May 12, 1953 R. L. MILLER 2,638,305

WEIGHT PROPORTIONING MEANS AND METHOD

Filed April 4, 1949 3 Sheets-Sheet 1

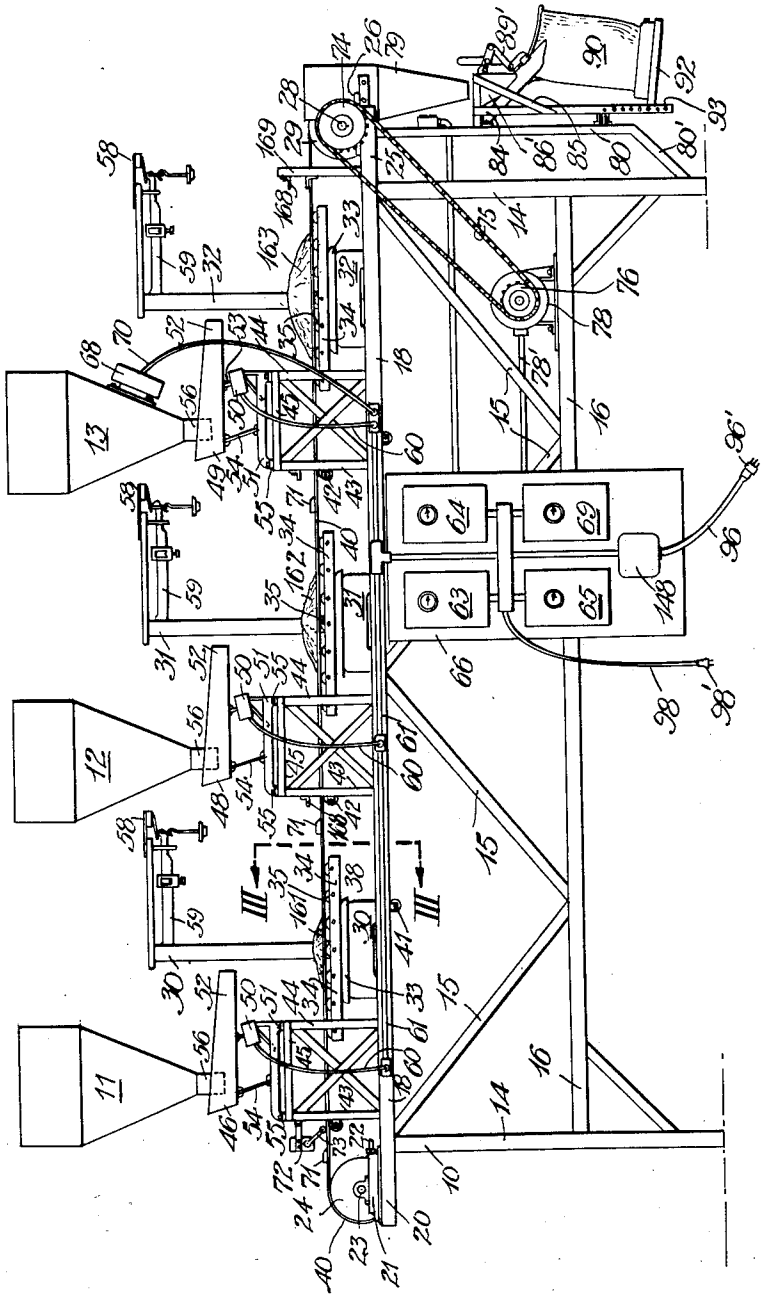


Fig. 1.

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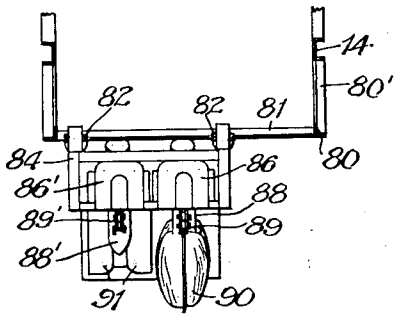


Fig. 4.

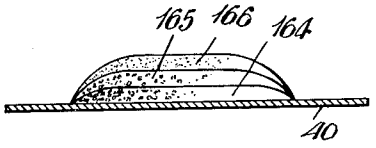


Fig. 5

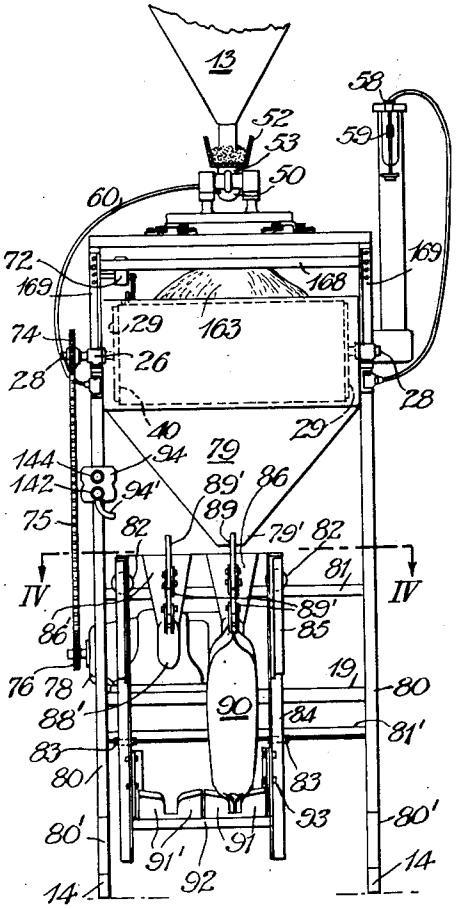


Fig. 2

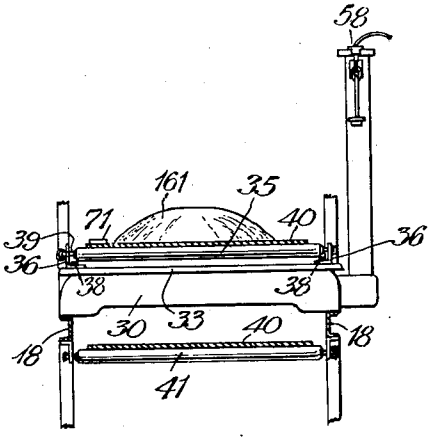


Fig. 3

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WEIGHT PROPORTIONING MEANS AND METHOD

Filed April 4, 1949 3 Sheets-Sheet 3

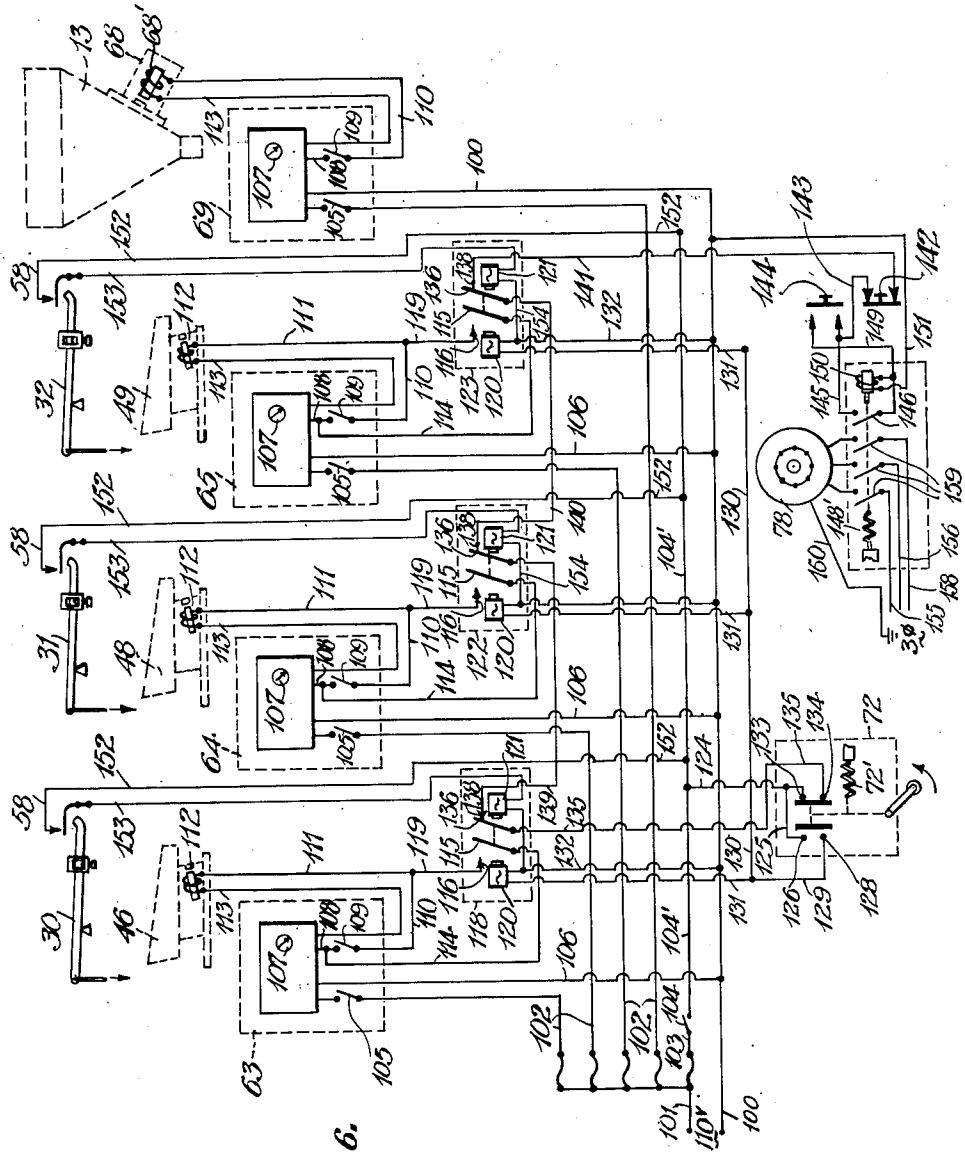


Fig. 6.

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UNITED STATES PATENT OFFICE

2,638,305

WEIGHT PROPORTIONING MEANS AND METHOD

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Application April 4, 1949, Serial No. 86,974

10 Claims. (Cl. 249—14)

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This invention relates to a method of and means for proportioning, blending and packaging to a desired weight a mixture of a plurality of dry materials having different particle sizes and particularly to such a method and means which will accomplish such objects rapidly and economically.

The packaging of many widely used mixtures requires the blending of a plurality of materials having particle sizes which may vary over a wide range. A common method of blending such a mixture is the batch process in which the individual materials are weighed separately and allowed to gather in a drum or other rotatable mixing device. In order to allow economical operation of such a batch process, it is necessary to place sufficient material in the rotating mixing chamber to fill a number of packages of the desired finished mixture from one loading of said chamber, since the time and labor involved in each loading prohibits the economical use of such a method should the mixer be loaded in single package lots.

However, any such batch process encounters the problem of segregation of the variously sized ingredients particularly where dry materials are being blended. It can be seen that it would not be possible to draw off uniformly composed single packages of a dry mixture from such a batch process since the larger particles would tend to leave the rotating chamber first and the finer particles tend to concentrate in the materials remaining behind in the chamber. Thus, in the case of a mixture such as dry concrete, where at least three separate ingredients are mixed, ranging in size from rock or gravel of about one inch diameter down to Portland cement passing through a 200 mesh screen, it can be seen that the problem of segregation would be present to a degree that would preclude the use of such a batch process where such a mixture is to be accurately packaged.

It is therefore a fundamental object of the invention herein disclosed to provide a means for the proportioning, blending and uniform packaging to weight of a mixture of several dry ingredients having widely different particle sizes wherein each such package of the mixture is of the same composition and weight.

In order to economically package a mixture of low cost ingredients in a package of relatively large weight, it is essential that the manual operations be kept to a minimum. This factor is particularly emphasized at the present time by the large and increasing costs of labor. A further advantage and object of the invention herein described, therefore, is the proportioning, blending and packaging to weight of a mixture in a fast and economical operation requiring a minimum of manual guidance.

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As mentioned above, in order to economically package a mixture of low cost ingredients, it is essential that manual operations be kept to a minimum. One such manual operation, which is desirable to eliminate, is that of closing the top of an open mouth bag by either sewing or tying in a suitable manner. A valve type bag eliminates this closing operation. Due to its construction, utilizing a tubular valve type bag can best be effected where the materials to be placed therein are directed into the valve opening in a steady stream flowing for a short time interval, said stream possessing appreciable velocity such as would result from the materials falling freely for a short distance before entering the valve tube.

Should the proportioning apparatus be of the type that discharges the total contents of the bag in a single mass, the result is that the valve opening of the bag is choked by the sudden rush of the mixture into the tube. The mass of material then accumulates in and above the valve tube and, since the material has lost its velocity by being halted momentarily in its passage to the bag, the mixture dribbles slowly through the tube into the bag. This slows down the filling of the bag and may prevent such filling without manual aid.

It is therefore a further object of this invention to provide a means for proportioning, blending and packaging a mixture of a plurality of materials in a valve type bag in a manner that will feed the mixture quickly into and through the tube of such a valve type bag without choking the tube. The invention therefore possesses the further advantage of eliminating the additional manual effort of closing the open mouth type bag by substituting therefor the quick closing valve type bag.

It is sometimes desirable, in the use of machines of this type, to move the machine, either to set it for drawing materials from other storage bins or to use the storage bins for other purposes. It is therefore a further advantage and object of the present invention to provide a portable unit which will accomplish all of the foregoing objects and advantages.

Obviously, there are some mixtures which may require a large number of separate ingredients in their formation and blending. In the past it

has been generally necessary to cluster all of the storage bins for the variously required materials around a centrally located proportioning and blending means. Due to this requirement, there has been a definite limit as to the number of storage bins of different materials and an associated limit upon their size. Conversely, due to the characteristics of this invention, it is an advantage and object to provide a method and means to accomplish all of the foregoing objects and advantages while at the same time being adaptable to the blending and proportioning of an infinite number of ingredients in a mixture by eliminating the need for clustering the various ingredients about such a centrally disposed mixing and blending means.

In the marketing of packaged mixtures, it is essential that every package be of identical composition and substantially the same weight. To ensure such identical composition, it is necessary that some means be employed to individually weigh all of the separate ingredients that go to make up the packaged mixture before said separate ingredients are blended and packaged. Accordingly, it is a further object of this invention to provide a means of individually weighing each ingredient of a mixture in conjunction with the blending and packaging thereof providing thereby identically composed packages of the said mixture in uniform weights.

Further objects are to provide a construction of maximum simplicity, economy and ease of assembly and disassembly and such further objects, advantages and capabilities as will later more fully appear and as are inherently possessed by the device and invention described.

The invention further resides in the combination, construction and arrangement illustrated in the accompanying drawings and while there is shown therein a preferred embodiment, it is to be understood that the same is capable of modification and change and comprehends other details, constructions, and uses without departing from the spirit of the invention or the scope of the appended claims.

The embodiment of the invention illustrated in the accompanying drawings and described herein is designed primarily for the proportioning, blending and packaging of dry mixtures containing cement but it is not intended to limit the use of the invention in any way by such illustration as it is believed that the same is adaptable to many other uses particularly to the proportioning, blending and packaging of any type of free flowing materials.

Referring now to the drawings:

Figure 1 is a side elevational view of the preferred form of the device of the present invention.

Figure 2 is an end elevational view, from the delivery end of said device.

Figure 3 is a fragmentary transverse sectional view taken on the line III—III of Figure 1 and looking in the direction of the arrows.

Figure 4 is a top plan view of the bagging section of the said device.

Figure 5 is an idealized diagrammatic section of the mounding of materials in layers on the belt.

Figure 6 is a schematic wiring diagram for the automatic operation of the device.

Referring now more particularly to the drawings forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same, hoppers 11, 12 and 13 are set to receive and contain three separate materials which are to be blended by the action of the device, assuming there are three ingredients to be weighed, mixed and packaged. Suitable means, not shown, are provided to secure the said hoppers 11, 12 and 13 in place above the device as shown, and other means, also not shown, are provided to provide and maintain a supply of material in these hoppers so as to insure a satisfactory flow of material to the machine at all times. The said hoppers 11, 12 and 13 are mounted along a single center line, and at the same level over the machine, generally designated as 10.

The frame 10 for the machine of the present invention as shown in the side view in Figure 1, consists of a rectangular box-like angle iron structure composed of legs 14 disposed at each corner thereof, and suitable diagonal braces 15. Identical side members 16 and 18, which are parallel to each other and to the floor level, cooperate with diagonal braces 15 to form a rigid trussed structure. The bottom chord members 16 form a motor support. Suitable cross members 19 connect and are perpendicular to these side members 16 and 18 for additional strengthening of the entire frame structure.

At the rear end 20 of upper members 18 there are mounted two identical adjustable bearing supports 21, one on either side and parallel to each other, the center lines of said supported bearings being adjustable by the set screws 22. Rotatably secured in said bearings 21 by axle 23 is a large belt pulley 24. At the front end 25 of said upper side members 18 a similar but non-adjustable set of bearings 26 are mounted on the upper side of said members 18, parallel to each other and with identical center lines perpendicular to said side members 18 and parallel to the center line of the rear pulley 24. On an axle 28 the head pulley 29, identical with pulley 24, is rotatably secured in said bearings 26.

Horizontally spaced between the opposing pulleys 24 and 29 on the upper side members 18 are three identical platform type scales 30, 31 and 32, the platforms 33 of which support a section 34 of free running parallel rollers 35. The top running surfaces of each of said rollers 35 and each of the sections 34 and the top of the running surfaces of the pulleys 24 and 29 are on a common horizontal plane parallel to the upper edge of the side members 18. The roller sections 34 are composed of opposing parallel angle iron side pieces 36 secured to the opposite sides of the scale platforms 33 in any suitable manner such as bolts 38 as shown in Figure 3. Spaced holes are cut in said side pieces 36 to accept and secure the axles 39 of each of the rollers. Said rollers 35 are identical in length to the large pulleys 24 and 29 in order to accommodate a common belt 40. This common belt 40 is a wide endless type and circulates about the two opposing pulleys 24 and 29 and over the top of rollers 35 on the scale platforms 33 returning beneath the structure, supported by suitable intermediate return rollers 41. Similar intermediate rollers 42 are secured to the side members 18 on vertical uprights 43 and are set so that their upper running surfaces are on the same plane as all other belt supporting surfaces. Uprights 43 extend upwardly and cooperate with identical uprights 44 parallel thereto and spaced therefrom to form the support for the rectangular frames 45 establishing a bridging member over the belt 40. Each of these frames 45 is spaced equally from one an-

other above the side members 18. Secured upon each of these bridges 45 over the exact center of the belt 40 are standard magnetic vibratory feeders 46, 48 and 49, respectively. These feeders 46, 48 and 49 are powered by individual electro-magnets 50 mounted on a base 51 beneath the trough 52. A leaf spring link 53 runs between said magnet 50 and the forward end of said trough 52 for transmitting the vibratory force thereto. The opposite or rear end of the trough 52 is supported by another leaf spring 54 on the base 51. This base 51 is provided with front and rear mounting brackets 55 for securement and support of said feeder on bridge 45.

The hoppers 11, 12 and 13 respectively are so placed with respect to the feeders 46, 48 and 49 that the discharge openings 56 of each of said hoppers is positioned within the rear closed end of the trough 52 above the floor level thereof. This arrangement of the discharge openings 56 within the troughs 52 is such that the material within said openings 56 chokes any flow therefrom by building up a small pile from the floor of the trough 52 under said openings 56. Differential vibration of the trough 52 by means of rectified power acting upon the electro-magnet 50 causes the material within the trough to flow forward and pour from the open end thereof. Such vibration immediately dissipates the small pile of choking material under the openings 56 thereby allowing said openings 56 to admit material to the trough 52 at a rate of flow which is automatically set by the movement of material along said trough 52 by said differential vibration.

Each of the scales 30, 31 and 32 is equipped with a micro switch 58 whose contacts are closed by the movement of the beam 59 of said scale when said beam is brought to balance position. The scales 30, 31 and 32 are positioned so that the discharge from each of the feeders 46, 48 and 49 is deposited in the exact center of the roller sections 34 which are supported by said scales. In this manner the discharge of feeder 46 is deposited and weighed by scale 30, the discharge from feeder 48 by scale 31 and the discharge from feeder 49 by scale 32.

Each of the feeders 46, 48 and 49 is powered thru an individual cable 60 which connects with a common rigid conduit 61 attached to side member 18 and which carries electrical leads from the rectifier panels 63, 64 and 65 which are supported on a panel board 66. A magnetic type vibrator 68 is located upon the side near the lower end of hopper 13, which for the purposes of this description contains cement, in order to vibrate the material within the hopper and thus maintain it in a free flowing state. This vibrator 68 is also connected to the rigid conduit 61 by a cable 70 and is supplied with power by rectifier unit 69.

The length of belt 40 and consequently the length of the entire machine 10 is based and is dependent upon the distance between the various feeders 46, 48 and 49. Said belt 40 is divided into segments each equal to the distance between feeders by spacing blocks 71 which are mounted on the upper surface of said belt 40 near one edge. These blocks 71 are set to cooperate with and engage the limit switch 72 which is secured on the rearmost upright 43 in a position so that its actuating lever 73 will be operated by the passage of said block 71 beneath it.

The head pulley 29 is directly connected through its axle 28 with a sprocket 74 and said sprocket is driven by means of a chain 75 cooperating with a drive sprocket 76 secured to the shaft of a motor 78. Due to the nature of the duty cycle imposed upon it, the motor 78 must be of the three phase type and it is mounted, as previously mentioned, on lower chord members 16.

At the front or discharge end 25 of the machine 10, a collecting hopper 79 is secured to the side members 18 in such a position that all material carried on the belt 40 over the pulley 29 is deposited in said hopper 79. In position below the discharge end of the hopper 79 two uprights 80 are secured on the front legs 14 by the brackets 80' and on the forward end 25 of the members 18. As shown in Figure 2, these uprights 80 support two horizontal rails 81 and 81' parallel to each other and lying in a plane perpendicular to the line of travel of the belt 40. Hung from vertical wheels 82 engaging upper rail 81 and from horizontal thrust wheels 83 engaging rail 81' is the bag support carriage 84. The bag support carriage 84 is a rectangular angle iron frame with right angle brackets 85 at the upper end thereof supporting the deflecting hoppers 86 and 86'. The deflecting hoppers 86 and 86' are inset into inclined tubular bag filling spouts 88 and 88' possessing conventional lever operated bag clamps 89 and 89'.

The bag filling spouts 88 and 88' are formed to accept the sleeve of a conventional valve type paper bag 90 of the tuck-in sleeve style so that the clamps 89 and 89' may secure such a bag thereon by clamping said sleeve against the spout 88. The lower end of the bag 90 rests upon a supporting shoe 91 which is directly under the spout 88. A similar shoe 91' is located directly beneath spout 88' on the common frame 92 which is vertically adjustable by means of the cooperating bolts and holes 93 in the lower end of the carriage 84. It is therefore possible to shift the carriage 84 horizontally beneath the hopper 79 so that either of the deflecting hoppers 86 or 86' is directly beneath the discharge opening 79' of said collecting hopper 79. This bottom discharge opening 79' is formed to an open cross sectional area of a size to prevent the discharge of material therefrom at a rate and volume such as would clog the narrow spouts 88 and 88'.

Conveniently located to the side of the carriage 84 on the leg 14 is a push button box 94 appropriately connected to the control panel board 66 by conduit 94'. The motor 78 is also appropriately connected by conduit 78' with the motor starter 148 also located on the control panel board 66. Power cable 96 which supplies the three phase electrical power to the motor starter 148 is equipped with a conventional plug-in type connector 96'. The cable 98 supplies 110 volt current to the device and is also equipped with a suitable plug-in type connecter 98'. It is to be noted that the plug-in type connectors facilitate movement of the device 10 as a portable unit of equipment.

The electrical system shown in Figure 6 in detail utilizes a common neutral wire 100. Electrical power for each of the half-wave rectifier units 63, 64, 65 and 69 is supplied by separately fused taps off power source 101 so that the identical leads 102 supply each rectifier. The fifth tap 103 off power source 101 supplies power for the control circuit and possesses a manual switch 104 for disconnection. In addition, each of the wires 102 possesses an identical manual switch 105 permitting individual control of the rectifier power.

Each of the three rectifiers 63, 64 and 65 are electrically connected to their respective feeders

46, 48 and 49 in exactly the same manner and this circuit will therefore be covered by the single description of the connection of rectifier 63 and the corresponding feeder 46. As mentioned previously, power is conducted from main lead 101 through lead 102 across manual line switch 105 to rectifier 63. This circuit is completed to the common neutral wire 100 through lead 106. Wire 108 conducts rectified power from rectifier 63 through switch 109 into wire 110 thence through wire 111 into the electro-magnet 112 of feeder 46. This circuit is completed back to rectifier 63 through wire 113.

The manual load switch 109 is by-passed by another circuit which starts from the rectifier at wire 108 passing through wire 114 to the movable contact arm 115 of a mechanical locking electrically reset relay 118. The other side 116 of the movable contact arm 115 is connected through the line 119 to the wire 111 loading to the feeder 46. This movable contact arm 115 is operated by the energization of the coils 120 and 121 of the relay 118 by the actuation of the control circuit described below. Each of the other rectifiers 64 and 65 is connected exactly as is rectifier 63 with their respective feeders 48 and 49. In this manner the circuit between rectifier 63 and feeder 46 is completed by the energization of coil 120 in relay 118 pulling movable contact arm 115 into contact with point 116. Similarly, relay 122 completes the circuit between rectifier 64 and feeder 48 and relay 123 completes the circuit between rectifier 65 and feeder 49.

The hopper vibrator 68 is energized by rectifier 69 which is identical with the other rectifiers 63, 64 and 65. Rectifier 69 draws current through power lead 102 from line 101 across line switch 105 and completes its circuit through the common neutral wire 100. Rectified power is drawn from rectifier 69 to the hopper vibrator 68 through wire 108 across load switch 109, thence through line 110 into the hopper vibrator electro-magnet 68', completing the circuit through line 113.

The rectifiers 63, 64, 65 and 69 are adjustable in direct current output by rheostats 107 connected therein in a conventional manner. It is therefore possible to control the amplitude of vibration of each of the electro-magnets 112 in the feeders 46, 48 and 49 and the electro-magnet 68' in the hopper vibrator 68. Thus, individual control of the rate of flow of material in each of the feeders 63, 64 and 65 and of the intensity of vibration of hopper 11 is achieved by adjusting said rheostats 107. As is well known to one skilled in the art, the rate of flow of a given material along a differentially vibrating trough 52 depends upon the amplitude of vibration of said trough when the feed conditions into said trough are held constant. By experimenting with the rate of flow of the various ingredients of the mixture involved, it is possible, therefore, to set the direct current output of each of the rectifiers so that the feeders will each supply a preselected amount of said ingredients in approximately the same length of time.

Coils 120 of the relays 118, 122 and 123 receive their power from the control power wire 104' in the following manner. Line 124 draws power from line 104' through jumper 125 to contact 126 of one side of the double pole double throw limit switch 72. The other contact 128 is connected by line 129 to the common lead 130. Coils 120 in each of the relays 118, 122 and 123 draw their power through leads 131 from the common wire 130 and the circuits through coils 120 are completed to common neutral wire 100 through leads 132. In this manner, closing of the contacts 126 and 128 simultaneously energizes each of the coils 120.

Wire 124 also supplies the power for the motor starting control circuit by conducting power from line 104' to contact 133 on the second side of the limit switch 72. This limit switch 72 is maintained normally with contacts 133 and 134 closed by the tension of spring return 72'. From contact 134 through wire 135, control power is conducted to movable contact 136 in relay 118. Opposing stationary contact 138 is connected by line 139 with movable contact 136 in relay 122 and opposing stationary contact 138 in relay 122 is connected by line 140 with movable contact 136 in relay 123. Opposing stationary contact 138 in relay 123 is connected by line 141 with one side of normally closed pushbutton 142. The other side of this pushbutton 142 is connected by jumper 143 with one side of normally open pushbutton 144 and also by line 145 with one side of the sealing switch 146 in magnetic motor starter 148. The other side of sealing switch 146 is connected with the opposite side of normally open pushbutton 144 by line 149. The circuit is completed to common neutral wire 100 through solenoid 150, which actuates the magnetic motor starter 148, through the wire 151. It should be noted that the contacts 136 and 138 in each of the relays 118, 122, and 123 are wired in series with one another and also in series with the normally open motor starting pushbutton 144.

Coils 121 of each of the relays 118, 122 and 123 draw power from line 104' through wires 152 across micro switch 58 on each of the scales 30, 31 and 32 and through line 153 into said coils 121 completing their circuits to the common neutral wire through lines 154 and 132.

The three phase motor 78 is energized along power wires 155, 156 and 158 through the contactors 159 of the magnetic starter 148 and is grounded through the line 160. Magnetic starter 148 is maintained in an open position by the tension of spring 148' when the solenoid 150 is not energized.

Prior to operation of the device, the balance arm of each of the scales 30, 31 and 32 is preset. For example, in the manufacture of a dry concrete where a bagged mixture containing 30 pounds of sand, 45 pounds of coarse aggregate and 15 pounds of Portland cement is desired, the scales are set as follows:

Scale 30 is set to come into balance and close micro switch 58 when a total weight of 30 pounds plus the constant tare weight of the roller section 34 and the portion of the belt 40 supported thereby are imposed upon it. Similarly, scale 31 is set to come into balance and close its respective micro switch 58 when a total weight of 75 pounds plus the constant tare weight of its roller section 34 and the portion of the belt 40 supported thereby are imposed upon it. As described later, this 75 pounds is made up of a layer of 30 pounds of sand and a layer of 45 pounds of coarse aggregate. Scale 32 is set to come into balance and close its respective micro switch 58 when a total weight of 90 pounds plus the constant tare weight of the roller section 34 and the portion of the belt 40 supported thereby are imposed upon it. This 90 pounds, as described later, is made up of a layer of 30 pounds of sand, a layer of 45 pounds of coarse aggregate and a layer of 15 pounds of cement.

For the purpose of this operational descrip-

tion, we will assume that the machine has been in operation and that each of the scales 30, 31 and 32 is appropriately weighted with material as described above. In this position, each of the micro switches 58 is closed.

Each of the hoppers 11, 12 and 13 is filled with its respective material, i. e. sand; coarse aggregate and cement. The line switches 105 of each of the rectifiers 63, 64, 65 and 69 are closed and the rectifying units allowed to warm up. Load switches 109 on the feeder rectifier units 63, 64 and 65 are only used when it is desired to operate one of the feeders manually. Line switch 104 is closed to admit power to the control circuit. Load switch 109 in rectifier 69 is closed to actuate vibrator 68 which is mounted on the side of hopper 13.

A bag 99 is clamped in filling position on the spout 88 and the carriage 84 is positioned under the collecting hopper 79 so as to receive its discharge in deflecting hopper 86.

Since the three micro switches 58 are closed on each of the scales 30, 31 and 32, the reset coils 121 in each of the relays 118, 122 and 123 is energized by power flowing from line 104' through lines 152 across micro switches 58 through lines 153 into coils 121 and back to neutral line 100 through leads 154 and leads 132.

The device is now ready for production operation and the operator presses the pushbutton 144. Closing of this pushbutton 144 allows current to flow from power line 104' through line 124, across contacts 133 and 134, through line 135, across closed contacts 136 and 138 in relay 118. From contact 138 in relay 118, the current flows through line 139 across closed contacts 136 and 138 in relay 122, thence by line 140 to closed contacts 136 and 138 in relay 123 and through line 141 to normally closed pushbutton 142. Since pushbutton 142 is normally closed, the current flows across it into line 143, thence through pushbutton 144, momentarily manually closed by the operator, through line 149 into solenoid 150. The solenoid 150 is energized and this circuit is completed to the common neutral line 100 by going through line 151.

The energization of solenoid 150 against the spring 148' acts to simultaneously close contactors 159 and sealing switch 146 in the magnetic motor starter 148. Three phase current then flows through the lines 155, 156 and 158 across contactors 159 into motor 78 starting said motor. Even though the pushbutton 144 is only momentarily depressed by the action of the operator, sealing switch 146 allows solenoid 150 to remain energized by current flowing through line 145. As the motor 78 is now running, the belt 40 is moved by the action of the driving sprocket 76, the chain 75, the driven sprocket 74 and thence through pulley 29 to the belt 40. Motion of the belt 40 carries the three piles of material 161, 162 and 163 forward.

Forward movement of the piles 161, 162 and 163 from above the scale platforms 33 unbalances the scales 30, 31 and 32, the beams 59 drop down, allowing the micro switches 58 to open and thus de-energizing the reset coils 121. Belt 40 continues to move under the power of the motor 78 until a belt spacing block 71 momentarily actuates the limit switch 72 against the tension of the spring return 72'. Actuation of the limit switch 72 opens the circuit established across the contacts 133 and 134 by the original pressing of the pushbutton 144, thus de-energizing the solenoid 150 and allowing the spring return 148' to open the magnetic motor starter 148 which stops the motor 78. Stopping of the motor 78 stops the motion of the belt 40. Since the spacing blocks 71 mounted on the belt 40 are spaced the same distance apart as are the feeders 46, 48 and 49, the belt 40 has moved a distance equal to the spacing between the feeders 46, 48 and 49 and consequently the rearward two piles of material 161 and 162 have advanced to new positions under the front two feeders 48 and 49 and the front pile 163 is carried over the head pulley 29 and falls into the collecting hopper 79.

The actuation of the limit switch 72 momentarily completes a circuit across the contacts 126 and 128, allowing current to flow from power line 104' through line 124, through jumper 125 across contacts 126 and 128, through common line 130 and lines 131 into coils 120 of relays 118, 122 and 123, thence through lines 132 to neutral line 100 completing the circuit and energizing the coils 120. The momentary energization of coils 120 draws the movable contacts 115 to the contacts 116 and completes the by-pass load circuits to the feeders 46, 48 and 49.

As mentioned previously, the operator has closed the line switches 105 on each of the rectifiers and current flows from lines 102 across the line switches 105 into the rectifiers and returns to the common neutral wire 100 through the lines 106. By establishing the by-pass load circuit by the closing of contacts 115 and 116, direct rectified power flows from rectifiers 63, 64 and 65 through the lines 108 and 114 across contacts 115 and 116, through lines 119 and 111 into coils 112 of each of the feeders 46, 48 and 49 and returns to the rectifiers through lines 113. Thus, all three feeders are simultaneously energized and the materials begin to flow therefrom and deposit upon the belt 40 at the several weigh points. Since relays 118, 122 and 123 are of the mechanical locking, electrically reset type, even though the energizing of the coils 120 is but momentary, the circuits closed across contacts 115 and 116 remain established until the reset coils 121 are re-energized by the closing of the micro switches 58, as will be described later. The feeders continue to deposit material upon the belt 40 beneath them until the weights registered upon the scales 30, 31 and 32 reach the preset limits and the scale beams 59 rise to balance position, thereby closing micro switches 58. The closing of micro switches 58 results in the energization of reset coils 121 which swing the movable contact arms breaking the circuit across points 115 and 116, thus shutting off the feeders 46, 48 and 49, and establishing the circuit across points 136 and 138. While all feeders are energized simultaneously, it should be noted that they will shut off individually depending upon the rate of deposition of material upon their individual scales 30, 31 and 32. An attempt is made to roughly adjust the rates of flow from all feeders by varying the setting of the rheostats 107 so that the desired weights of materials will be deposited in approximately the same time interval upon all scales.

The operator having pressed the pushbutton 144 has caused the belt 40 to move forward into the next loading position which results in the front pile 163 being carried over the head pulley 29 and into the collecting hopper 79.

As shown in Figure 5, since the deposited front pile 163 consists of a primary layer 164 of sand

deposited upon the belt 40 by the feeder 46, a secondary layer 165 of coarse aggregates deposited upon the sand layer 164 by the feeder 48 and a third layer 166 of cement laid on top of the secondary layer 165 of coarse aggregates by the feeder 49, and since the falling of this pile 163 through the collecting hopper 79 has a commingling action, the resulting mixture which flows through the deflecting hopper 86 and is directed into the bag 90 through the spout 88 is of a generally blended and uniform cross sectional composition. This layered deposition eliminates the necessity of using the familiar baffle method of blending in a collecting hopper.

It is to be noted that this method of depositing the ingredients upon the belt 40 in successive layers, as illustrated in Figure 5 and as described, may be further refined to assure even more uniform cross sectional composition by the addition of horizontally spaced spreading and leveling bars 168, as shown in Figure 2. These bars 168 are vertically adjustable on uprights 169 and secured parallel to the upper surface of the belt 40. In this manner, each pile 161, 162 and 163 is leveled by a blading action of the bars 168 as the pile is carried forward to its new position. Thus the final three layered pile 163 which is carried over the head pulley 29, consists of individual layers of the same general area, but differing in thickness.

While the pile 163 is being deposited in the bag 90, which is clamped on the spout 88, the operator slides the valve opening of an empty bag over the spout 88' and clamps it in place by the clamp 89'. As soon as the bag 90 has received the total contents of the hopper 79, the operator unloosens the clamp 89 and removes the bag 90 from the spout 88 and horizontally shifts the carriage 84 to the other filling position, wherein the deflecting hopper 86' is directly under the discharge opening 79' of the hopper 79. The operator then presses the pushbutton 144 again, which initiates another cycle as described above.

It is to be noted that should the operator attempt to press said button 144 prior to the time when each of the feeders 46, 48 and 49 has deposited the desired preset weight of ingredient upon the belt 40 to bring each scale 30, 31 and 32 into balance, the series connection of contacts 136 and 138 between the relays 118, 122 and 123 and said pushbutton 144 prevents such premature pressure of the pushbutton 144 from completing the starting circuit and operating the motor 78 starting movement of the belt 40.

I claim:

1. The method of combining, prior to mixing, a plurality of dry ingredients having different particle sizes to form a mixture having a predetermined composition by weight which includes the step of providing equally spaced separate weighing and loading stations for the delivery of each ingredient, the step of controlling the deposit of each such ingredient onto an intermittently movable endless belt by weighing through the belt while the belt is at rest at such stations, and moving the said belt to the next weighing and loading station as soon as the cumulative weights of the said layers of ingredients presently and previously deposited on the said belt have attained predetermined values.

2. The method of proportioning and packaging mixtures of dry ingredients which comprises depositing a predetermined weight of each of a plurality of different ingredients in layers onto an intermittently movable belt while the belt is at rest, intermittently moving the said belt between predetermined loading and weighing stations to form in stages layered mounds of substantially uniform weight and composition for each state, blending and mixing each completed layer mound by successively discharging it into a collector at the discharge end of the conveyor belt, and feeding the said blended ingredients in the said collector into a sack container before the next mound of material is discharged into said collector.

3. The method of proportioning and packaging mixtures of dry ingredients which comprises depositing a predetermined weight of each of a plurality of ingredients having different particle sizes, in layers onto an intermittently movable conveyor belt while the said belt is at rest, intermittently moving the said belt between predetermined loading and weighing stations for accumulating by successively deposited increments layered mounds of predetermined weights and substantially uniform composition, mixing and blending said ingredients by successively depositing each completed layered mound into a collector at the delivery end of the conveyor belt, and completely discharging each such blended ingredients thus deposited into the said collector into removable containers before the next completed mound is deposited in said collector.

4. The method of mounding and packaging a plurality of dry materials of different particle sizes which comprises depositing a predetermined weight of each of the said materials in mounds of successive layer onto an intermittently movable conveyor belt, periodically moving the said belt between substantially equidistantly spaced loading stations for accumulating on the said belt predetermined weights of the materials comprising the said layered mounds, intermittently blending each of the completed layered mounds of material during delivery into a collector, and discharging all materials in each mound thus deposited into the said collector into a removable container before the next such completed and blended mound is deposited in said collector.

5. The method of continuously forming uniformly composed mounds of a plurality of weighed dry ingredients with each ingredient in a separate layer, which comprises the steps of successively depositing increments of predetermined weight of each ingredient on an intermittently movable endless belt conveyor, said depositions being made at substantially equidistant spaced loading and weighing stations along said conveyor, automatically controlling the feed of each ingredient deposited at its station by weighing through the belt of said conveyor at each station, and moving said conveyor to the next station upon completion of the said deposition, until each successive mound has received its proper weight of all ingredients in successive layers.

6. The method of continuously forming uniformly composed mounds of a plurality of dry weighed ingredients with each ingredient in a separate layer which comprises the steps of successively depositing increments of predetermined weight of each ingredient on an intermittently movable endless belt conveyor, said depositions being made at substantially equidistant spaced loading and weighing stations along said conveyor, automatically controlling the weight of each ingredient deposited at its station by weighing through the belt of said conveyor, moving said conveyor to the next station upon comple-

tion of the said deposition, until each successive mound has received its proper weight of all ingredients, blending the ingredients of each mound, separately and during delivery from the delivery end of said conveyor to a collector and packaging each completed and blended mound delivered to said collector.

7. Gravimetric loading apparatus of the character described comprising a conveyor mounted for movement to and beyond a loading station, a feeder at said station for feeding dry material to said conveyor, means for operating the conveyor, means for operating the feeder, means for controlling said conveyor and feeder-operating means to move the conveyor to said station, halt the conveyor, operate the feeder to feed material to the stationary conveyor, and weight responsive means immediately below said feeder and conveyor to halt operation of the feeder when a predetermined weight of material has been fed to the conveyor.

8. Gravimetric loading apparatus of the character described comprising a conveyor mounted for intermittent movement to and past a plurality of spaced feeding stations, a feeder at each station for feeding dry material to said conveyor, means for operating the conveyor, means for operating each feeder, and means for controlling said conveyor and feeder-operating means to move the conveyor in increments each equal to the spacing between stations, to halt the conveyor at the end of each increment of movement, to operate each feeder to feed material to the conveyor during each interval between movements thereof, and weight responsive means immediately below said feeder and conveyor to halt operation of each feeder when a predetermined weight of material has been fed to the conveyor.

9. Gravimetric loading apparatus of the character described comprising an endless conveyor; a plurality of feeders located at an equal number of feeding stations spaced at equal intervals along said conveyor, an electric motor for operating said conveyor, electrically operated means for independently operating each feeder, a motor circuit including manually operable means for closing the same; a feeder circuit for each feeder, means operated by the conveyor for automatically opening the motor circuit and closing the feeder circuits when the conveyor has travelled a distance equal to the spacing between stations, and weighing means responsive to the weight load for each feeding station for opening the feeder circuit thereof when a predetermined weight of material has been loaded at said station.

10. A gravimetric loading apparatus comprising a conveyor mounted for movement along a predetermined path, a plurality of shaker-type feeders located along said path at an equal number of feeding stations, electrically operated shaker means for shaking each feeder, a motor for operating said conveyor; a motor circuit, a feeder circuit for each feeder, means including a normally open switch and a relay for closing the motor circuit and for maintaining it in closed condition, switch means operated by the conveyor for opening the motor circuit when the conveyor has moved a distance equal to the spacing between feeding stations, means also actuated by the conveyor for closing each feeder circuit when the motor circuit is opened and for maintaining said feeder circuit in closed condition, weighing means for weighing the load on the conveyor at each feeding station, and means operated by each said weighing means for opening its feeder circuit when a predetermined weight of material has been fed to the conveyor at said station.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
Re. 21,169	McCreery	Aug. 1, 1939
719,923	West	Feb. 3, 1903
924,191	Scales	June 8, 1909
924,940	Rough	June 15, 1909
1,080,236	Saylor	Dec. 2, 1913
1,203,285	Webber	Oct. 31, 1916
1,300,274	Jeffries	Apr. 15, 1919
1,724,403	Hutchinson	Aug. 13, 1929
2,007,874	Redler	July 9, 1935
2,198,788	Popov	Apr. 30, 1940
2,285,765	Carswell	June 9, 1942
2,549,704	Noble	Apr. 17, 1951

FOREIGN PATENTS

Number	Country	Date
434,501	Great Britain	of 1935
529,272	Great Britain	Nov. 18, 1940
566,651	Germany	Dec. 20, 1932