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2,778,076

MEANS FOR TEMPERING FOUNDRY SAND

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2 Sheets-Sheet 1

FIG. 1

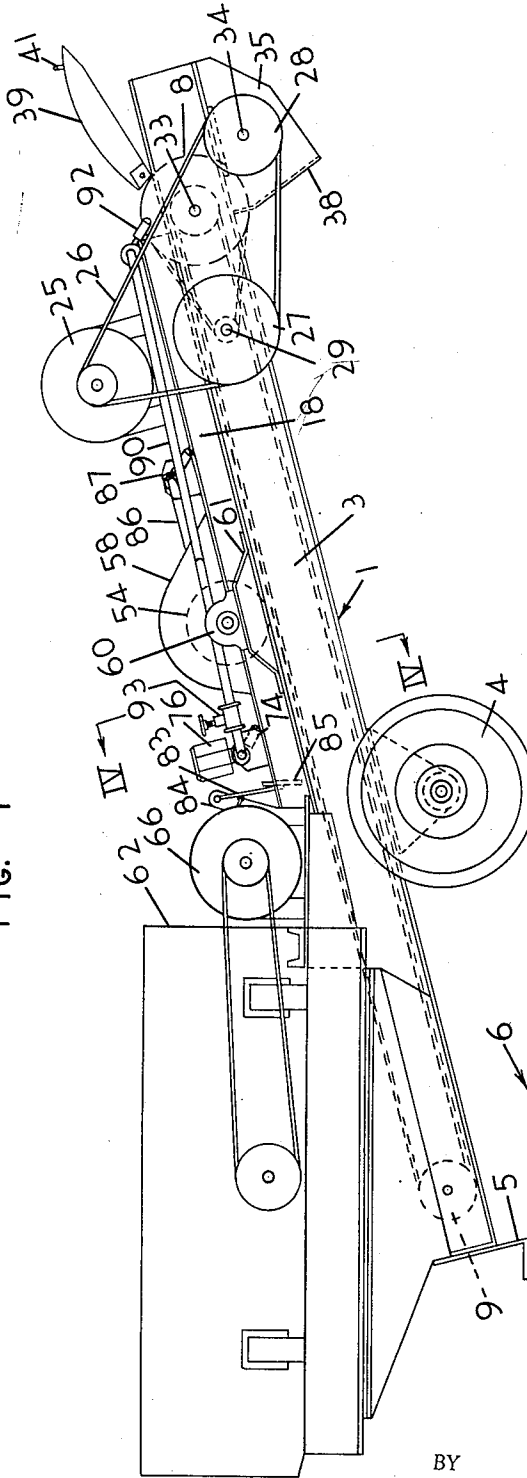
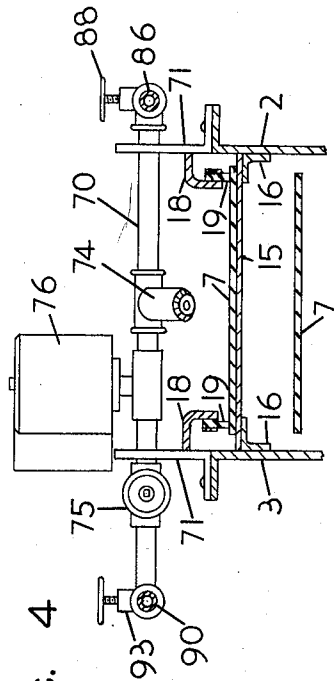


FIG. 4



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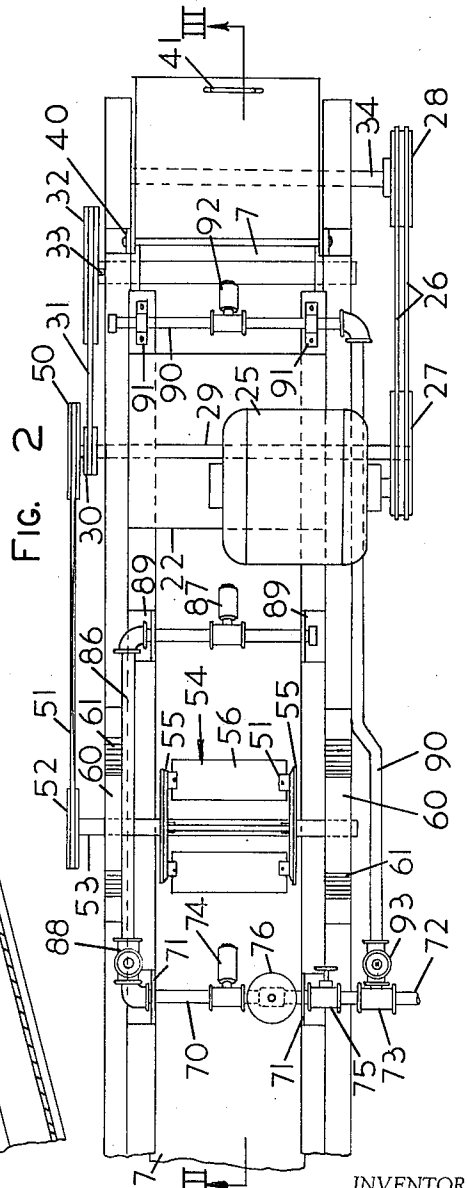
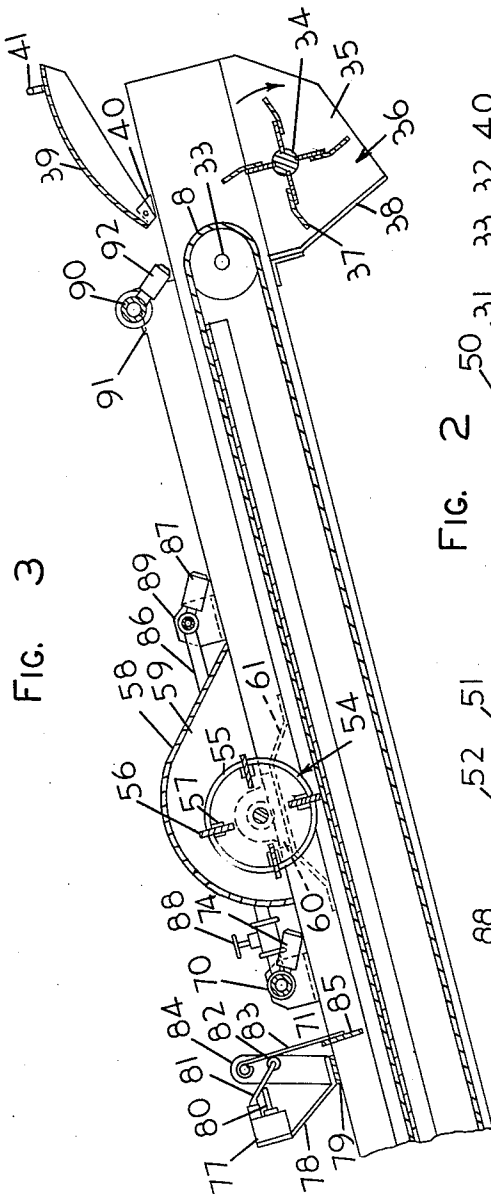
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MEANS FOR TEMPERING FOUNDRY SAND

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2 Sheets-Sheet 2



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MEANS FOR TEMPERING FOUNDRY SAND

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1 Claim. (Cl. 22—89)

This invention relates to foundry equipment and more particularly to means for tempering and conditioning foundry sand for reuse combined with a conveyor whereby the tempering and conditioning of the sand may be carried out automatically while the sand is being transported by the conveyor.

In small foundries, the handling and preparing of the sand for reuse after it has been shaken from the flask and the casting removed presents a serious problem. The conventional equipment available for transporting and reconditioning this sand ready for its next cycle through the foundry process is large, bulky and wholly unsuited to the needs and available space of the average small foundry. It is essential to these foundries that they have equipment requiring a capital investment commensurate with the size of their operation. Among the equipment which is unsuited to their circumstances is that normally provided for tempering the sand.

My invention is designed to provide a compact, dependable, low cost unit for effectively tempering and conditioning the sand during its transportation from the shakeout unit to the storage area ready for reuse at the molding station. My equipment is so designed that it will effect this tempering and conditioning while the sand is in transport. The equipment is designed to be mounted upon a portable sand conveying unit, thus adapting it particularly to the flexible needs of a small foundry and to foundries working in light metals.

These and other objects and purposes of my invention will be immediately seen by those acquainted with the design and construction of foundry equipment upon reading the following specification and the accompanying drawings.

In the drawings:

Figure 1 is a side, elevation view of a portable conveyor unit having my sand tempering equipment mounted thereon.

Figure 2 is a fragmentary, plan view of the conveyor unit shown in Figure 1, showing that portion of it mounting the sand tempering equipment with the hood for the blending wheel removed.

Figure 3 is a sectional, elevation view taken along the plane III—III of Figure 2.

Figure 4 is a sectional, elevation view taken along the plane IV—IV of Figure 1.

In executing the objects and purposes of my invention, I have provided a portable conveyor having a powered belt for elevating the sand. Above one portion of the belt there is provided a plurality of nozzles designed to spray water upon the sand at various intervals in its travel for both cooling the sand and returning the required moisture lost in the making of the casting. There is also provided a rotor having vanes thereon designed to mix the wetted sand and the dry sand whereby a thorough dispersion of the water will be effected throughout the entire body of the sand and assure an even tempering. Means are provided for automatically regulating the flow of

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water whereby the flow of water occurs only when the conveyor is actually transporting sand.

In the following description, the terms "upwardly" and "downwardly" are frequently used and are to be taken to mean "upwardly" in the direction of the conveyor as normally used and as it appears in Figure 1 and "downwardly" away therefrom. The terms "forwardly" and "rearwardly" are also frequently used and are to be taken to mean "forwardly" toward the discharge end of the conveyor or to the right in Figure 1 and "rearwardly" away therefrom.

Referring now specifically to the drawings, the numeral 1 indicates a conveyor bed having side frame elements 2 and 3. The conveyor bed 1 is supported by means of the wheels 4 and tail rest 5. In operating position, the conveyor bed 1 is inclined with the tail rest 5 seated on the floor 6.

Mounted within the conveyor bed 1 is an endless belt 7, supported by the driven pulley 8 at the upper or discharge end of the conveyor bed and the idler pulley 9 at the lower or receiving end of the conveyor bed. The conveyor belt 7 occupies almost the entire spacing between the side frame elements 2 and 3. The upward run of the belt 7 is supported by the plate 15 anchored to the side frame elements 2 and 3 by the angles 16. The downward or return run of the belt is within the outline of the conveyor bed 1.

On each side of the conveyor bed 1 angle members 18 are mounted to the side frame elements 2 and 3 (Figure 4). The angle members 18 each have one leg projecting downwardly toward the conveyor belt 7. To this leg of each of the angle members 18 is mounted the adjustable skirt or guide 19. The guides 19 are vertically movable whereby they may be adjusted to compensate for wear of the bottom of the skirt against the surface of the belt 7. Thus, they may be positioned to almost contact the belt surface to prevent material spilling from the side of the belt. The adjustable guides 19 are made of a flexible material such as rubber or rubber impregnated fabric whereby they will not injure the belt 7.

A prime mover 25 is mounted to a platform 22 (Figure 2), which platform is secured to the conveyor adjacent its forward end. By means of the belt 26, the prime mover 25 drives the pulleys 27 and 28 (Figure 1). The pulley 27 is affixed to the shaft 29, which shaft has a pulley 30 at the other end. The pulley 30 is, by means of the belt 31, connected to the pulley 32 (Figure 2). The pulley 32 is mounted on the shaft 33 which in turn mounts the driven pulley 8 for the endless belt 7. The pulley 28 is mounted on the shaft 34. The shaft 34 is journaled in the depending flanges 35 mounted on the side frame members 2 and 3 (Figure 1). Mounted on the shaft 34 is a conditioning or tempering drum 36 (Figure 3). The conditioning drum consists of four, equally spaced blades 37, each having their radial outer end slightly curved away from the direction of rotation of the drum. The drum is mounted to rotate with its upper portion moving away from the belt 7, as indicated by the arrow in Figure 3.

Also mounted to the shaft 29 adjacent the pulley 30 is a further pulley 50, which by means of the belt 51 is operatively connected to the pulley 52. The pulley 52 drives the shaft 53 mounting the blending wheel 54. By means of the differential in pulley sizes, the blending wheel 54 is caused to have a peripheral speed approximately twice that of the movement of the belt 7. The purpose of this will be explained more fully under "Operation." The direction of rotation of the blending wheel 54 is such that its lower periphery is moving in the same direction as the upper run of the belt 7. To effect this, the belt 51 is twisted to form a figure 8 thereby reversing the direction of rotation of the shaft 53.

The blending wheel 54 consists of a pair of end plates 55 between which extend four, equally spaced, flexible, rubber or composition blades or paddles 56. The paddles are attached to the end plates by means of U-shaped clips 57, one on each end, and a bolt for anchoring the paddle to the clip. Mounted on the L-shaped angle members 18 and enclosing the upper portion of the blending wheel 54 is a somewhat tear drop shaped hood 58. The elongated portion of the hood extends forwardly from the blending wheel. The ends of the hood are enclosed by the end members 59. The hood serves to confine to the conveyor the material agitated by the blending wheel. The shaft 53 is supported by means of journals 60 seated on the brackets 61 mounted to the side frame elements 2 and 3.

At the end of the flanges 35, adjacent the driven pulley 8, the flanges are connected by a plate-type deflector 38 (Figure 3). The flanges 35, together with the deflector 38, constitute a discharge chute for the conveyor. The upper side of the chute is closed by an adjustable hood 39, pivotally mounted by the hinge 40, at its end adjacent the driven pulley 8, to the side frame elements 2 and 3. A handle 41 is provided on the hood 39 to facilitate adjustment. The hood 39 is vertically adjustable whereby the distance the sand is thrown by the drum 36 may be regulated according to the size of the hopper or area into which the conditioned sand is being discharged.

At the lower or receiving end of the conveyor bed 1 is a shakeout and screening unit 62. The shakeout and screening unit is arranged to discharge the sand onto the conveyor belt 7 whereby it will be transported along the conveyor and subjected to the tempering action about to be described.

Between the shakeout unit 62 and the blending wheel 54 a pipe 70 is mounted transversely of the conveyor bed by means of the brackets 71 secured to the angle members 18. On one end, the pipe 70 is connected to a water source 72 through the T-fitting 73. At the center of the conveyor a spray nozzle 74 is mounted in the pipe 70. The spray nozzle 74 is arranged to direct its spray downwardly toward the belt 7 and forwardly toward the blending wheel 54. The nozzle 74 is designed to discharge a fine spray of water across the entire width of the belt 7 between the adjustable guides 19. Between the nozzle 74 and the T-fitting 73 a manual valve 75 and a solenoid operated valve 76 are mounted in the pipe 70, the manual valve being positioned between the solenoid operated valve 76 and the water source 72.

Operation of the solenoid operated valve 76 is controlled by a switch 77 mounted on the bracket 78 and cross bar 79 (Figure 3). The switch 77 is provided with a plunger 80 operated by a depending, pivoted lever 81 having a roller 82 on its lower end. The roller 82 contacts a depending arm 83, pivotally hung from the leg 84. The leg 84 is supported by the cross bar 79. The lower end of the arm 83 mounts a paddle 85 of non-corrosive material, the lower end of which, when the arm 83 is in its normal or resting position, just clears the surface of the belt 7. The plunger 80 is urged outwardly from the switch 77 to close an electrical circuit. The weight of the arm 83 and paddle 85, however, normally force the lever 81 toward the switch and the plunger 80 to open the circuit. The solenoid operated valve 76 is designed to open the valve only when energized. Thus, the valve 76 is open only when the arm 83 is moved forwardly and upwardly.

Then end of the pipe 70 remote from the T-fitting 73 connects with the pipe 86 extending forwardly along the conveyor to a point forwardly of the end of the hood 58. At this point the pipe 86 extends over the conveyor to mount a second nozzle 87. The nozzle 87 is centered between the sides of the conveyor and is inclined in the same direction as and at the same angle as the nozzle 74. Like the nozzle 74, it is designed to discharge a fine spray extending the entire width of the conveyor. A manual

valve 88 is mounted in the pipe 86 adjacent its connection with the pipe 70 whereby the nozzle 74 may be operated independently of the nozzle 87. That portion of the pipe 86 extending transversely of the conveyor is supported by brackets 89 mounted on the angle members 18.

Connected to the T-fitting 73 is an L-shaped pipe 90 extending forwardly along the conveyor to a point approximately above the driven belt pulley 8. The forward leg of the pipe 90 extends transversely of the conveyor on the supports 91 and, at the center of the conveyor, mounts a spray nozzle 92. The nozzle 92 is inclined at such an angle that its spray is directed at the material at the point of discharge of the material from the belt 7. The flow of water through the pipe 90 to the nozzle 92 is regulated by the manual valve 93. The nozzle 92 is designed to discharge a finer spray than the nozzle 74 and 87, preferably, the water is discharged as a fog.

Operation

After a mold has been poured and the metal forming the casting therein has solidified sufficiently that the casting may be removed, the flask containing the sand and casting are placed on the shakeout unit 62. The vibrating shakeout and screening unit 62 is driven by the motor 66 dislodging the sand and the casting from the flask, the casting then being removed by hand. The sand removed from the flask is deposited upon the belt 7 which is maintained in constant operation by the prime mover 25, carrying the sand upwardly toward the discharge end of the conveyor.

The belt 7 moves slowly to allow the sand reasonable time to cool as it moves along the conveyor bed 1. As the sand is moved up the conveyor bed, it is drawn under the arm 83 where it contacts the paddle 85. The movement of the sand past the paddle 85 swings the arm 83 forwardly, permitting the plunger 80 to pivot the lever 81 forwardly and upwardly. This results in closing the circuit and energizing the solenoid operated valve 76 to permit water to flow to the nozzles 74 and 87. The spray of water discharged by the nozzle 74 wets the surface of the sand before it reaches the blending wheel 54. This surface wetting serves the dual purpose of cooling the sand and restoring some of the water lost by the sand in the casting operation. The sand is next moved under the blending wheel where the more rapid rotation of the blending wheel with relation to the belt causes the sand to be picked up by the blending wheel, turned over and over and thrown against the hood 58. The "over and over" movement of the sand by the blending wheel has been established by stroboscopic tests. These tests disclosed that the sand travelled through two complete loops before striking the hood 58. This thoroughly mixes the sand wetted and cooled by the spray from the nozzle 74 with the dry and warmer sand lying close to the belt. The action of the blending wheel also tends to aerate the sand, further cooling it. The sand, as it leaves the zone of the blending wheel 54 is less compact and is, therefore, better prepared to absorb the water supplied by the nozzles 87 and 92. The mixed and blended sand is then moved forwardly by the belt 7 until it is again sprayed by water discharged from the nozzle 87. This water further cools the sand and replaces the remainder of the water lost in the casting operation. The sand, after being sprayed by the nozzle 87, is ready for re-use. To prevent dust which might be created by the conditioning drum 36, there is provided a fogging nozzle 92. The fogging nozzle 92 is designed primarily for use when the conveyor belt 7 is running empty or the machine is being run with the nozzles 74 and 90 shut off. In this event the action of the conditioning drum 36 will cause appreciable dust unless the fogging nozzle 92 is operated to wet this dust down. For this reason, it is important that the fogging nozzle 92 be capable of operation independent of the nozzles 74 and 90. The combination of cooling, aerating, blending and watering thoroughly re-

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conditions the sand ready for reuse. The action of the blending wheel 54 and of the conditioning drum 36 tend to break up any hard spots which might occur in the sand and to prevent lumps of unconditioned sand from appearing in the final, reconditioned product. Furthermore, by the arrangement of my invention, all of this reconditioning is carried out while the sand is being conveyed from the shakeout unit to the storage area or bin ready for reuse at a molding station.

Since the condition of the sand removed from the flasks at the shakeout unit 62 varies from time to time, the amount of water required to recondition the sand varies. The quantity of water added to the sand is dependent upon the quantity lost in the casting operation and the temperature of the sand. To meet this circumstance, I have made it possible to vary the number of operating nozzles. Thus, by closing valve 88, nozzle 74 can be caused to operate alone. By closing valve 93 only, nozzles 74 and 87 may be caused to operate without nozzle 92. When the conveyor is used merely to move sand with little or no tempering desired, valve 75 may be closed, leaving only nozzle 92 operating.

Since all the necessary equipment for the operation of my sand conveyor shakeout and reconditioning unit is combined in a single structure, and this structure is rendered portable by the wheels 4, a major portion of the sand handling equipment for a foundry is thus made portable for convenient relocation from one area of a plant to another, as needed. All of the various parts of the unit cooperate to provide a complete sand handling and reconditioning unit wholly integrated within itself. This unit is particularly adaptable to the changing needs of small foundries and at the same time is comparatively low in initial cost and subsequent maintenance.

Numerous modifications of my invention may be made without departing from the principle thereof. Each of these modifications is to be considered as included in the hereinafter appended claim unless the language of the claim expressly states otherwise.

I claim:

In foundry sand conditioning equipment for handling

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used foundry sand and adapted to cool the sand and restore the sand's moisture content, the combination comprising: a portable frame; an inclined conveyor bed mounted on said frame and having an endless conveyor belt; means for driving said belt; means for discharging hot, dry, used foundry sand on one end of said belt; a wheel having a plurality of radially projecting flexible paddles; means for rotatably mounting said wheel above said belt and intermediate and substantially spaced from each of the ends thereof with said paddles arranged transversely of said belt; said paddles extending substantially the full width of said belt; said wheel being spaced from said belt only sufficiently to permit said paddles to pass said belt without contact therewith a hood above said wheel for preventing sand from being thrown out of said equipment; means for rotating said wheel in the same direction as the movement of said belt and at a peripheral speed substantially greater than the speed of said belt; a first nozzle for spraying water on the hot sand being carried by said belt, said nozzle being between the sand receiving end of said belt and said wheel; a second nozzle for spraying water on said sand, said second nozzle being between said wheel and the sand discharge end of said belt, whereby the top surface portion of said sand is wetted and cooled by water discharged from said first nozzle and said wetted and cooled sand is mixed with hot, dry sand on said belt by said wheel and the resulting mixture is sprayed with water discharged from said second nozzle.

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