Oct. 21, 1952 H. L. BILTERMAN 2,614,707

CONVEYER APPARATUS

Filed March 23, 1950 2 SHEETS—SHEET 1

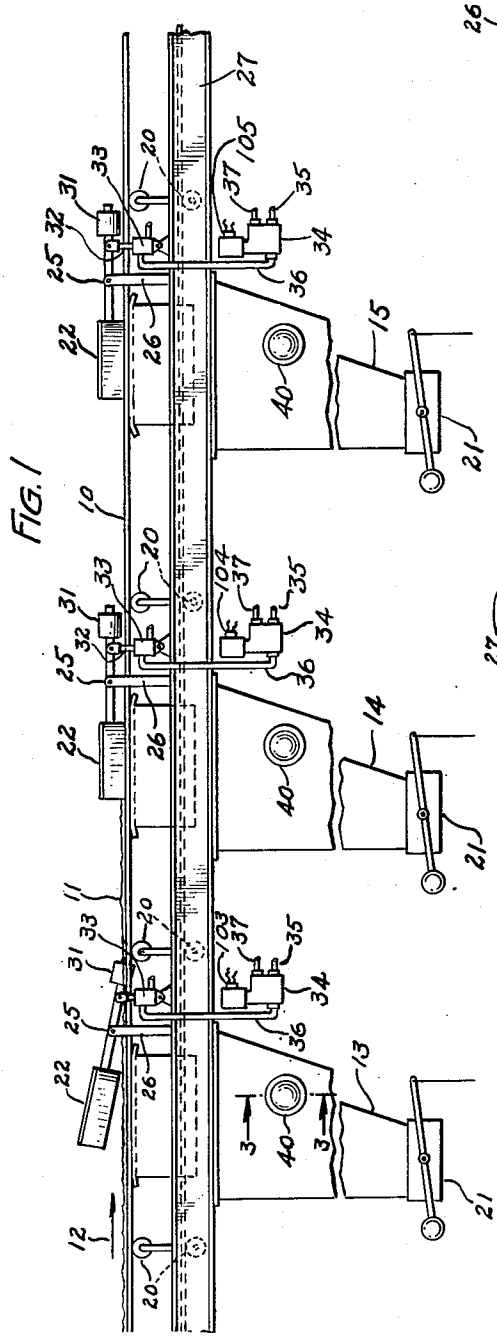


FIG. 1

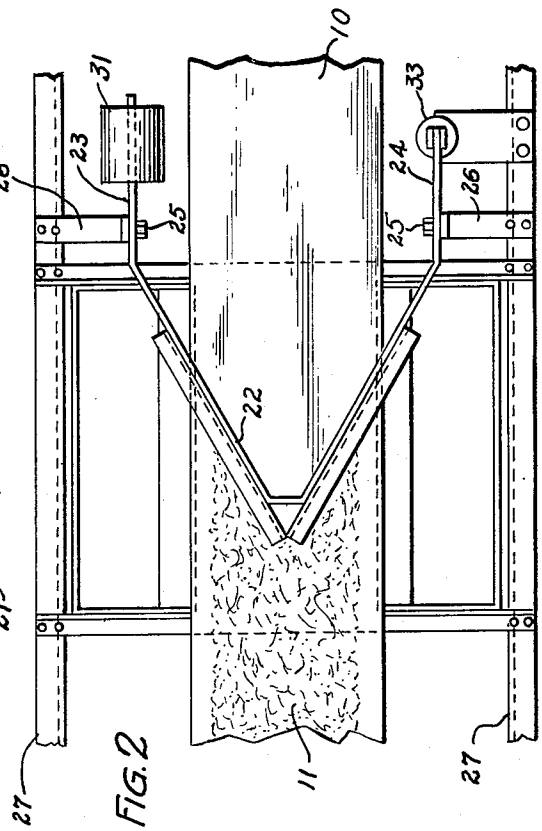


FIG. 2

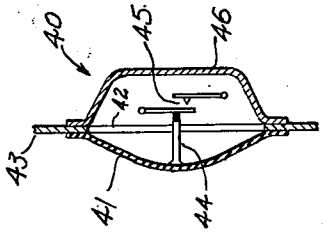


FIG. 3

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Oct. 21, 1952 H. L. BILTERMAN 2,614,707

CONVEYER APPARATUS

Filed March 23, 1950 2 SHEETS—SHEET 2

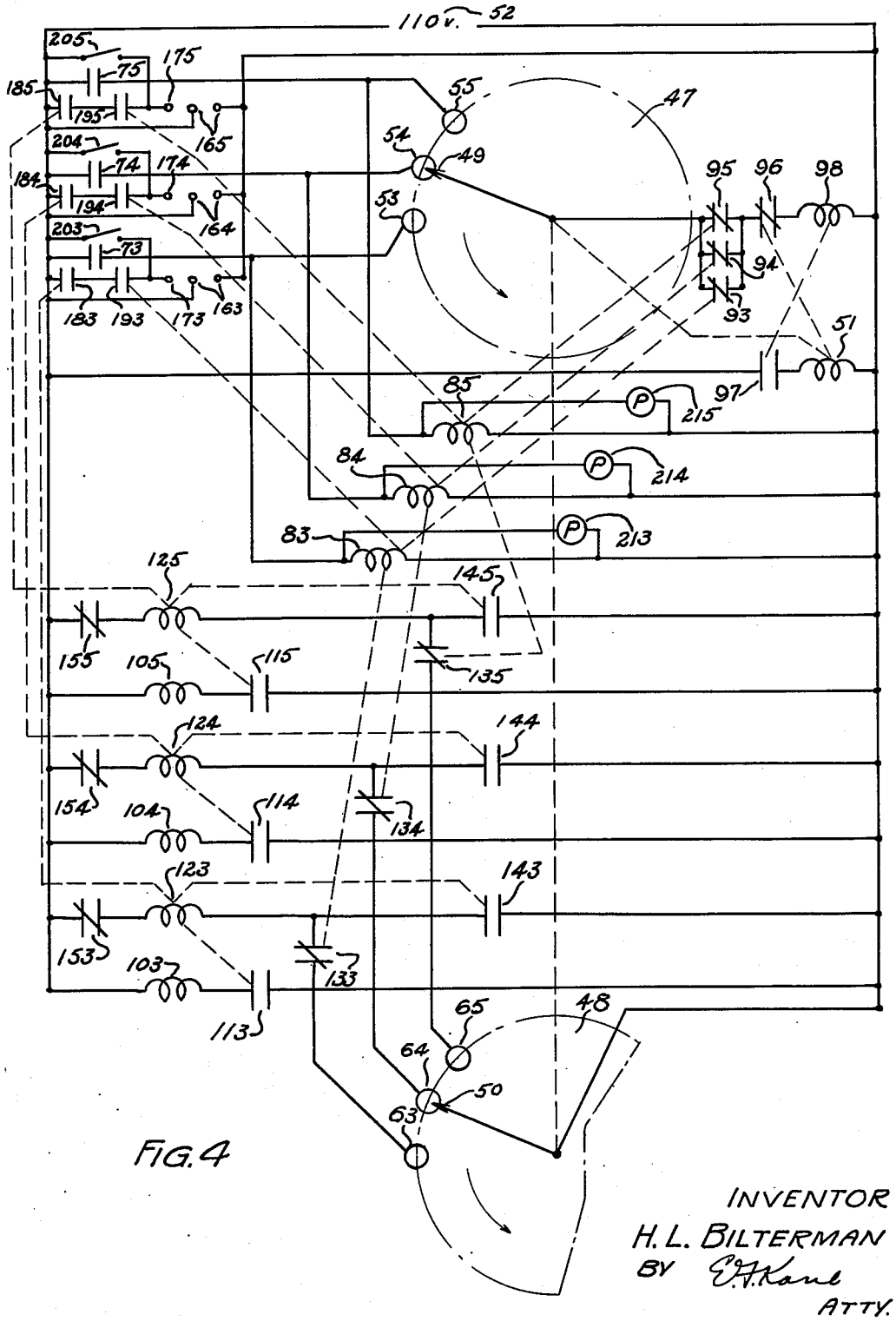


FIG. 4

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UNITED STATES PATENT OFFICE

2,614,707

CONVEYER APPARATUS

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Application March 23, 1950, Serial No. 151,497

7 Claims. (Cl. 214—17)

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This invention relates to conveyor apparatus and more particularly to apparatus for controlling the feeding of granular materials as needed to a plurality of receptacles.

In previous apparatus for controlling the feeding of granular materials, such as sand being fed to molders' hoppers in a foundry, the construction of the hoppers or receptacles with respect to the main supply conveyor has been such that an end receptacle was provided to receive all of the material which was not deflected into any of the preceding receptacles. Such an arrangement is, at times, undesirable since it is possible that the end receptacle may be filled to overflowing while some of the preceding receptacles still need sand, in which case any sand left on the main conveyor after the preceding receptacles have been supplied will be deposited in the end receptacle regardless of the fact that it is already full. This condition results in sand being wasted or spilled on the foundry floor.

It is an object of the present invention to provide a simple and efficient apparatus for maintaining predetermined quantities of granular materials at all times in a series of receptacles arranged along a main material supply conveyor.

In accordance with one embodiment of the invention as applied to a conveyor and distributing apparatus for automatically supplying and controlling the feeding of molding sand as needed to a series of molders' supply bins, there is provided a belt for carrying a supply of sand along the line of bins. Above each bin a movable plow is mounted which, while in an operative position adjacent the upper plane of the advancing belt, serves to deflect sand from the belt into the associated bin. Switch mechanisms sensitive to the pressure of the sand within the bins are so arranged in the bins that circuits are completed to maintain the plows in operative sand-deflecting positions until a predetermined amount of sand is deposited in each of the bins, whereupon the circuits are broken and, after a predetermined time interval, the plows are withdrawn from their operative positions.

This invention obviates the difficulty just described by providing a control circuit wherein the deflecting plows are maintained in their operative positions for a predetermined length of time after their respective pressure-sensitive switches have been actuated in order that the patch of sand between the operated plow and the next preceding operated plow may be deflected into the receptacle whose pressure responsive switch has been actuated. Such a system elimi-

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nates the necessity for an end receptacle to receive any sand left on the conveyor since in this arrangement no sand will remain on the conveyor after its course has run past the last receptacle provided with a deflector. A solenoid actuated stepping switch arrangement, consisting of two banks of stepping switch contacts, is provided to cooperate with the several bin control pressure responsive switch mechanisms and control the plow circuits so that the plows may be operated in sequential order. Furthermore, the circuits are so arranged that the stepping switch contacts, when connected to a pressure responsive switch indicating a full receptacle, are immediately moved to the contacts associated with the next preceding receptacle.

A more complete understanding of the invention may be had by reference to the following detailed description when considered in conjunction with the accompanying drawings, wherein

Fig. 1 is a fragmentary schematic side view of a sand conveying and distributing apparatus embodying the features of this invention and showing three intermediate units of the apparatus;

Fig. 2 is a plan view of one unit of the apparatus shown in Fig. 1;

Fig. 3 is an enlarged vertical sectional view of one of the pressure responsive switches taken along line 3—3 of Fig. 1; and

Fig. 4 is a circuit diagram showing the means for controlling the various units of the sand conveying and feeding apparatus and the operation of the entire apparatus.

Referring to the drawings, with particular reference to Figs. 1, 2 and 3, there is provided an endless conveyor in the form of a belt 10, on which granular material 11, such as sand in the present instance, has been deposited at its left end (Figs. 1 and 2) and is carried in the direction of the arrow 12. Sand is fed from opposite sides of the belt 10 into a series of spaced molders' supply bins supported below the belt.

Any desired number of receptacles or bins may be provided and, for purposes of illustration, three intermediate bins 13, 14 and 15 are shown in Fig. 1 and, for simplicity, the electrical circuit in Fig. 4 has been limited to the control circuits associated with the bins 13, 14 and 15. The belt 10 is driven by any suitable driving means, which is not shown, since it forms no material part of the invention and the belt 10 is supported throughout its course by a series of rollers 20. The bins, as shown in Fig. 2, extend beyond the opposite longitudinal edges of the belt 10 so that sand, when fed from such belt edges, will

drop into the bins during the advance of the belt in the direction of the arrow 12. At their lower ends, the bins are equipped with dispensing valves 21, which are manually controlled by molders stationed adjacent each bin to cause sand as needed to be supplied by gravity from the bins which, in the operation of the apparatus, are maintained with a predetermined quantity of sand supplied from the belt whenever the supply of sand in any bin falls below a certain level.

Arranged above the plane of the upper length of the belt 10, and in alignment with each of the bins, is a V-shaped plow 22 having its closed end facing in the direction opposite to the direction of movement of the belt and the sand carried thereon. Each plow 22 is provided with rearwardly extending spaced parallel arms 23—24 (Fig. 2) which are pivoted at 25—25 to vertical support bars 26—26, which may be secured to a framework 27 extending along the belt 10 adjacent the series of bins. The rollers 20 are rotatably supported upon the frame work 27 and the bins are suspended therefrom.

A counterweight 31 is adjustably mounted on each of the plow arms 23 and the counterweight serves to prevent the plow 22 from dropping suddenly when released from its inoperative position to its operative lower position, wherein it deflects sand from the belt 10 into the associated bin. Each of the plow arms 24 is connected to a piston rod 32 of an air cylinder 33, the supply of air under pressure to the cylinder to maintain the plow in its upper inoperative position being controlled by a solenoid operated air valve 34 having its inlet port connected by a conduit 35 to a main source of air under pressure (not shown). A conduit 36 connects the air cylinder 33 with the valve 34, which conduit supplies air to the cylinder through the valve and also serves as an exhaust conduit from the cylinder into the valve and through an exhaust conduit 37 of the latter to atmosphere. When the solenoid of the air valve 34 is energized, the supply of air under pressure to the cylinder 33 is cut off by the valve and the plow 22 falls by gravity under control of the counterweight 31. Upon deenergization of the solenoid of the air valve 34, the valve is actuated to cause air under pressure to flow and operate the piston in the cylinder 33, which moves down and by means of the piston rod 32 connected thereto, the plow is moved about its pivots 25—25 to its upper inoperative position, where it remains until the solenoid of the air valve 34 is again energized.

Each of the bins is provided with a pressure-sensitive switch mechanism 40, which is shown diagrammatically in Fig. 3. The switch mechanism 40 consists of a circular diaphragm 41 of suitable flexible material which is sealed and secured around an opening 42 provided in a vertical wall 43 of each bin at a certain predetermined level. The diaphragm 41, when the bin is empty or not filled to the desired level, will normally extend inwardly from the inner surface of the wall 43 as shown, but, when the bin is sufficiently filled with sand, the pressure of the sand against the diaphragm causes it to be deflected outwardly. Attached centrally to the outer face of the diaphragm 41 is a switch actuating member 44 arranged to make and break contact with a set of normally open contacts 45. A cup-shaped cover 46, attached to the outer face of the bin, serves to enclose the switch mechanism 40.

The circuit for controlling the apparatus of Figs. 1 and 2 is shown in Fig. 4 and will now be described with respect to the three intermediate bins 13, 14 and 15. It is to be understood, however, that the apparatus is applicable to any number of bins spaced consecutively along an endless conveyor belt, and the description is confined to the three intermediate bins for the purpose of simplicity. Furthermore, in all cases where switches, contacts, relays and timers are individually associated with each bin, such electrical mechanism will be assigned reference numerals ending in the same number as its particular bin.

Referring in particular to Fig. 4, the mechanism consists of a pair of stepping switches 47 and 48 having movable contacts 49 and 50, respectively, when contacts are movable angularly in tandem through single steps or increments by means of a stepping switch operating coil 51, which along with the rest of the circuit is energized from a voltage source 52. The stepping switch 47 has a number of fixed contacts 53, 54, 55 corresponding in number and sequence to the number of bins to be served, and the stepping switch 48 likewise has a set of fixed contacts 63, 64, 65. Each of the contacts 53, 54, 55 is connected to a set of the normally opened pressure responsive switch contacts shown in Fig. 3, and again for simplicity the particular contacts are redesignated 73, 74, 75. It is to be understood that each of the sets of contacts 73, 74, 75 are similar to the set of contacts 45 shown in Fig. 3 and each of the pressure-sensitive switch contacts 73, 74, 75 has one side thereof connected directly to one side of the voltage source 52. The other side of each of the pressure-responsive switch contacts, in addition to being connected to the fixed contacts 53, 54, 55 on the stepping switch 47, is also connected to one side of auxiliary relay operating coils 83, 84, 85, and the other side of the auxiliary relay operating coils 83, 84, 85 are connected to the other side of the voltage source 52. Thus it will be seen that any time that a bin has a sufficient supply of sand, its pressure-sensitive switch contacts are closed, thereby energizing its auxiliary relay operating coil. Each of the auxiliary relay operating coils 83, 84 and 85 seperately controls a first set of normally closed contacts 93, 94, 95, respectively, which latter contacts are connected in parallel, with the parallel connected contacts all being connected in series to the movable contact 49 on the stepping switch 47.

The movable contact 49 also has connected in series therewith, a pair of normally closed contacts 96, which are adapted to be opened by energization of the stepping switch operating coil 51. The stepping switch operating coil 51, which is connected directly across the voltage source 52, is energizable by closure of a set of normally opened contacts 97 connected in series with the operating coil 51. The set of contacts 97 are in turn closable by energization of a relay operating coil 98 which is also in series with the normally closed contacts 96, the parallel connected contacts 93, 94, 95 and the movable contact 49 on the stepping switch 47. Thus it will be seen that any time the movable contact 49 is in contact with one of the fixed contacts 53, 54, 55, associated with a closed pressure responsive switch contact 73, 74, 75, the relay operating coil 98 will be energized, thus closing its contacts 97 and causing the stepping switch operating coil 51 to be energized. Energization of the stepping switch operating coil 51 causes the stepping switches 47, 48 to be stepped in tendem to the next set of fixed contacts, and at the same time, breaks the

circuit to the relay operating coil 98 at contacts 96. This latter action results in the contacts 97 again opening, thus deenergizing the stepping switch operating coil 51 until such time as the relay operating coil 98 is again energized by virtue of the movable contact 49 being in contact with another fixed contact associated with a closed pressure-responsive switch contact.

It will be observed here, that one of the functions of the auxiliary relay operating coils 83, 84, 85, is to control the parallel connected contacts 93, 94, 95 in such a manner, that if at any time all of the pressure responsive switch contacts 73, 74, 75 indicate that all of the bins are supplied with sand, all of the contacts 93, 94, 95 will be opened thereby completely disabling the stepping mechanism.

The general function of the circuit described thus far in connection with the stepping switch 47, is to cause the stepping switches 47, 48 to step in an orderly fashion to continuously seek out an empty bin, and a further function is to disable the stepping mechanism completely whenever all of the bins are full.

That part of the circuit now to be described is primarily concerned with the actual raising and lowering of the plows 22, which are individual to the bins. As has been disclosed before, each of the plows 22 is provided with separate means for moving the plows into and out of operative or sand deflecting position and this mechanism consists of a solenoid operated air valve 34 associated with each plow. Each of the solenoid operated air valves 34 is provided with a separate actuating solenoid 103, 104, 105, and the function of the circuit now to be described is to insure that the solenoids 103, 104, 105 are energized and deenergized at the proper time. Each of the solenoids 103, 104, 105 is adapted to be energized by closure of a set of normally opened contacts 113, 114 and 115, which contacts are connected in series with the solenoids 103, 104, 105 directly across the voltage source 52. The contacts 113, 114, 115, are closable by energization of solenoid operating relays having operating coils 123, 124, 125. The operating coils 123, 124, 125 are connected through sets of normally closed contacts 133, 134, 135 to the fixed contacts 63, 64, 65 on the stepping switch 48, and the movable contact 50 on the stepping switch 48 is connected directly to one side of the voltage source 52. The normally closed contacts 133, 134, 135 are controlled by the auxiliary relay operating coils 83, 84, 85 in the stepping circuit, and it will be observed, therefore, that simultaneous stepping of the movable contacts 49 and 50 into contact with fixed stepping switch contacts associated with an open pressure-responsive switch will cause the associated operating coils 123, 124, 125 to be energized through the stepping switch 48, and therefore, a set of the contacts 113, 114, 115 to the associated solenoids 103, 104, 105 will be closed to cause the associated plow 22 to be lowered into position to deflect sand into the bin having the opened pressure-responsive contacts.

As has been explained previously, the belt 10 is being continuously supplied with sand. Since this condition prevails, it is necessary that steps be taken to insure that none of the sand reaches the end of the conveyor, since such would result in the sand being deposited on the foundry floor. The possibility of such an occurrence is eliminated by the use of a special locking and timing circuit which will be described hereinafter. Since the stepping switches are stepping in reverse order, or in other words, since the bins are being supplied in the order from the bin most remote from the sand supplying position at the beginning of the run of the belt 10 to the bin nearest the sand supplying position at the beginning of the run of the belt 10, it is necessary that each of the plows remain in material deflecting position for a length of time sufficient to insure that the patches of sand between the plow in deflecting position and the plow which is next moved into deflecting position, is actually removed from the belt before it reaches the end of its course. Since the operating coils 123, 124, 125 when energized cause the solenoids 103, 104, 105 to move their associated plows into deflecting position and hold them there, and since the operating coils 123, 124, 125 would otherwise be immediately deenergized by the closing of the associated pressure-responsive switch contacts 73, 74, 75 due to the immediate stepping of the stepping switches 47 and 48, a locking circuit is provided to maintain the operating coils 123, 124, 125 energized after stepping of the stepping switches, and this locking circuit consists of a set of normally opened contacts 143, 144, 145 under control of the operating coils 123, 124, 125 and connected in series therewith across the voltage supply 52. Thus, the operating coils 123, 124, 125 are not deenergized until a set of normally closed timer contacts 153, 154, 155 also connected in series with the operating coils 123, 124, 125 are opened and that part of the circuit now to be described has as its purpose, the provision of suitable time delay periods between the time of closing of a pressure sensitive switch and the time its associated plow is raised.

In order to provide for the proper time delay as described above, a series of timers having their energizing contacts 163—164—165 connected directly across the voltage supply 52 are provided. Thus the timers are always conditioned to perform a timing operation. The function of the timers is to cause the plow associated with each timer to remain in its downward or operative position for a length of time sufficient to remove all of the sand remaining on the belt after the associated pressure responsive switch is closed. In order to function in this manner, the timers are set for progressively shorter time intervals with the timer closest to the sand supply and of the conveyor being set for the shortest time interval. It is necessary that each timer be set to allow its associated plow to remove all of the sand remaining on the conveyor belt at the time of closing of its associated pressure responsive switch contacts, because it is possible that none of the other bins will need sand at this time. In other words, it is not sufficient that each timer be set to cause its plow to merely remove that portion of the sand remaining between its plow and the next succeeding plow, since it is possible that the succeeding plows will not be lowered due to a sufficient quantity of sand being present in their bins.

The timers are provided with actuating contacts 173—174—175, which latter contacts are adapted to be energized by either one of two alternate paths, and energization of the contacts 173—174—175 causes the timer to begin its timing operation at the end of which its contacts 153—154—155 are opened to cause deenergization of solenoid operating coils 123—124—125, which action breaks the locking circuit at contacts 143—144—145 and also breaks the circuit at 113—114—115 to solenoids 103—104—105, and thereby, causes the associated plow to be raised.

The paths through which the actuating contacts 173—174—175 on the timer may be energized, are connected in parallel and include a single path having the normally opened pressure-responsive switches 73—74—75 connected in series therewith, and another path having two sets of normally opened contacts 183—184—185 and 193—194—195 connected in series therewith. The set of normally opened contacts 183—184—185 are controlled by the solenoid operating coils 123—124—125, and the set of contacts 193—194—195 are controlled by the auxiliary relay operating coils 83—84—85. It will thus be observed that immediately upon energization of any one of the operating coils 123—124—125 and consequent lowering of its associated plow, the associated contacts 183—184—185 will also be closed to prepare a circuit to the actuating contacts 173—174—175 on the timers. Upon closure of the associated pressure-responsive switch 73—74—75, the timer is immediately actuated, and thus starts its timing cycle. At the same time, the auxiliary relay 83—84—85 associated therewith is energized, thus completing the circuit to the timer actuating contacts at contacts 193—194—195. This action not only assures continued energization of the actuating contact 173—174—175, but also locks the associated auxiliary relay 83—84—85 in its operated position. The timer, therefore, will continue its cycle until it has timed out, at which time, its contacts 153—154—155 open to cause the associated plow to be raised. It is necessary that the timer actuating contacts be connected through the contacts 183—184—185, 193—194—195 because if the timer actuating contacts were only connected to the pressure-responsive switches 73—74—75, it would be possible, in a case where an operator removed sand from a bin at the approximate time when the pressure-responsive contact associated with the bin was closed, for the timer to fail to operate through its complete cycle due to premature opening of the pressure-responsive contacts, in which case the plow would not be raised. It is to be noted that the timer is of the type wherein its contacts 153—154—155 are normally closed and remain normally closed until the timer actually times out, at which time the contacts open momentarily and the timer then resets automatically.

Under certain circumstances in the actual operation of foundries or the like, it is sometimes desirable to disable one or more of the molders' positions. In order to provide for such a contingency, each of the pressure-responsive switches 73—74—75 is provided with a shunting switch 203—204—205 which may be moved to its closed position and thus disable the associated bin. This action is accomplished by virtue of the fact that the movable stepping switch contact 49 momentarily connected to a closed shunting switch 203—204—205 will be immediately stepped to its next position.

Referring again to Fig. 1, it will be noted that the schematic diagram indicates the plows 22 associated with bins 14 and 15 being in their lowered positions. Such a condition prevails when the bin 15 has been provided with sufficient sand to cause its pressure-responsive switch to close, at which time the movable contact 49 is stepped to a position wherein it is associated with the pressure-responsive switch 74 associated with bin 14. In this case, bin 14 has also indicated a need for sand, and consequently, the plow 22 associated therewith has been lowered. Due to the timing circuit described hereinbefore, the plow 22 associated with bin 15 remains in its lowered position long enough to remove the sand remaining between bins 14 and 15 on the belt 10.

In a situation where all of the molders' bins have a sufficient supply of sand therein, it is obviously undesirable for sand to be moved along the conveyor since it would result in the sand being deposited on the foundry floor. Ordinarily, it is undesirable to stop the conveyor under such conditions, but instead, the sand normally being fed to the conveyor is deflected back into the sand preparing mechanism. In order to provide an operator with a warning system whereby he can cause the sand to be properly deflected from the conveyor, a group of pilot lights 213—214—215 are connected in shunt with the auxiliary operating coils 83—84—85. It will thus be obvious that if at any time all of the bins indicate that they have a sufficient supply of sand, all of the pilot lights 213—214—215 will be lighted, thus giving the operator a visual signal to stop the feeding of sand to the conveyor.

Throughout the description of the apparatus, such description has been confined to foundry operation and the supply of molding sand to operator's positions. It is obvious that the arrangement disclosed and described herein may also be used to advantage in the handling of many other types of granular materials, and the arrangement having been described in connection with a foundry purely for purposes of simplicity.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. In a system for handling granular material, an endless belt conveyor, a plurality of material receiving stations adjacent the conveyor, material deflecting means individual to each station movable into material deflecting position with respect to the conveyor to supply each station with material, material responsive switches individual to each station and closable in response to the presence of a predetermined amount of material thereat, a first and a second stepping switch connected in tandem and having a number of fixed contacts corresponding in number and sequence with said material responsive switches, means connecting each of said material responsive switches to its corresponding fixed contact on said first stepping switch, a movable contact on each stepping switch movable into contact with each of said fixed contacts in sequential order, a stepping switch actuating relay responsive to contact of the movable contact on said first stepping switch with a fixed contact associated with a closed material responsive switch to cause said stepping switches to be stepped one increment, solenoids individual to each of said deflecting means energizable to move the deflecting means into material deflecting position, solenoid actuating relays individual to each solenoid and having their operating coils connected to the individual fixed contacts on said second stepping switch, auxiliary relays individual to each material responsive switch and having their operating coils in parallel with the contacts on said first stepping switch, normally closed contacts on each auxiliary relay interposed in the circuit between its associated solenoid actuating relay operating coil and its

fixed contact on said second stepping switch, a locking circuit for each of said solenoid actuating relays in parallel with the contacts of said second stepping switch and said normally closed contacts on the auxiliary relays, a separate timer for each material deflector, said timers being operable under control of said material responsive switches, a pair of normally closed contacts on each timer interposed in its associated solenoid actuating relay circuit to cause its associated material deflector to be raised a predetermined time interval after energization of the timer, and an auxiliary circuit to each timer tending to maintain it energized until the solenoid actuating relay is deenergized.

2. Apparatus for handling granular material including a movable endless conveyor, a plurality of receiving stations adjacent said conveyor, material deflectors individual to each station for transferring material from the conveyor to the stations, power means to move the deflectors into and out of transferring position, material responsive switches at each station closable by presence of a predetermined amount of material at each station, a pair of stepping switches, means associated with the first of said stepping switches responsive to a closed material responsive switch momentarily connected thereto to cause said stepping switches to be stepped in tandem to their next position, means associated with the second of said stepping switches to move one of said deflectors into transferring position in response to an open material responsive switch in the circuit to the first stepping switch, and timing means to cause said deflectors to be held in material transferring position a predetermined length of time after closure of their associated material responsive switches.

3. In material handling apparatus including a conveyor and a plurality of material receiving stations adjacent thereto, the combination of material responsive switches at each station, material transferring means at each station for transferring material from the conveyor to the station, a first stepping switch having its contacts sequentially connected to the material responsive switches, individual means to move said material transfer means into position, a second stepping switch having its contacts sequentially connected to said individual means, means responsive to each closed material responsive switch to step said stepping switches in tandem to the next contact, means responsive to an open material responsive switch momentarily connected through said first stepping switch to actuate one of said individual means to move its associated transferring means into position, and individual timing means actuable upon closure of its material responsive switch to render its material responsive switch inoperative to remove its transferring means for a predetermined length of time after closure thereof.

4. In a system for handling granular material, the combination of a conveyor for supplying material, receptacles for receiving the material from the conveyor, individual deflectors associated with each receptacle for discharging the material from the conveyor into the receptacles, individual deflector actuating means for moving each deflector into and out of deflecting position, material responsive switches individual to each receptacle, a first and a second stepping switch each having a plurality of fixed contacts and a single movable contact, means connecting each material responsive switch to one of said fixed contacts on said first stepping switch, means for stepping said stepping switches in tandem, means responsive to movement of the first stepping switch movable contact into engagement with a fixed contact connected to a closed material responsive switch to actuate said stepping means through one increment, means responsive to movement of the first stepping switch movable contact into engagement with a fixed contact connected to an open material responsive switch to temporarily disable said stepping means, electromagnetic means to initiate actuation of the material deflector individual to the receptacle containing said open material responsive switch, said electromagnetic means being connected through the contacts on said second stepping switch, and timing means initiated by closure of each material responsive switch to delay removal of each material deflector from deflecting position for a predetermined length of time after closure of its associated material responsive switch.

5. Apparatus for conveying granular material to a plurality of consecutively arranged receiving stations comprising a conveyor having its course adjacent the stations, a separate material responsive switch associated with each receiving station, each of said switches being operable by depletion of the material in its associated receiving station, a separate material removing member associated with each receiving station and movable to a position to cause material to be removed from the conveyor into the associated receiving station, a first and a second stepping switch each having a plurality of contacts corresponding in number and sequence to the receiving stations, means for advancing said stepping switches in tandem, means connected through the contacts of said first stepping switch to cause advancement of said stepping switches in response to a closed material responsive switch momentarily associated therewith, means connected through said second stepping switch to cause the material removing member momentarily associated therewith to be moved into material removing position, and means responsive to each closed material responsive switch to disable the associated means for moving the material removing member into removing position.

6. In a system of the character described, the combination of an endless conveyor for supplying material, a plurality of receptacles for receiving the material from the conveyor, movably mounted deflectors for discharging material from the conveyor into the receptacles respectively, means for shifting the deflectors into and out of their operative positions controlled by the material in the receptacles respectively, a stepping switch rendering said shifting means operable in succession in response to absence of a predetermined amount of material in the instant receptacle, a second stepping switch, means associated with said second switch to step said switches in tandem to their next succeeding position in response to presence of a predetermined amount of material in the instant receptacle, and timing means to hold an operated deflector in its operative position for a predetermined length of time after said switches are stepped.

7. In a control circuit for controlling the feed of material to a plurality of receptacles positioned adjacent a travelling conveyor belt, the combination of a pressure sensitive switch in each of the receptacles, an auxiliary relay individual to each receptacle and having its coil in series with the pressure sensitive switch in each receptacle, a

solenoid operating relay individual to each auxiliary relay and adapted to be disabled by operation of its associated auxiliary relay, individual solenoids operable by each solenoid operating relay, a first stepping switch having its contacts connected sequentially to the operating coils of said solenoid operating relays, a second stepping switch, means associated with said second stepping switch to cause said stepping switches to be stepped in tandem through one increment in response to each closed pressure sensitive switch associated with said second stepping switch, and means individual to each of said solenoids and operable under the control thereof for directing material from the conveyor belt to its associated receptacle.

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No references cited.