VIBRATOR ACTUATOR FOR SAND HOPPERS


Application January 3, 1955, Serial No. 479,500
1 Claim. (Cl. 222—55)

This invention relates to foundry equipment and more particularly to an attachment for a foundry sand hopper, the bottom of which is formed by a conveyor, the attachment being designed to break the bridging of the sand above the conveyor.

Foundry sand, by its very nature, is a difficult material to pass through a restricted opening. It has a strong tendency to form bridges. It is the automatic rupture of these bridges which is the principal objective of this invention.

Various means have been known for some time. These have not been entirely satisfactory because of either inadequate or excessive operation. The object of this invention is to provide a simple means to regulate the operation of the anti-bridging vibrators for the sand hopper by making its operation conform closely to the equipment's requirements.

Timed operation of the anti-bridging vibrators is not satisfactory since the formation of the bridge is erratic. Excessive operation of the vibrating equipment is self-defeating because it will tend to pack the sand, thus ultimately forming a more effective bridge than had previously existed.

Vibrators, particularly of the type contemplated in this invention, are air operated. Excessive operation is expensive since compressed air is a costly medium for operating equipment. Accordingly, its conservation is an important operating economy.

This invention provides a means fulfilling each of these objectives. In addition, it is particularly suitable for foundry operations where such equipment is exposed to abrasive dust, severe temperature differentials and frequent shocks.

These and other objects and purposes of this invention will be understood by those acquainted with the design and use of foundry equipment upon reading the following specification and the accompanying drawings.

In the drawings:

Fig. 1 is a side elevation view of a sand handling unit equipped with my invention.

Fig. 2 is a sectional elevation view taken along the plane II—II of Fig. 1.

Fig. 3 is an enlarged front elevation view of the control and sensing mechanism of my invention showing the surrounding structure in phantom.

Fig. 4 is a side elevation view of the control and sensing mechanism appearing in Fig. 3 showing the surrounding structure in phantom.

Fig. 5 is a wiring diagram of my invention.

In executing the objects and purposes of this invention, I have provided on the sand gate controlling the discharge of sand from the hopper an electrical switch. The operation of this switch is controlled by a pivoted, sensing plate placed in the path of the sand carried by the conveyor out from the bottom of the hopper. When the conveyor is loaded with sand, the sensing plate is pivoted into a raised position, the electrical switch is opened and the vibrators shut off. When the sand supply on the conveyor fails, the sensing switch is closed and the vibrators operate until sand is once more discharged from the hopper.

Referring specifically to the drawings, the numeral 1 refers to a sand hopper having downwardly converging sides 2 and 3. The hopper 1 is of the live bottom type, having a conveyor 4 at the bottom. The conveyor 4 includes an endless belt 5 operating over a pair of end pulleys 6 and 7, one of which is driven. The belt 5 forms the bottom of the hopper and is enclosed by a housing 8. The upper run of the belt 5 is supported by any suitable means such as a bed plate to enable it to sustain the weight of the sand pressing down from the hopper above. All of the equipment so far described is conventional. Therefore further detailed description of this structure is believed unnecessary for a proper understanding of this invention.

The forward end of the housing 8 opens into an elevator 9 through a suitable aperture near the bottom of the elevator's housing 10. The elevator is of conventional design having an endless carrier 11 equipped with buckets 12 traveling over top and bottom pulleys 13 and 14, one of which is driven. At the top, the elevator discharges through the chute 15 into the sand hopper 16.

The sand hopper 16, normally, is placed over a molding station and the sand for forming the molds is drawn as required from its lower end. The elevator 9, the chute 15 and the sand hopper 16 are conventional structures. Therefore, further detailed description of them is believed necessary for a proper understanding of this invention.

The sand hopper at the forward end has an opening 20 (Fig. 2) centered about and somewhat narrower than the conveyor belt 5. The width of the opening 20 is fixed but the height of the opening is made adjustable by a gate 21. The gate 21 consists of a plate mounted against the exterior surface of the hopper's front panel 22. The gate 21 has a pair of slots 23, each cooperating with one of the two threaded locking members 24. The threaded locking members are mounted on threaded studs welded to the front panel 22. When the gate 21 has been adjusted to the correct height to deliver the desired quantity of sand, the locking members 24 are tightened, fixing the position of the gate.

Mounted on the gate and movable with it is a sensing device 30, best seen in Figs. 3 and 4. The sensing device 30 has a mounting plate 31 fixedly secured by bolts 32 to the gate 21. Secured to the upper portion of the mounting plate 31 is a switch 33 having a downwardly projecting switch operating plunger 34. The switch 35 is of the type that when the rod is extended the circuit is open and when the rod is retracted the circuit is closed. Preferably, the switch 35 is of the fully enclosed type so that it will not be subject to malfunction due to sand and other coarse materials commonly present in foundry operations.

Below the switch 33 a pair of ears 35 project outwardly from the plate, one on each side of the switch actuating rod 34. The ears 35 are apertured and a shaft 36 extends between them and through the apertures. The shaft 36 is free to rotate in the ears.

Mounted on the shaft 36 is a probe or sensing plate 37. The upper portion of the sensing plate is wrapped partially about the shaft 36 and forms a switch contacting arm 38. The angle made by the arm 38 with respect to the main body of the sensing plate 37 is such that when the plate is in its lowered position, as shown in full lines in Fig. 4, the arm presses against the plunger 34 of the switch 33 causing it to retract, closing the circuit. When
the plate is forced upwardly into the position indicated in broken lines in Fig. 4, the arm 38 disengages the plunger 34 causing the switch to open the circuit. The sensing plate 37 is normally in the position shown in full lines in Fig. 4 and is urged to this position by gravity since the lower portion of the sensing plate 37 is substantially heavier than the arm 38.

The sensing mechanism 30 controls the operation of the regulator assembly 40 and, thus, the two in combination function as an operating control member for the vibrators. The regulator assembly 40 has a solenoid 41 mounted on a supporting platform 42. The solenoid 41 is connected to the piston of the control valve 43. The control valve is supported by the bracket 48. The control valve 43 regulates the admission of air to the vibrators 44.

One vibrator 44 is located on each side of the hopper 1 adjacent its lower end. Air is supplied from a suitable source to the valve 43 through the conduit 45. Air supplied to one of the vibrators 44 passes through the conduit 46 and to the other vibrator through the conduit 47. The solenoid 41 is of the holding type. Thus, so long as the switch 33 remains closed, the solenoid holds the valve 43 in open position. Electrical impulses from the switch 33 are transmitted by suitable wires 50.

Electrical power to operate the unit is received through the conductor 51. A master control switch 52 is provided to permit the entire vibrator unit to be rendered inactive when so desired. The vibrator controls are wired in parallel with the motor operating the conveyor belt 5, as indicated in Fig. 5 where a fragmentary portion of the motor operating circuit 54 is illustrated with the motor diagrammatically shown as element 55. The operation of the circuit is controlled by the main motor control switch 56.

**Operation**

When the hopper 1 is first filled, no sand lays on the belt in the area of the sensing plate 37. Thus, the plate is in its lowered position pressing against the switch plunger 34 and closing the circuit for the solenoid 41. As soon as the conveyor belt 5 is activated, the solenoid 41 will be actuated and the valve 43 opened. This causes the vibrators 44 to function. However, almost immediately sand will start to discharge from the hopper 1 on the belt 5. The sand passing under the sensing plate 37 will raise it, disengaging the arm 38 from the switch plunger 34. This de-actuates the solenoid 41, closing the valve 43. Immediately, operation of the vibrators 44 will cease. When a bridge forms in the hopper, sand will cease to be discharged on the belt. As a result there will be nothing to support the sensing plate 37 and it will return to its normal lowered position. As soon as this happens, the switch 33 is again closed and the vibrators will operate, rupturing the bridge. The resulting discharge of sand raises the sensing plate 37, stopping the vibrators.

It will be seen from this description that vibration will be applied almost immediately after a bridge has formed and will cease as soon as the bridge is broken and sand once more moves along the belt. Thus, operation of the vibrating units is positively limited to those periods when they are required. This prevents packing and the formation of sand bridges resulting from excessive vibration. It also prevents the waste of air and the disturbing noise caused by unnecessary operation of the vibrators.

It will be seen that the installation is mechanically simple and may easily be applied to existing equipment already in use in the field.

It will also be understood that electrically operated vibrators may be substituted for the pneumatically operated ones. In this event a suitable electrical switch would be substituted for the pneumatic valve 43. It would be possible to dispense with the valve 43 and solenoid 41, utilizing the switch 33 for directly controlling the operation of the vibrators 44. The use of the solenoid arrangement is considered preferable since it permits the switch 33 to be operated on a low voltage and by only slight pressures.

It will be understood that various modifications of this invention can be made without departing from the principles thereof. Each of these modifications is to be considered as included in the hereinafter appended claim unless this claim by its language expressly states otherwise.

**Claims**

In apparatus for handling foundry sand including a hopper having a sand carrying conveyor at its lower end, the discharge end of said conveyor being external of said hopper, the improvement in said apparatus comprising: a vibrator mounted on said hopper; means for operating said vibrator; said hopper having a vertically adjustable gate above the discharge end of said conveyor; a switch having an external operating element mounted on said gate; said switch being coupled to said operating means for controlling the same; a sensing member pivotally mounted on said gate adjacent said switch; said sensing member contacting said switch operating element and adapted to open and close said switch; one end of said sensing member projecting into the path of sand carried by said conveyor and movable by said sand; said sensing member when moved by said sand urging said switch into open position and when released by said sand urging said switch into closed position.

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