

April 15, 1952

R. L. McILVAINE
SAND COOLING DEVICE

2,593,327

Filed Nov. 3, 1947

2 SHEETS—SHEET 1

Fig. 3

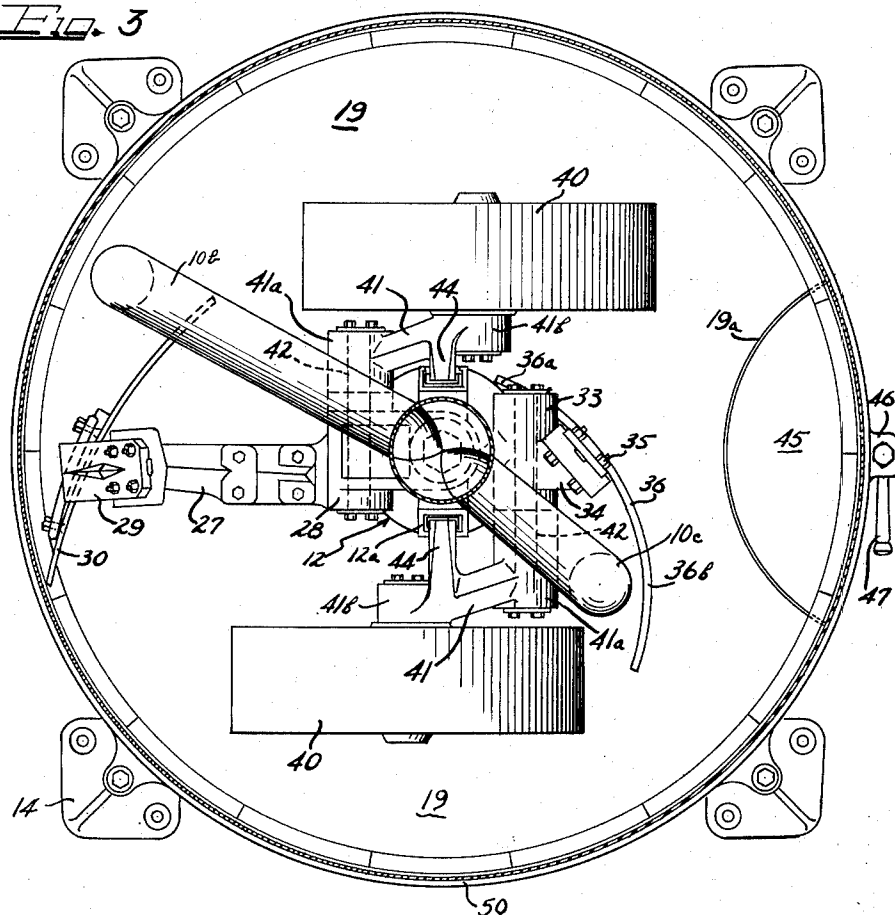


Fig. 1

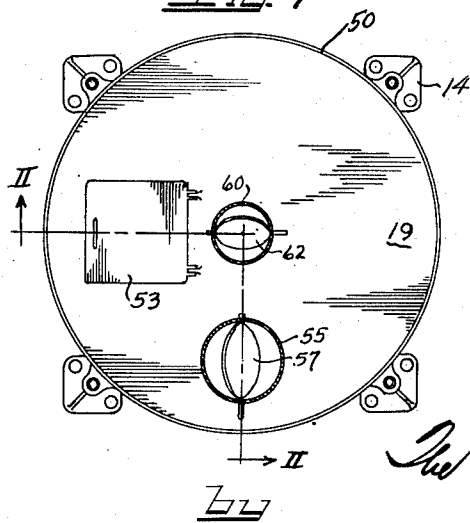
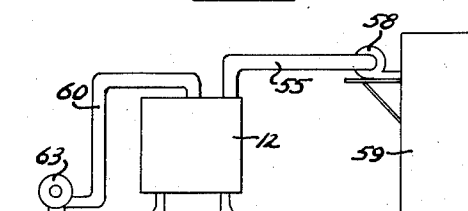


Fig. 4



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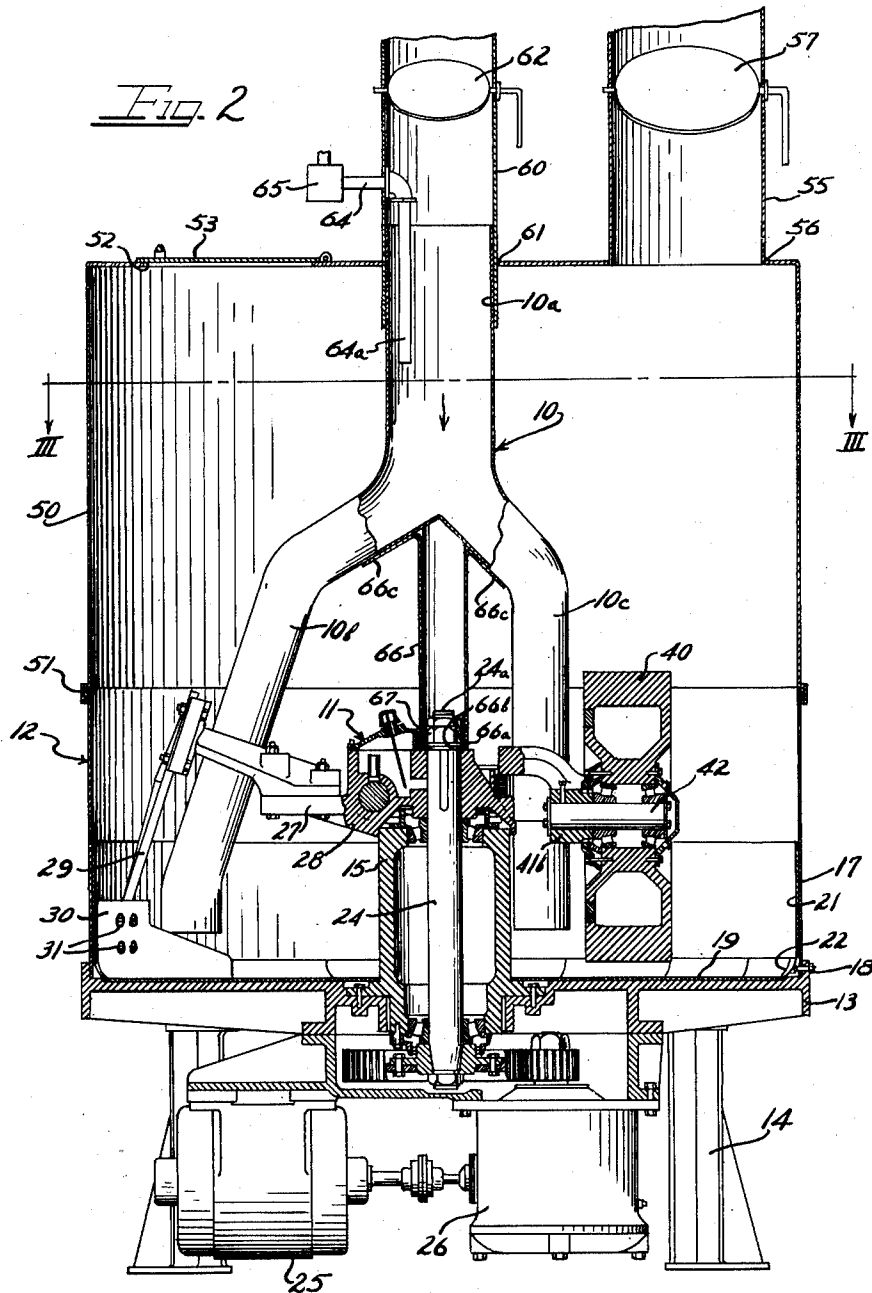
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2 SHEETS—SHEET 2



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UNITED STATES PATENT OFFICE

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SAND COOLING DEVICE

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6 Claims. (Cl. 22-89)

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This invention relates to a cooling device for use in the treatment of granular materials. More particularly it relates to a device arranged to cool material, such as sand, as it is being worked or mixed.

In the foundry and chemical process industries it is often necessary to mix a quantity of granular materials while they are in a warm or hot condition. This heated state of the material may be due to a previous conditioning operation or it may be the result of chemical reaction during the mixing operation. For convenience in further handling, it is necessary that the material be cooled and it has been found desirable and economical to cool the material while it is being mixed.

Another problem that arises during the mixing or processing of certain materials is the accumulation of toxic gases which must be removed. Also, in the mixing and working of sand, dust and fines are separated from the main bulk of the sand. These small particles must be removed before they work their way into bearings of the machine.

While this device for cooling material herein disclosed is particularly adapted to cooling heated sand in a foundry and will hereinafter be specifically described for such an application, it is to be understood that this invention is not limited to such usage, being generally useful for cooling any powdered or granular material.

It is therefore an object of this invention to provide improved means for cooling sand or other similar material as it is being mixed or worked.

Another object of this invention is to provide improved means for exhausting gases and dust from the mixing chamber.

A further object of this invention resides in the provision of apparatus for cooling heated material that makes use of the combined cooling effect produced by the passage of air through and over the material and by the evaporation of liquid introduced into the material as it is being mixed.

According to the general features of this invention, air and water are introduced into the material in the crib of a mulling machine through a turret which revolves with the mulling and mixing apparatus; discharge duct means of the turret being disposed at advantageous positions in the crib so that the air and water will be immediately intimately mixed into the material.

A special feature of this invention is the provision of a cooling device that employs a sealed mixing chamber for controlling the flow of dust and odor laden air from the chamber.

Other objects, features and advantages of the present invention will be readily apparent to those skilled in the art from the detailed description of the annexed sheets of drawings.

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On the drawings:

Figure 1 is a plan view of the cooling device of this invention, showing the intake and discharge pipes in section;

Figure 2 is a vertical irregular sectional view taken substantially on lines II-II of Fig. 1;

Figure 3 is a horizontal sectional view taken on line III-III of Fig. 2 looking in the direction indicated by the arrows; and

Figure 4 is a diagrammatic side view of the apparatus of this invention.

As shown on the drawings:

The invention here shown is particularly interrelated with a miller, designated generally by the reference character 12, which is shown diagrammatically in Fig. 4 with reference to other components of the system and in detail in Figs. 2 and 3. The miller is more or less of a conventional construction with the exception of the construction of its turret head 11 and the relation of parts thereof to the other parts of the miller.

In Fig. 2, an air and water supply duct designated generally by the reference character 10 is illustrated mounted on a turret 11 of the mulling machine 12.

The mulling machine 12 in addition to the turret comprises a base 13 supported on legs 14 and carrying in a central aperture a substantially cylindrical bearing support member 15. A cylindrical shell 17 is secured at its lower end to the base 13 by a plurality of bolts 18. A wear plate 19 having a central aperture for receiving the bearing support member 15 is positioned in a recess on the base 13. Arranged to fit snugly inside the lower portion of the shell 17 is a cylindrical wear plate 21 and an arc shaped corner member 22 disposed between the bottom wear plate 19 and the cylindrical wear plate 21.

Rotation of the mulling apparatus is carried out through a drive shaft 24, journaled in bearings in the support member 15, and driven at its lower end by an electric motor 25 through a gear drive 26. At its upper end, the drive shaft 24 is secured in the turret 11 for rotating the same. An arm 27 extends outwardly from a sleeve portion 28 formed integral with the turret to support a scraper holder 29 at the lower end of which a scraper and plow member 30 is secured by counter-sunk capscrews 31.

The scraper is arranged to scrape material from the side and bottom walls of the crib and direct it inwardly toward the center of the crib. As the material moves inwardly it is toppled over the inner end of the scraper blade, the height of which decreases progressively towards its inner end. There is thus provided immediately behind the scraper a zone in which the sand is in a loose, toppled condition favorable to the penetration of air and water.

As best seen in Fig. 3, a sleeve portion 33 on the turret 11 has an arm 34 projecting outwardly therefrom to support, through bolts 35, a curved plow blade 36. This plow blade is arranged at its innermost end 36a to scrape material from the support member 15 and is curved to urge the material outwardly. The blade of the plow is of a height at its outermost portion 36b to permit material to topple thereover as the turret rotates thus providing a second zone in which the material is in a loose, tumbled condition.

Oppositely disposed in the crib of the machine and arranged to rotate with the turret 12 is a pair of conventional muller wheels 40. The muller wheels are pivotally mounted on the turret by means of support arms 41 which have sleeve portions 41a pivotally mounted on axles 42 carried by the sleeve portions 28 and 33 of the turret. The support arms also comprise an inwardly projecting limit arm 44 that abuts on a shoulder portion 12a of the turret 12 to limit the downward pivoting of the muller wheels. An inner sleeve portion 41b of each support arm is arranged to receive a muller wheel shaft 42, Fig. 2, about which the muller wheels 40 revolve as the turret rotates.

To remove material from the crib there is provided a discharge door 45 in the floor of the crib. The door may conveniently be made in the shape of a sector of a circle, fitting in its closed position into a mating opening 19a in the wear plate 19. The door is opened by pivoting it on a hinge 46 by means of a handle 47. When the door is open rotation of the plow and scraper will cause the material to be pushed through the door opening.

In accordance with the teachings of this invention, the crib or the mulling machine is made into a sealed unit by assembling the shell and the base of the crib in air tight relation and securing a cylindrical hood 50 in sealing engagement over the top of the crib. As seen in Fig. 2, the hood 50 is joined to the crib by means of a telescoping peripheral joint 51 which joint may include a resilient gasket member or the like to obtain a tight seal.

In order that material may be loaded in the mulling machine, a loading port 52 is provided on the top surface of the hood. A door 53 is disposed over said port for opening and closing the same.

At one side of the top surface of the hood, an exhaust duct 55 of circular cross section is attached as by welding, over a mating aperture 56 in the hood. To prevent circulation of air through the sealed chamber during loading of the machine, a manually operated damper 57 is pivotally disposed in the duct 55.

As illustrated in Fig. 4, an exhaust fan or blower 58 is connected at the end of the duct 55 for exhausting the sealed chamber and thus pulling dust and gases therefrom and directing them to an accumulator 59 which may be of any standard type suitable to the installation.

Air for cooling the material is delivered to the sealed chamber through an intake duct 60 which may be of circular cross section and secured by welding in a circular aperture 61 in the top surface of the hood 50. The lower end of this intake duct 60 may extend for a short distance down into the chamber as seen in Fig. 2. A damper 62 is provided in the duct 60 to control the flow of air therethrough and a blower 63 may be optionally connected to the inlet sides of the duct 60.

One of the important features of this invention is the provision for supplying a quantity of water or other liquid which is intimately mixed with the heated material and which cools the material by evaporation of the liquid. For this purpose, a pipe 64 is fitted through the side of the intake duct having a depending portion 64a that extends down into the chamber. A conventional liquid metering device 65 may be connected any place in the pipe 64 to regulate the flow of liquid into the chamber. This metering device may conveniently include a dial for accurately recording the quantity of liquid delivered to each batch of material in the machine.

The supply duct 10 is provided to distribute air and water inside the mixing chamber. This duct comprises a main duct 10a which is arranged in telescoping relationship with intake duct 60, the upper end of the main duct being considerably above the lower end of the water supply pipe 64. Two auxiliary ducts 10b and 10c branch off from the main duct 10a, one of these branch ducts 10b having an opening immediately behind the scraper 30, while the other duct 10c has its lower opening immediately behind the plow 36. It is to be noted that the auxiliary ducts 10b and 10c discharge into the material at locations where the material is in a loose and toppled condition. Thus, most of the air will immediately penetrate the material. A portion of the air will of course pass across the top of the sand to cool it by conduction.

The supply duct 10 is mounted on the turret 11 by means of a support tube 66. This tube has a closed bottom 66a with an aperture 66b therein for receiving the upper threaded end 24a of the drive shaft 24. A nut 67 threaded on the end of the shaft 24 clamps down tightly on the bottom 66a to hold the support tube 66 in an upright position on the turret 11. At its upper end, downturned flanges 66c are secured, as by welding, to the underside of the auxiliary ducts 10b and 10c to support the same.

While only two auxiliary ducts are employed in the embodiment of the applicant's invention herein disclosed, it is within the scope of this invention to provide additional similar ducts advantageously disposed in the sealed chamber.

Since the supply duct is secured to the turret 11 and since it telescopes inside the intake duct 60, it will of course rotate with the turret.

Thus, there is provided in this invention a sealed mulling chamber, means for supplying air and liquid to selected areas in the chamber to obtain efficient commingling of the water and air with the material being mixed. These areas are located adjacent radially inner and outer portions of the muller wear plate 19.

It is contemplated in this invention that the liquid will mix with the material and cause cooling of the material by evaporation of the liquid. Further cooling is accomplished by the blowing of air both over and through the material in the chamber. The amount of liquid required to cool a batch of the material from one temperature to another can be fairly accurately calculated and the quantity delivered to the material can be controlled by the metering device 65.

In operation, a batch of the material to be mixed, such as sand, is deposited in the sealed mulling chamber through the loading door opening at 52. The motor 25 is started to begin the rotation of the muller wheels 40, the plow 36 and the scraper 30. The supply duct 10, of course, rotates with the mulling and mixing ap-

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paratus. A metered amount of water is introduced into the supply duct 10 from the pipe 64, to pass downwardly in the duct to be intimately mixed with the material in the machine.

It is proposed in this invention to maintain a slight vacuum in the sealed mixing chamber. This may be done by either of two methods. As illustrated in Fig. 4, a predetermined quantity of air may be delivered to the sealed chamber of the mulling machine 12 by the blower 63 through the intake duct 60. At the same time, the exhaust blower 58 may be operated at a greater capacity than the blower 63. Thus, a negative pressure will be maintained in the chamber and dust and gasses will pass out through the exhaust duct 55.

The second method of maintaining a vacuum in the sealed chamber involves removing the blower 63. Then, operation of the exhaust blower 58 will cause atmospheric air to enter through duct 60 and the pressure differential so caused will result in a vacuum being maintained in the sealed chamber.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention, and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In combination in a device for cooling material, a chamber for receiving the material, a drive shaft centrally disposed in said chamber, mulling wheels rotatably mounted on said drive shaft, plowing means mounted on said drive shaft in spaced angular relation to said mulling wheels, a duct mounted on said drive shaft for rotation therewith, said duct having a plurality of discharge outlets disposed immediately behind said plowing means, and means for delivering air and water to said duct.

2. In combination in a device for cooling material, a sealed chamber for receiving the material, rotating means in the chamber for agitating the material, a duct mounted for rotation with said rotating means and having discharge stations adjacent the material, means for delivering water to said duct, a first blower for delivering air to said duct, a second blower connected to said sealed chamber for exhausting air therefrom, said second blower being operated at a greater capacity than said first blower to maintain a vacuum in said chamber.

3. In combination in a device for cooling material, a cylindrical casing affording a sealed chamber for the material to be cooled, a drive shaft centrally disposed in said chamber, a pair of muller wheels disposed on opposite sides of said chamber and secured to said drive shaft, a pair of plows disposed on opposite sides of said chamber in spaced angular relation to said muller wheels and secured to said drive shaft for rotation therewith, separate intake and exhaust ducts mounted in said casing in communication with said chamber, a distributing duct supported on said drive shaft for rotation therewith having one end telescoped in said intake duct and a plurality of auxiliary ducts branching from the

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other end, each auxiliary duct having a discharge portion immediately behind one of said plows, means for rotating said drive shaft, a first blower for delivering air to said intake duct, and a second blower connected to said exhaust duct, said second blower being operated at a greater capacity than said first blower to maintain a vacuum in said sealed chamber.

4. A mulling and cooling device for granular material comprising a generally cylindrical material-receiving chamber, a mulling wheel located in said chamber, means for rotating said mulling wheel in an annular path, plow means located in said chamber and rotatable with said mulling wheel, said plow means having a relatively low trailing edge coinciding upon rotation of the plow means with the annular path of said mulling wheel, and an air duct fixed with respect to said plow means and rotatable therewith, said duct having a discharge opening immediately adjacent the trailing edge of said plow means for directing air against said material as it is tumbled thereover.

5. In a muller having a material-receiving chamber, cross-head means disposed in the chamber for rotation relative thereto, and mulling means and plow means supported by said cross-head means and rotatively substantially fixed relative to the cross-head means, the improvements which comprise means defining an air inlet to said material-receiving chamber, and an air duct supported by said cross-head means and rotatively substantially fixed relative to said cross-head means, said duct being in rotary connection with said air inlet and having a discharge opening behind said plow means, and conduit means leading through said air inlet to said chamber and into said air duct to deliver liquid into said air duct.

6. In combination in a device for cooling material, a cylindrical casing affording a sealed chamber for the material to be cooled, a shaft centrally disposed in said chamber, a pair of muller wheels disposed on opposite sides of said chamber and secured to said shaft, a pair of plows disposed on opposite sides of said chamber in spaced angular relation to said muller wheels and secured to said shaft, separate air intake and exhaust ducts mounted in said casing in communication with said chamber, a distributing air duct supported on said shaft in rotatively substantially fixed relation thereto having one end telescoped in said air intake duct and a plurality of auxiliary air ducts branching from the other end, each auxiliary duct having a discharge portion behind one of said plows.

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