

May 12, 1936.

H. S. LENHART  
FEEDING AND BATCHING APPARATUS  
Filed May 14, 1935

2,040,660

3 Sheets-Sheet 1

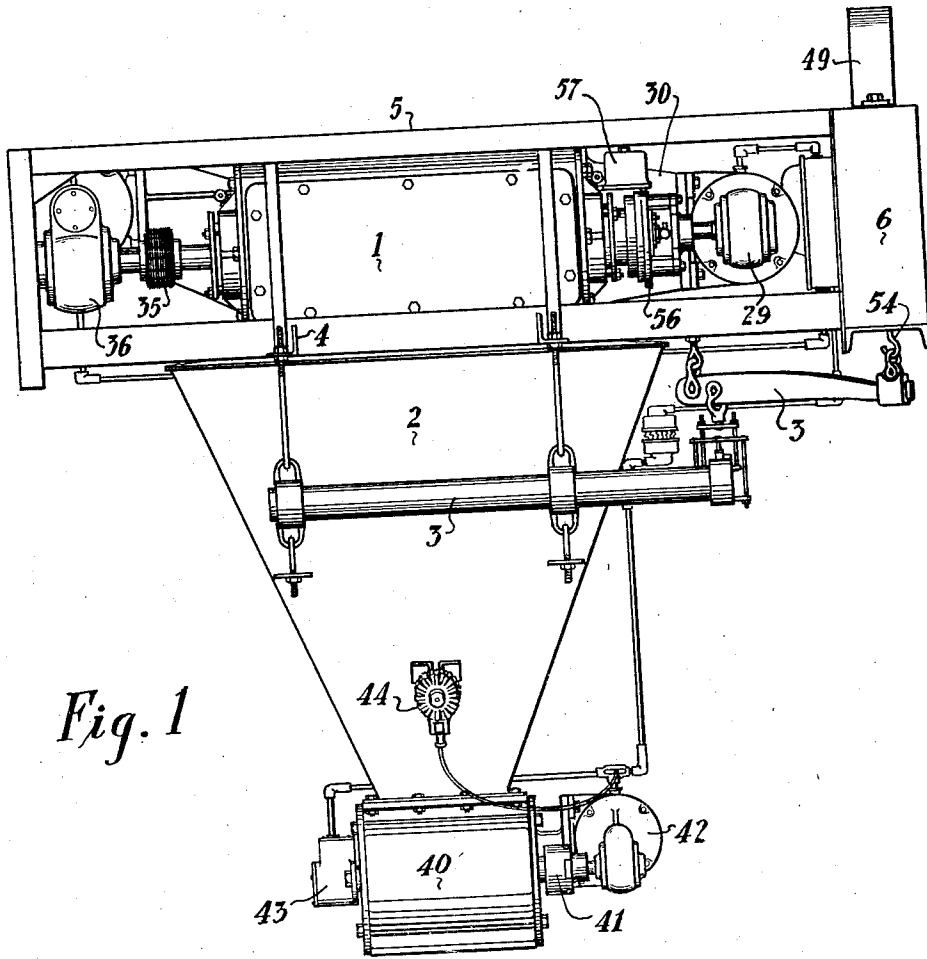


Fig. 1

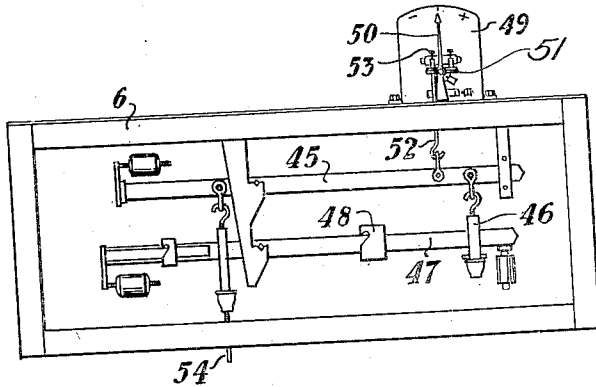


Fig. 2

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3 Sheets-Sheet 2

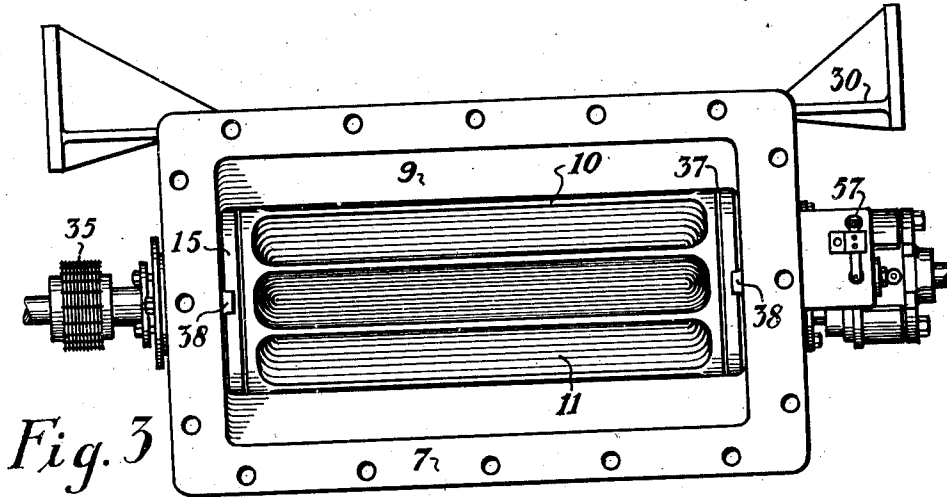


Fig. 3

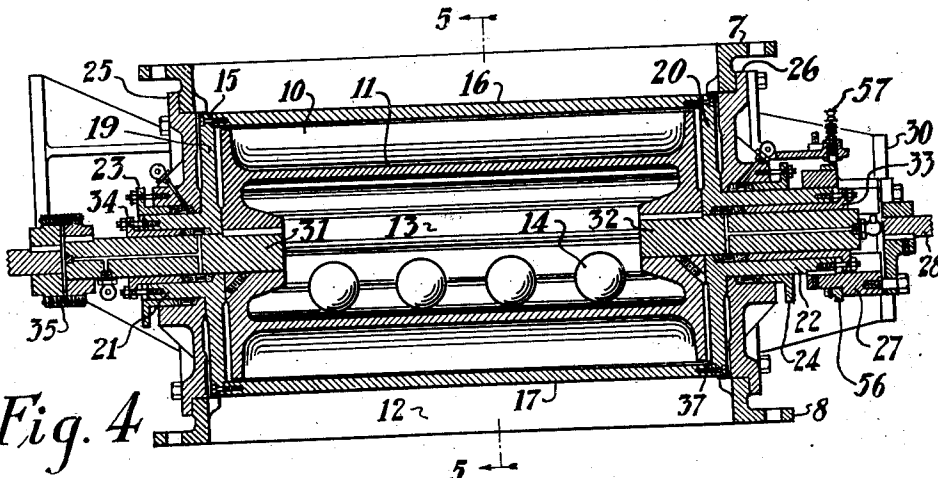


Fig. 4

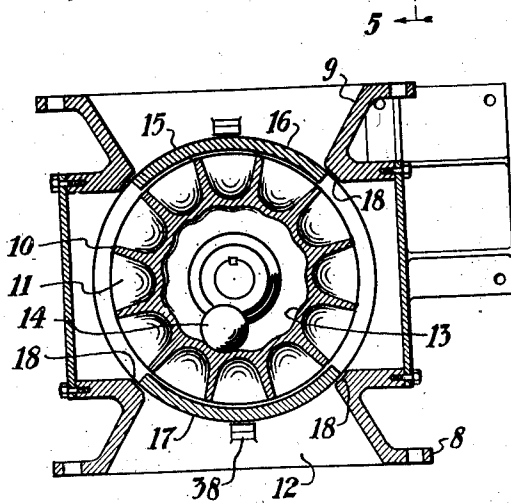


Fig. 5

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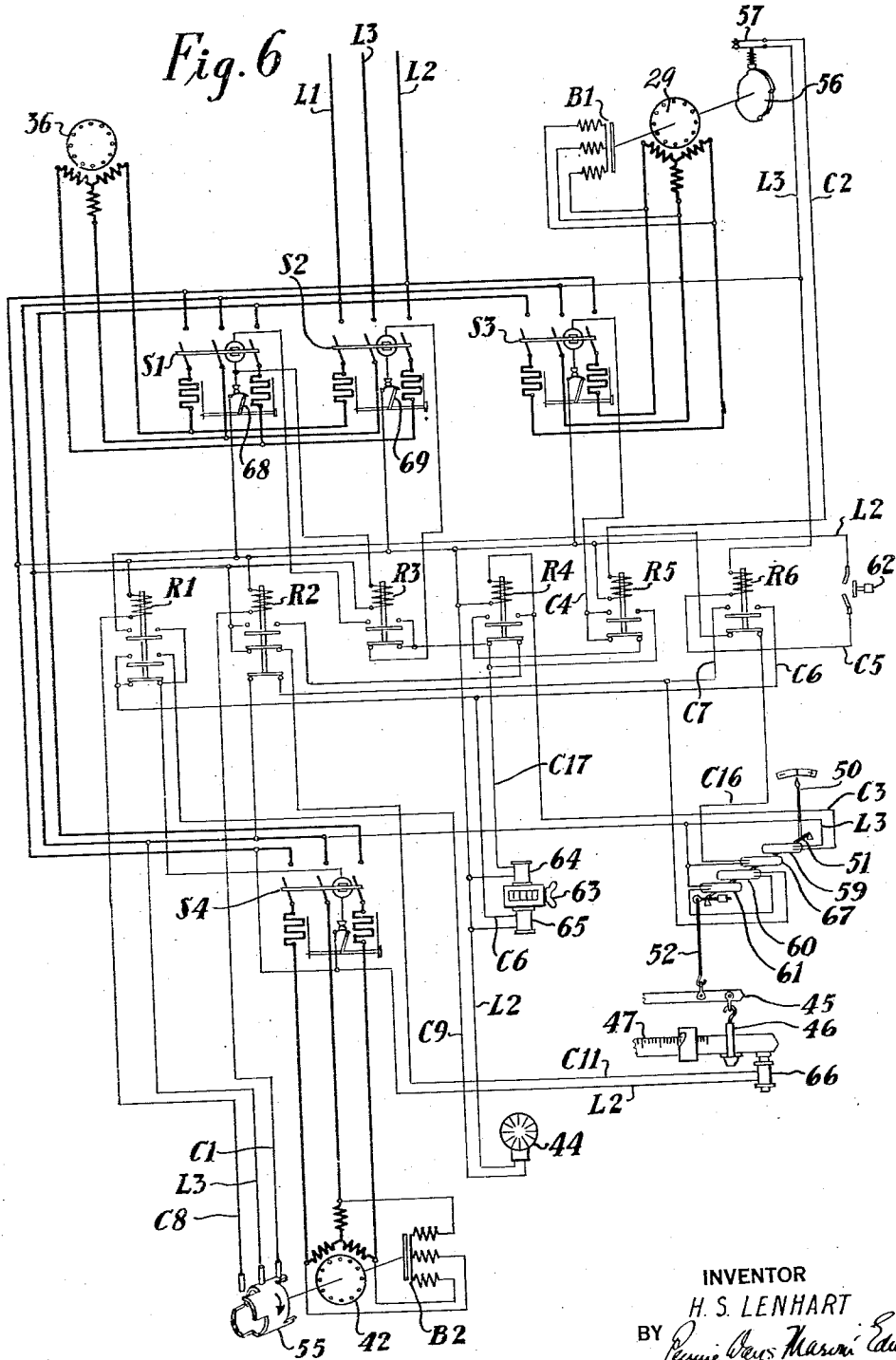
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FEEDING AND BATCHING APPARATUS

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3 Sheets-Sheet 3



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# UNITED STATES PATENT OFFICE

2,040,660

## FEEDING AND BATCHING APPARATUS

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Application May 14, 1935, Serial No. 21,335

11 Claims. (Cl. 249-45)

This invention relates to a feeding and weighing apparatus, and more particularly to an apparatus for withdrawing a batch or series of batches of pre-determined weight of pulverized or finely divided materials from a storage bin or other source of supply. It is especially concerned with a feeding device for withdrawing materials at a uniform rate, including positive means to shut off the flow of material to and from the feeding apparatus when the desired quantity has been withdrawn.

The purposes of the complete apparatus are similar to those of Morrow Patent No. 1,911,235, of which the present invention is an improvement. As recited in that patent, dry pulverized materials such as Portland cement, become fluent and behave similarly to liquids when mixed with air. In this condition they are liable to flood or flow through extremely small openings, such as the clearance spaces between the casing and rotating parts of mechanical feeders. Heretofore, this has required expensive and specially designed feeding apparatus to avoid the withdrawal of an excessive quantity of material. Such excesses not only involve serious cumulative losses but present other difficulties, such as incorrect cement-water ratios, when the apparatus is used in connection with the batching of concrete mixtures.

The apparatus will be described in connection with the handling of Portland cement, but it is to be understood that it also may be used for handling materials such as cement raw materials, lime, soda ash and others which can be handled by a mechanical feeder.

For batching Portland cement, it is essential that the feeding apparatus withdraw the material rapidly at a uniform rate, for otherwise the quantity of material withdrawn cannot be controlled accurately within the permissible limits of tolerance of over or under-weight. Such variations delay the discharge of the batches, as will be explained more fully hereinafter, and thereby prevent operation of the apparatus at a useful rate.

As in the operation of the Morrow apparatus, withdrawing and discharging the batch are effected by automatic and remote control whereby errors in weight are avoided and unauthorized variations in the desired weight cannot be made by the operator, but the present apparatus is more completely automatic and is so controlled that the operator can only start the initial operation for the withdrawal of cement from the supply bin after which his sole function is to discharge successive batches which can be accom-

plished by remote control provided only that each batch is within a permissible tolerance over or below the pre-determined weight. All other operations are automatic and beyond his control.

In general, my invention comprises the combination of a mechanical feeder for withdrawing the material at a uniform rate and a valve mechanism which serves as a positive means to interrupt the flow of material when the desired quantity has been withdrawn, to prevent the discharge of an over-weight due either to a flood of cement through a clearance space between the elements of the feeder or to the discharge of an excessive quantity resulting from continued operation of the feeder after the power has been shut off, due to the momentum of the rotating part or parts. The feeder discharges into a batch hopper or scale pan which may be supported by conventional scale elements such as those of a beam scale. The batch hopper may be discharged by a gate or valve of any suitable type.

The feeder is an improvement over that disclosed in the Morrow patent in that it is considerably less expensive, as such precise construction is not essential, and includes a positive means for relieving the pressure-head of material upon the feed roll as well as means to shut off the flow of cement, including that retained in the flutes or pockets in the roll. The feed roll rotates within a drum-type gate or valve having oppositely arranged sealing elements which, when the flow of cement is interrupted close both the inlet and discharge openings of the feeder casing. The feed roll and gate valve are independently driven through flexible couplings as by means of electric motors provided with built-in speed reducers. The feed roll driving motor can be of relatively low power, since the gate valve relieves the pressure-head on the roll and thereby reduces the starting torque.

The batch hopper is supported by the beam elements of the scale and the latter may conveniently be carried by supports secured to the feeder casing or its flange. The top of the batch hopper is preferably closed by a flexible apron of canvas or the like, which is also attached to the lower flange of the feeder casing. The batch hopper or scale pan is preferably discharged through a rotary gate valve similar to that enclosing the feed roll, whereby the cement may be discharged slowly by successively increasing the openings in the gate, to prevent splashing of the cement from a truck or other receptacle. For simplicity, the apparatus will be described in combination with a scale of the double beam

type, but it is to be understood that other scales of conventional type may be utilized. When a double beam scale is used, the poise or counter-weight on the tare beam is moved to balance the tare weight of the scale pan and its associated parts. It is preferably equipped with a tell-tale index or pointer to indicate to the operator that a batch of permissible weight has been withdrawn and that the batch hopper can be discharged. Certain of the control switches, the function of which will be described hereinafter, are operated by the tare beam and may conveniently be combined with the operation of the tell-tale.

When the apparatus is first placed in service, the desired pre-determined weight is established by making the proper adjustment of the poise on the balance beam. If desired, a casing may be provided to surround the apparatus, or the beam box may be locked to prevent unauthorized changes in the batch weight.

In brief, the operation of the apparatus is as follows:

Assuming that the scale elements have been adjusted, as described above, and the hopper discharge gate is closed, closing of the power service switch energizes both the power supply and control circuits. The feed roll and the double gates which surround it start simultaneously, the gate rotating a quarter of a turn to its fully opened position, whereupon the circuit to its driving motor is opened and further rotation prevented by a spring-actuated magnetic brake. The feed roll continues to operate until the quantity of cement deposited in the hopper or scale pan approaches the pre-determined batch weight, whereupon the circuit to the feed roll driving motor is opened and the gate motor circuit is again energized causing the gate and roll to turn together until the gate is entirely closed. This not only offers positive protection against flooding but also prevents the discharge of an excessive quantity of material due to over-running of the roll as a result of its momentum. The control circuits are so adjusted that the material falling between the feeding apparatus and the batch hopper, that is the material in suspension when the feeder gate is closed, equals the necessary additional quantity of cement to provide for a batch weight within the desired limits of tolerance.

For convenience, the circuit controlling the discharge gate may be provided with a push-button switch or the like, which controls the operation of the driving motor. The discharge gate may be opened successively increasing distances to prevent sudden discharge of cement by closing the push-button switch for short successive intervals. The gate cannot be closed, however, or the feeder started until it has reached its fully open position and the hopper has been completely discharged with the tare beam again in balance. To expedite the complete discharge of the hopper, the usual magnetic vibrator may be provided and conveniently connected in the circuit controlled by the push-button switch whereby it will be actuated when the gate reaches its fully opened position.

As soon as the tare beam returns to balance, the discharge gate motor circuit is closed automatically, after which the circuit is opened both to the motor and a magnet which releases a spring-actuated magnetic brake on the motor shaft. At this time the feeder and its gate motor circuits are again energized and the next batch

is withdrawn automatically in a similar manner.

In order to prevent interruption of the operation, due to the entrance of foreign material which may lodge between a wall of a pocket of the feed roll and an edge of the gate, the sealing elements of which serve as the side walls of the feeder casing when in open position, the feed roll is automatically reversed in direction of rotation by the provision of two starters of the magnetic type, one of which is normally closed, the other serving to reverse the phase. Each starter includes a thermal overload relay which becomes overheated when the driving motor is overloaded. The release of this relay de-energizes the starter magnet and actuates the other starter to reverse the motor. Ordinarily this reversal will dislodge the foreign material, unless it is of unusual size and causes it to be ultimately discharged to the scale pan. The roll will then run in the new direction until a similar overload occurs, whereupon the second starter is released and the other is closed.

It will be realized from the foregoing that the operation of the apparatus requires no manual intervention other than the closing of a single switch to discharge the batch, all other operations being completely automatic. This prevents delaying the rate of withdrawing and discharging successive batches without sacrificing any of the advantages of the Morrow apparatus in preventing the discharge of a batch below or above the permissible tolerance in pre-determined batch weight.

For a better understanding of the invention, reference is made to the accompanying drawings in which:

Fig. 1 is a side elevation of the complete apparatus;

Fig. 2 is a fragmentary detail of the scale beam and tell-tale;

Fig. 3 is a plan view of the feeder with the gate open;

Fig. 4 is a longitudinal section of the feeder with the gate closed.

Fig. 5 is a cross-section of the feeder on line 5-5 in Fig. 4, and

Fig. 6 is a wiring diagram of the power and control circuits, with all elements illustrated in the positions occupied before the circuits are energized, and with the hopper discharge gate in fully closed position, the power circuits being shown in bold and the control circuits in light lines.

Referring to the drawings, and first to Fig. 1, the apparatus will be seen to consist of a mechanical feeder, the casing of which may be used conveniently to support the remainder of the apparatus about to be described. The entire apparatus may be supported by securing the upper flange of the feeder to a corresponding flange on a cement storage bin (not shown). A batch hopper or scale pan 2 is carried by the lever elements of the scale, indicated generally at 3 which are in turn supported by brackets 4 secured to frame members 5 which also support the scale beam box 6.

By reference to Figs. 3, 4 and 5, it will be seen that the feeding apparatus comprises a casing having an upper flange 7, intended to be secured to a supply bin, spout or the like (not shown), and a lower flange 8. The walls at the inlet port of the casing slope inwardly as at 9 to conduct the cement to a mechanical feeding device preferably comprising a feed roll 10, provided with parallel flutes or pockets 11 to convey the cement

to the discharge port 12, the pockets being preferably of uniform size so that the flow of material will not be erratic. Feed roll 10 is hollow and its interior surface is preferably irregular or corrugated as indicated at 13 whereby one or more weights such as the balls 14 will serve to vibrate the apparatus sufficiently to discharge cement from the pockets 11 and thereby provide for high capacities and uniform feeding. The balls 14 likewise serve to prevent the material from lodging between the ends of the roll and the parts about to be described, thereby reducing wear and friction between the parts. For purposes of economy, the roll 10 is preferably cast as a single piece, the balls being supported by wires in the core and freed after the sand is withdrawn from the casting.

The feed roll rotates within a drum-type gate 15 preferably provided with oppositely arranged gate members 16 and 17 whereby both the inlet and discharge ports of the casing may be sealed completely and the roll 10 totally enclosed, the gate members serving as the side walls of the casing when the gate is fully open. The casing is bored longitudinally so that the inner edges 18 of the sloping walls 9 of the inlet and outlet ports are concentric to the gate, and a minimum clearance is provided whereby the cement will be prevented from flowing between the outer surfaces 30 of the gate members 16 and 17 and the surfaces 18 when the gate is in closed position. The gate members 16 and 17 are secured to end plates 19 and 20 provided respectively with hollow shafts 21 and 22 which rotate in bronze bearings 23 and 24 which also serve as packing glands, the latter being secured to circular end plates 25 and 26 which close the ends of the casing and are of sufficient diameter to permit the removal of the gate 15 and feed roll 10. The shaft 22 is rotated through a flexible coupling 27 secured to the speed reducer shaft 28 of a motor 29 of the usual type combined with reduction gearing and a spring actuated magnetic brake, to be described hereinafter in connection with the operating circuits. The motor may conveniently be supported by a bracket 30 secured to the casing of the feeder.

The feed roll 10 is carried by shafts 31 and 32 the latter turning in a bronze bushing 33, which likewise serves as a packing gland. Shaft 31 turns in a bushing 34 carried by the hollow shaft 21 and is driven through a flexible coupling 35 by a motor 36, also provided with reduction gearing, but not including a brake, as continued operation of the feed roll 10 due to its momentum is harmless since either of the gate elements 16 or 17 will have closed the discharge port 12 when the flow of cement is to be stopped, as will be explained hereinafter. The motor 36 may be of relatively low power, as compared with that disclosed in the Morrow patent, since a gate element, such as 16, protects the roll 10 from the pressure-head of material in the storage bin and thereby reduces the starting torque, as the preferred method of operation is to start rotation of both the roll 10 and the gate 15 simultaneously.

For purposes of economy, in construction and to reduce wear and friction losses, a substantial clearance may be provided as at 37 between the ends of the feed roll 10 and the end plates 19 and 20 of the gate 15. This clearance together with the vibrating effect of the balls 14 prevents the packing of cement between the adjacent surfaces and allows the material to discharge freely when the gate is open. For convenience in assembly, the inner end walls of the casing are

provided with bosses 38, to support the feed roll before end plates 19 and 20 are secured to the casing.

It will be seen that the gate 15 and feed roll 10 are arranged to move independently and as these parts are symmetrical they may turn in either direction. As will be described in connection with the operation of the apparatus, it will be apparent that if foreign material tends to lodge between an edge of a pocket 11 and a surface 18 of the inlet, that reversal of the direction of rotation of the feed roll will permit the material to be discharged unless it is of unusual size.

Again referring to Fig. 1, it will be seen that the hopper 2 is discharged by a gate 40 preferably of the rotary type having opposed sealing elements substantially similar to feeder gate 15, or that disclosed in the Morrow patent. This gate may be driven through a flexible coupling 41 by a motor 42, preferably of the type provided with reduction gearing and a magnetically operated spring-set brake. The other shaft of gate 40 serves to operate a drum switch or commutator 43 the function of which will be described hereinafter. A magnetic vibrator 44, of conventional type is preferably secured to a wall of the hopper 2 to provide for the rapid and complete discharge of material.

The scale elements may be of conventional type and comprise a tare beam 45 provided with a loop 46, which engages the end of the weigh beam 47 which carries the usual poise 48. A tell-tale 49 comprising the usual scale and index 50 serves two functions, first to indicate to the operator that a batch can be discharged and also to actuate certain of the control circuits. To this end the tell-tale includes a pivotly mounted support 51 actuated by the tare beam 45 through a link 52. If these control switches are of the mercury contact type, the support 51 is provided with clips having set-screws 53 whereby the angular position of the switches may be so adjusted that the apparatus will function within desired limits. It will be recalled that the beam box is ordinarily closed and locked during normal operation, and a tell-tale is accordingly desirable. The lever elements of the scale, generally indicated at 3, are connected to the tare beam through the usual link 54.

The power and control circuits which cause the apparatus to function in the preferred manner are illustrated in Figs. 6, in which the associated elements are indicated in the positions occupied with none of the circuits energized and with the lower gate 40 in its fully closed position. The tell-tale 49 is shown with the index and its switches at neutral position with the tare weight of the hopper 2 and associated parts in balance. The preferred cycle of operation is briefly as follows:

When the power service switch (not shown) is closed, the upper gate 15 immediately begins to open and simultaneously the feed roll 10 starts rotation. The gate 15 opens only to its fully open position but the roll 10 continues to operate until the weight of material in the hopper or scale pan 2 approaches the pre-determined weight as established by the adjustment of the poise 48 on weigh beam 47. The roll is stopped and the gate closed prior to the deposit of the entire batch in the hopper to compensate for the weight of the material falling in suspension. When the gate 15 begins to close the motor 36 is de-energized whereby the gate and roll travel together to the closed position. Assuming that the batch is within the pre-determined limits of tolerance

by weight, the circuit to the motor 42 may be energized to open gate 40. This gate can be opened in steps, but it cannot be reversed there-  
 5 by preventing the operator from retaining any material in the batch hopper. When the tare beam comes to balance after all material has been discharged, the lower gate is closed auto-  
 10 matically without manual intervention. The vibrator 44 begins to operate after this circuit is closed, the gate is fully opened and continues only as long as the push-button is closed.

In Fig. 6 all power circuits are indicated by bold lines, the control circuits being indicated by light lines. Closing of the power service switch (not  
 15 shown) energizes lines L1, L2 and L3 and causes relays R2, R3 and R5 to close through the closed circuits represented by power line L3 and control line C1 through a commutator ring 55 of the drum switch 43 secured to the shaft of the discharge  
 20 gate 40. At the same time this closes the circuit through starters S1, and S3 which control respectively the driving motor 36 of the feed roll 10 and the motor 29 of the gate 15. Simultane-  
 25 ously to the closing of the circuit to motor 29 the magnets of a spring-set brake B1 are energized to release the brake from the shaft of the motor. When the gate 15 rotates a quarter of  
 30 a turn from the position illustrated in Figs. 4 and 5, to its fully open position, Fig. 3, a cam 56 having two oppositely arranged cam surfaces opens a limit switch 57 thereby opening circuit  
 L3 and C2, causing the relay R5 to return to open position and de-energize the magnet of starter  
 35 S3, at which time the motor 29 and the magnet of brake B1 is released and as the latter is spring-set it immediately prevents the motor and gate 15 from overrunning, thereby holding the  
 gate in its fully opened position.

As the gate 15 is now fully opened and the feed  
 40 roll 10 is delivering material to the scale hopper 2, motor 36 continues to operate until the weight approaches the desired limit, less the weight of the material that will fall in suspension after  
 45 gate 15 is closed. At this time the scale beams move a sufficient distance to tilt the support 51, which actuates four switches, which may be of the mercury contact type. Switch 59 is adjusted  
 50 angularly whereby the circuit about to be described is closed by a sufficient movement of the scale beams to compensate for the material fall-  
 55 ing in suspension. Closing of the switch 59 closes circuits L3 and C3 and energizes relay R4 through the contacts of which and relay R5 cir-  
 60 cuits are closed through lines C3 and C4 to energize the magnet of starter S3 to close the latter to start motor 29 and energize the magnets of brake B1 to release the motor shaft. The  
 rotary gate 15 again rotates a quarter of a turn to its fully closed position, at which time the  
 65 cam 56 closes the limit switch 57 through the circuits represented by lines L3 and C2, thereby energizing the magnet of relay R5 and de-ener-  
 70 gizing the magnet of starter S3 which stops the motor 29 and causes the brake B1 to engage the shaft. At the same time, when starter S3 is closed, the magnet of starter S1 is de-energized causing the circuit to motor 36 to be opened to stop rotation of the feed roll 10. As explained  
 above, motor 36 is not provided with a brake as over-running of roll 10 does not discharge an  
 75 excessive quantity of material, as the roll is now totally enclosed by the gate 15.

The material falling between the roll 10 and batch hopper 2, after the gate is closed, brings  
 75 the batch up to the desired pre-determined

weight and the proper angular adjustment of switch 59, to make a compensation for this quan-  
 tity, can best be determined by three or four trials after the apparatus has been installed. Switches 60 and 61 on the tell-tale support 51 are  
 5 oppositely arranged and are in the same circuit to control the discharge gate operating circuit so that the gate cannot be opened unless the  
 batch weight is satisfactory, the circuit being completed through both switches. The limits 10  
 of tolerance are adjusted by varying the angles of these switches from the horizontal. Decreasing the angles reduces the degree of tolerance.

Assuming that the circuit is closed through switches 60 and 61, at which time the weigh beam  
 15 is in balance, closing of the push-button switch 62 energizes relay R6 through circuits L2 and C5, the contacts of the relay closing circuits C6 and C7 which energize the magnet to close starter  
 S4 through the contacts of relay R1. Closing 20  
 of starter S4 energizes the magnets of the spring-set brake B2 releasing the latter and starting motor 42 to open the gate 40. When this gate  
 moves a quarter turn the commutator ring 55 closes circuits L3 and C8 thereby energizing re- 25  
 25 lay R1 and opening circuit C6, de-energizing the magnet of starter S4 and causing the latter to open, at the same time opening the circuit to magnetic brake B2, which being spring-set stops  
 the motor 42 from over-running. 30

When the circuit including the lines L2 and C8 is energized, a circuit is completed to a magnetic counter 63 provided with the usual release coil  
 64 and latch coil 65, a counter of the mechanical latch type being preferred as repeating is pre- 35  
 35 vented unless the latch is first released by coil 65.

If desired, the gate may be opened slowly by repeatedly closing push-button 62 for short suc-  
 cessive intervals, but as will appear hereinafter, it cannot be closed manually or otherwise until 40  
 40 the hopper is empty. Continued closing of the push-button 62 after the gate is fully opened energizes the vibrator 44 through circuits C9 and L2.

Further, when the circuits controlling the opening of discharge gate 40 are energized, the 45  
 45 solenoid 66 is energized through circuits C11 and L2 through the contacts of relay R2, relay R2 being released when the gate begins to open due to the opening of the circuits through lines C1  
 and L3, through the commutator 55. The sole- 50  
 50 noid 66 serves to lift the weigh beam 47 from the loop 46 suspended from tare beam 45, thereby allowing the tare weight to be balanced when  
 all of the material has been discharged from hopper 2. When the tare weight is in balance, a 55  
 55 circuit through lines C16 and L3 is closed through mercury switch 67, carried by the tell-tale support 51 through the contacts of relays R6 and R1,  
 thereby closing starter S4 and energizing the magnets of brake B2 to cause motor 42 to close 60  
 60 the gate 40 automatically. When this gate is fully closed, commutator 55 again assumes the position illustrated, opening circuits C8 and L3  
 to release relay R1, which upon opening breaks the circuit through C16 and releases the mag- 65  
 65 net of starter S4 and brake B2, to hold the gate in the closed position. The commutator 55 also closes circuit C1 and L3 to energize relay R2  
 which starts a repetition of the cycle above de- 70  
 70 scribed in withdrawing the next batch and also releases the mechanical latch of the counter by energizing the release coil 64 through the cir-  
 75 cuits C17 and L2.

Should foreign material stop the feed roll 10, a thermal overload relay 68 in the starter S1 75

overheats and opens the circuit through the magnet to release the starter. This also causes the release of relay R3 which closes its normally closed contacts and completes a circuit to the starter S2, which as the diagram shows, is oppositely connected to reverse the phase of the power circuit, and thereby the direction of rotation of motor 36 to cause roll 10 to change direction. Unless the material is of usual size it will assume a position within a roll pocket and clear the surface 18 of the feeder casing and ultimately be discharged to the batch hopper. The roll 10 will continue to turn in the new direction, opposite the direction of gate 15, until foreign material is again engaged between the feed roll and gate, whereupon a similar thermal overload relay 69 releases starter S2 and reverses the direction of rotation, provided the thermal overload relay 68 has cooled sufficiently to complete its circuit.

The operation of the apparatus will be apparent from the foregoing description and it will be seen that the sole function of the operator is to discharge the batches by remote control in the operation of the push-button switch or its equivalent. Although he can obviously stop the operation of the entire apparatus by opening the power circuit he cannot discharge a batch. If it should be desired to discharge a batch of more than the allowable weight deposited in the hopper by damaged apparatus, the casing which usually surrounds the apparatus or the cover of the beam box (not shown) may be unlocked and the scale brought to balance thereby closing mercury-contact switches 60 and 61, whereby the circuit to the motor 42 may be completed by closing the push-button switch 62.

I claim:

1. An apparatus for withdrawing batches of pre-determined weight of bulk materials from a storage bin comprising the combination of a scale, a batch hopper supported by elements thereof, the hopper being provided with a discharge gate, means for withdrawing materials at a uniform rate and depositing them in the hopper including a casing having inlet and discharge ports, a mechanical feeder within the casing, a motor for driving the feeder, electrically actuated gate members closing the inlet and discharge ports of the casing, electrically actuated means for driving said members, control circuits for the motor and said electrically actuated means including switch means movable to closed position by an element of the hopper discharge gate when the latter closes to energize the motor and gate actuating means to drive the feeder and open the gate members.

2. An apparatus for withdrawing batches of pre-determined weight of bulk materials from a storage bin comprising the combination of a scale, a batch hopper supported by elements thereof, the hopper being provided with a discharge gate, means for withdrawing materials at a uniform rate and depositing them in the hopper including a casing having inlet and discharge ports, a mechanical feeder within the casing, a motor for driving the feeder, a gate member closing the casing to the flow of material, a motor for driving the gate member, and a control circuit therefor including a switch movable to closed position by an element of the hopper discharge gate as the latter closes to energize the motor to open the gate.

3. An apparatus for withdrawing batches of pre-determined weight of bulk materials from a storage bin comprising the combination of a scale, a batch hopper supported by elements

thereof, the hopper being provided with a discharge gate, means for withdrawing materials at a uniform rate and depositing them in the hopper including a casing having inlet and discharge ports, a mechanical feeder within the casing, a motor for driving the feeder, a rotary gate having oppositely disposed gate members closing the inlet and outlet ports of the casing, a motor for driving the gate, a control circuit for said motor including a switch movable to closed position by an element of the hopper discharge gate when the latter closes to energize the motor, and a second switch in said circuit movable to open position by an element of the gate to de-energize the motor when the gate has rotated one quarter turn.

4. An apparatus for withdrawing batches of pre-determined weight of bulk materials from a storage bin comprising the combination of a scale, a batch hopper supported by elements thereof, the hopper being provided with a discharge gate, means for withdrawing materials at a uniform rate and depositing them in the hopper including a casing having inlet and discharge ports, a feed roll, provided with material receiving pockets, within the casing between said ports, a motor for driving the feeder, a rotary gate having a gate member concentric to the feed roll and closing a port of the casing, a motor for driving the gate, control circuits for said motors including switch means movable to closed position by an element of the hopper discharge gate as the latter closes to energize the motors.

5. An apparatus for withdrawing batches of predetermined weight of bulk materials from a storage bin comprising the combination of a scale, a batch hopper supported by elements thereof, the hopper being provided with a discharge gate, means for withdrawing materials at a uniform rate and depositing them in the hopper including a casing having inlet and discharge ports, a feed roll, provided with material receiving pockets, within the casing between said ports, a motor for driving the feeder, a rotary gate having oppositely disposed gate members surrounding and concentric to the feed roll, and closing the inlet and outlet ports of the casing, a motor for driving the gate, control circuits for said motors including switch means movable to closed position by an element of the hopper discharge gate as the latter closes to energize said motors, and a limit switch in the circuit of said gate driving motor movable to open position by an element of said gate to de-energize its motor when the gate has rotated a quarter turn.

6. An apparatus for withdrawing batches of pre-determined weight of bulk materials from a storage bin, comprising the combination of a scale, a batch hopper supported by elements thereof, the bottom of the hopper being provided with an electrically actuated discharge gate, a closing circuit therefor including a switch movable to closed position by a movable element of the scale when the hopper is completely empty to move the gate to its fully closed position automatically, means to withdraw materials at a uniform rate from the storage bin and to deposit them in the hopper including a casing having inlet and discharge ports, a feed roll, provided with material receiving pockets, within the casing between the ports, a motor for driving the feeder, a rotary gate having oppositely disposed gate members surrounding and concentric to the feed roll, and closing the inlet and outlet ports of the casing, a motor for driving said rotary gate, control circuits for said motors including

switch means movable to closed position by an element of the hopper discharge gate as the latter closes to energize said motors, and a limit switch in the circuit of said rotary gate driving motor, 5  
 8 movable to open position by an element of said rotary gate to de-energize its motor when the gate has rotated a quarter turn.

7. An apparatus for withdrawing batches of pre-determined weight of bulk materials from a 10  
 storage bin comprising the combination of a scale, a batch hopper supported by elements thereof, the hopper being provided with a discharge gate, means for withdrawing materials at a uniform rate and depositing them in the hopper 15  
 15 including a casing having inlet and discharge ports, a feed roll having material receiving pockets, within the casing between the pockets, a motor for driving the feeder, a control circuit therefor including a switch movable to closed 20  
 20 position by an element of the discharge gate as the latter closes to energize the motor, the motor having a power circuit equipped with two starters oppositely connected to reverse the phase to 25  
 25 change the direction of rotation of the feed roll, each starter having an overload relay, one of the starters being normally closed but subject to opening by operation of the relay, and means to close the other starter when the relay opens.

8. An apparatus for withdrawing bulk materials from a source of supply at a uniform rate, 30  
 30 comprising the combination of a casing having inlet and discharge ports, a feed roll within the casing, provided with pockets for transferring material from the inlet to the outlet, and a rotary 35  
 35 gate member concentric to the feed roll and movable to close one of said ports to the flow of material, and to permit the free transfer of material in its open position.

9. An apparatus for withdrawing bulk mate-

rials from a source of supply at a uniform rate, comprising the combination of a casing having inlet and discharge ports, a feed roll within the casing, provided with pockets for transferring material from the inlet to the outlet, and a rotary 5  
 5 gate having oppositely disposed gate members surrounding and concentric to the feed roll and movable to close the inlet and outlet ports, the gate members permitting the free transfer of material in open position. 10

10. An apparatus for withdrawing bulk materials from a source of supply at a uniform rate, comprising the combination of a casing having inlet and discharge ports, a feed roll within the casing, provided with pockets for transferring material from the inlet to the outlet, and a rotary 15  
 15 gate having oppositely disposed gate members surrounding and concentric to the feed roll, the gate members serving to seal the inlet and discharge ports in closed position and to serve as continuations of the side walls of the casing when in fully 20  
 20 open position, and permitting the free transfer of material in open position.

11. An apparatus for withdrawing bulk materials from a source of supply at a uniform rate, 25  
 25 comprising the combination of a casing having inlet and discharge ports, a feed roll within the casing, provided with pockets for transferring material from the inlet to the outlet, and a rotary 30  
 30 gate having oppositely disposed gate members surrounding and concentric to the feed roll and end plates beyond the ends of the feed roll, the end plates being provided with hollow shafts supported for rotation in the end walls of the casing, the feed roll being provided with shafts extending 35  
 35 into said hollow shafts and arranged for rotation therein.

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