact with or in close proximity to the inner surface of the casing **10** or liner **12** so as to remove compressed moist sand adhered thereto as a result of the passage of the associated roller. At its upper end the casing has a relatively large opening **58** through which the sand is caused to pass where it falls upon the moving conveyor **60** which carries it to a station for subsequent use. If desired, the upper end of the casing **10** may include an inclined wall portion **62** which assists in producing a change in direction of the sand from the vertically upward path which it pursues through the casing to the generally horizontal path which it follows in passing the opening **58** and onto the conveyor **60**.

It will of course be appreciated that if required or desired, suitable housing means may surround the opening **58** to prevent scattering of the sand, and this means may include screens or the like to permit the separation of air and sand so that the air may escape and the sand be deposited on the conveyor.

Referring now to FIGURE 2 there is shown more components of the system in which the casing **10** is included. In this figure sand is advanced along a first conveyor **70** from a station where previously used molds have been broken up. At this time the sand may include portions or fragments of tramp iron which it is required to remove before the sand can be reconditioned for use. For this purpose a cross conveyor indicated generally at **72** may be provided and include a magnetic belt or a belt containing magnetic means so as to remove the tramp iron and to remove it transversely away from the path of the conveyor **70**, where it may be removed by scraping or other means. The sand thus cleaned of tramp iron falls off the end of the conveyor **70** into a hopper **73** where it is picked up by an elevator **74** and raised through a casing **76** to the upper end thereof. The elevator **74** includes blades or buckets **78** which throw the sand through a throat **80** into a bin **82**. The lower end of the bin includes a centrifugal distributor **84** driven from a motor **86** by gearing indicated at **88**. The centrifugal distributor feeds the sand outwardly through an adjustable opening controlled by a gate **90** to a conveyor **92**. The conveyor **92** includes a valve control lever **94** having a roller **96** thereon. When no sand is present on the conveyor **92** the roller engages the upper run of the conveyor and means are provided responsive to this position of the lever **94** to terminate the addition of water through the spray nozzle **38** previously described in connection with FIGURE 1. Modulating control of the flow of water through the nozzle **38** is effected by the temperature measuring means **32** and the moisture measuring means **34** which control the electromechanical valve actuator **40**. In this figure the brush **42** is omitted for clarity but will normally be provided. In this figure the casing **10** is illustrated as including a forwardly projecting hood **98**.

Referring now to FIGURE 4 there is illustrated a somewhat different embodiment of the invention. In this case the casing is indicated at **110** and is provided with an abrasion resistant lining **112**. The casing is illustrated as positioned with its axis vertical and is provided with the vertical rotary drive shaft **114** driven in rotation from the motor **116** through gearing indicated at **118**.

Mounted on the shaft **114** adjacent the upper end thereof is a collar **120** carrying paddles **122** designed to distribute the sand circumferentially so that it will flow downwardly through the casing in separate particle form but essentially adjacent the inner surface of the casing. The sand is delivered to the upper end of the casing by a conveyor **124** and is brought to the required moisture content by a spray head **126** controlled by a valve **128** actuated by electromechanical control means **130** responsive to the temperature and moisture of the sand. Means for measuring the temperature and moisture content of the sand as it advances toward the casing **110** comprises a temperature measuring device **132** and a moisture measuring device **134** which may be identical with the temperature and moisture measuring devices **32** and **34** as described in conjunction with FIGURE 1.

Connected to the shaft **114** are a plurality of inclined blades or paddles **136** adjustably mounted on arms **138** carried by a mounting housing **140** fixed to the shaft **114**. The housing **140** includes a conical surface **142** shaped to assist in maintaining the flow of sand primarily along the inner surface of the lined casing **10**. The paddles **136** are adjusted to produce an upward flow of air which in this instance is insufficient to carry or to support the sand particles but acts to cool the sand. Accordingly, the individual sand particles fall or float downwardly at a rate determined by the inclination, number and speed of rotation of the paddles **136**. The blades or paddles are shaped to have an edge in proximity to the inner surface of casing **10** to scrape off and break up sand compacted against the surface by rollers, later to be described. In addition, a forced air blower may be connected by conduit **143** to the lower part of the casing to supplement the upward flow of air therethrough.

In addition to the paddles the shaft **114** is provided with a plurality of rollers **144** mounted on arms **146** which are pivoted to arms **148** on collars **150** fixed to the shaft. It will be appreciated that the illustration of FIGURE 4 is generally diagrammatic and that a relatively large number of rollers **144** may be provided at axially spaced intervals along the casing **110**. The rollers **144** operate exactly like the rollers **46** of FIGURE 1 and are urged outwardly by centrifugal action to carry out a milling or mulling action in which the sand is repeatedly compressed against the inner surface of the lined casing. Associated with the rollers **144** there will preferably be provided plows or scrapers one of which is shown at **152**, and which may be identical in all respects to the plows or scrapers **56** shown in FIGURE 1.

Adjacent the bottom of the lined casing **110** is a second distributor **154** which will tend to throw the sand radially outwardly, and accordingly the sand will pass through the discharge or outlet **156** to a conveyor **160** which will convey it to a station for subsequent use or storage.

Prior to its admission to the distributor **122** at the upper end of the casing the sand is subjected to aeration in a hood **162** having an ontlet **164** for dust and steam and including an aerator brush or similar device **166**.

It will be understood from the foregoing that while the sand flows downwardly in a finely divided condition through the lined casing **110**, there will be an upward flow of air through the casing which will be sufficient to retard the downward movement of the sand and which preferably will be at a rate sufficient to carry dust and fines upwardly where they may be ejected or collected after passing through the outlet **164**.

While in the specific embodiments of the invention illustrated, the passage of the sand is in a vertical direction through vertically elongated casings, it will, of course, be understood that similar results may be accomplished with elongated casings which are inclined or which even extend horizontally. The essential feature of the present invention is the repeated mixing of the sand and bonding additives, by alternately compressing it with rollers and breaking up compressed materials by the blades or paddles in a manner which facilitates sepa-

ration of steam and fumes without removal of dust and fines therefrom.

The arrangement disclosed herein has the following advantages: (1) Occupies less space; (2) sand is finely dispersed in an air flow to induce greater cooling; (3) reduced maintenance and upkeep cost relative to the amount of sand tempered; (4) volume of tempered sand produced is greater per unit of time because of elimination of charging and discharge time; (5) elimination of an elevator required in prior conventional systems; and (6) selective removal of steam and fumes without removal of fines and bonding additives.

In any of the variations of the present invention disclosed herein the sand after treatment is milled and has a moisture content controlled in accordance with its temperature so that it will be at the appropriate moisture content when ready for use. The operation of the structure disclosed herein results in practically perfect mixing of the sand so that when treatment is completed it is at substantially absolutely uniform moisture content throughout.

While reference has been made in the foregoing to conditioning foundry sand, it will be appreciated that the present invention is capable of effecting corresponding treatment of any finely divided or granular material.

The drawings and the foregoing specification constitute a description of the improved continuous type sand mixer in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. Apparatus for conditioning granular material comprising an enlongated cylindrical substantially vertical casing having a length more than double its diameter, said casing having an inlet opening at its lower end and an outlet opening in its side wall at the top thereof, means for establishing a continuous flow of granular material vertically upward through said casing to produce a continuous discharge of conditioned granular material at the same rate of supply of material to said casing through said inlet opening, a vertical rotary drive shaft in said casing extending for the full length thereof substantially along the axis of said casing, a plurality of inclined blades fixed to said shaft at substantially uniform axial spacing throughout the length of said shaft, rollers connected to said shaft intermediate adjacent pairs of axially spaced blades, means mounting said rollers for radially outward movement by centrifugal force into position to roll granular material against the inner surface of said casing, scrapers carried by said shaft in the same horizontal planes occupied by said rollers, means for continuously introducing granular material in finely divided separated particle condition into the bottom opening in said casing, and means for driving said shaft at a speed sufficient to produce a continuous upward flow of granular material through the combined mechanical action of the blades throwing the granular material upwardly and the flow of air upwardly through the casing induced by the fan action of said blades to produce a continuous discharge of conditioned granular material from the top opening of said casing at the same rate as the continuous introduction of granular material into the bottom opening thereof.

2. Apparatus as defined in claim 1 which comprises a conveyor belt having a horizontal run positioned to deliver granular material directly adjacent the inlet opening, a rotary feeding device positioned above said belt adjacent said inlet opening, and means for rotating said device at a speed sufficient to throw finely divided granular material through said bottom opening into said casing.

3. Apparatus as defined in claim 1 which comprises a conveyor belt having a horizontal run positioned to deliver granular material directly adjacent the inlet opening, a liquid spray head positioned over said belt to supply moisture to the granulated material, and means responsive to the moisture content of the granular material on said belt to regulate the flow of liquid through said head.

4. Apparatus as defined in claim 1 which comprises a conveyor belt having a horizontal run positioned to deliver granular material directly adjacent the inlet opening, a liquid spray head positioned over said belt to supply moisture to the granulated material, and means responsive jointly to the temperature and moisture content of the granular material on said belt to regulate the flow of liquid through said head.

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