

Aug. 20, 1963

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3,101,159

PARTICULATE MATERIAL DISPENSER

Filed Nov. 14, 1960

2 Sheets-Sheet 1

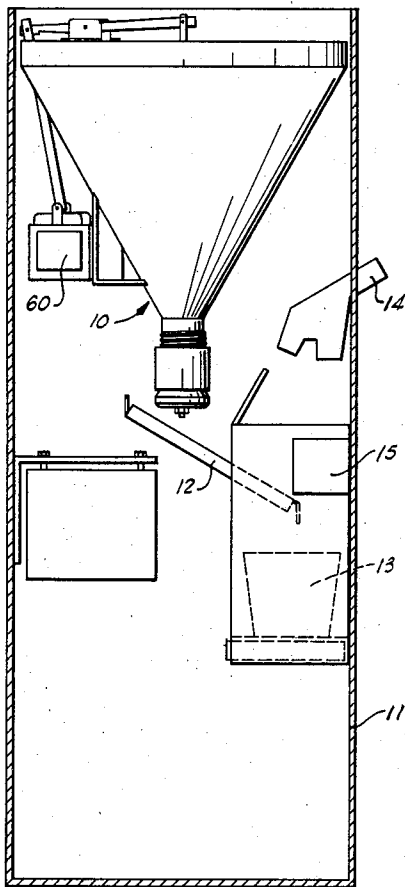


FIG. 1

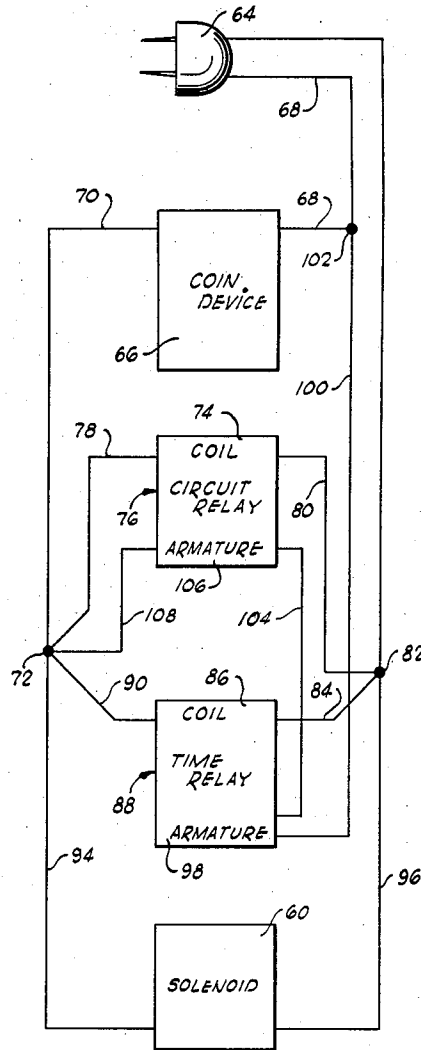


FIG. 3

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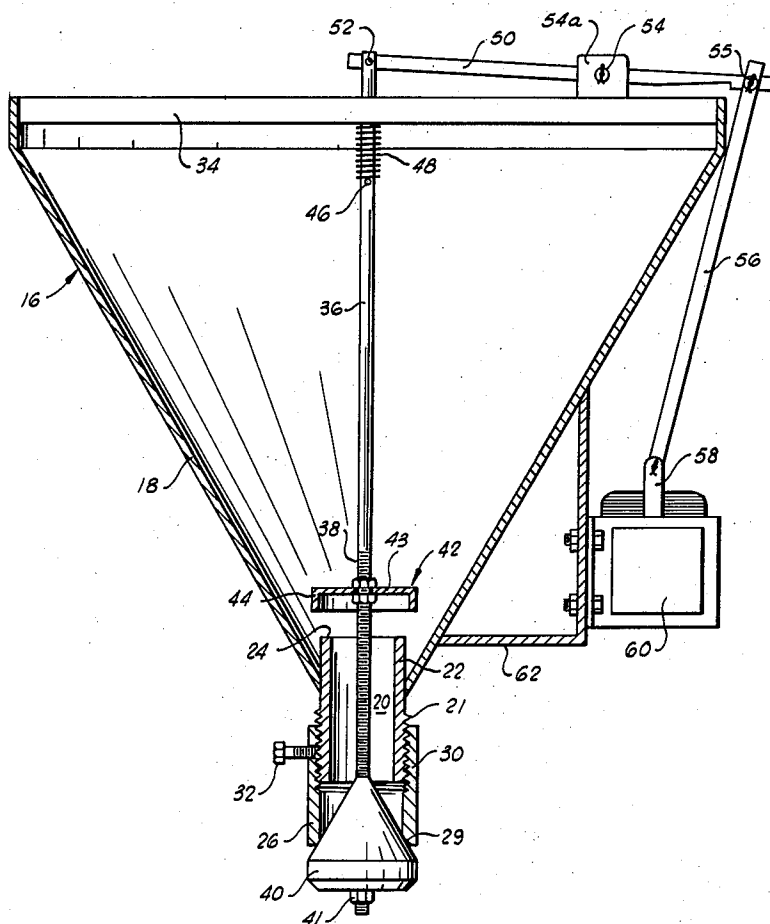


FIG. 2

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3,101,159

PARTICULATE MATERIAL DISPENSER

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Filed Nov. 14, 1960, Ser. No. 68,764

2 Claims. (Cl. 222-70)

This invention relates generally to improvements in dispensing mechanisms, and more particularly, but not by way of limitation, to an improved mechanism for dispensing soap in powdered form. This application is a continuation-in-part of applicant's co-pending application entitled "Particulate Material Dispenser," Serial No. 27,008, filed May 5, 1960, now abandoned.

During recent years a large industry has developed in maintaining automatic washing machines and dryers for public use. Each patron of such an establishment ordinarily places his laundry and a quantity of soap or detergent, and perhaps bleach, in a washing machine at the required time during the washing operation. Many patrons are not cognizant of the amount of soap required for proper operation of the machines and others are simply careless in measuring the quantity of soap which is added to the clothes load which has been placed in one of the washers. In either case, the failure to accurately measure the quantity of soap which is to be placed in the washing machine may result in an inefficient washing operation, and may also result in the unsightly overflow of soapsuds from the washing machine. Moreover, many patrons do not bring their own soap, but prefer instead to purchase the required quantity of soap at the laundry establishment if it is available there.

In view of these considerations, it has behooved the proprietor of such laundry establishments to maintain a supply of soap powder readily available to the vicinity of the washing machines. To insure accurate dispensation of the soap to patrons and thereby to avoid costly waste, unattractive soap overflow, and unsatisfactory service due to inefficient washing, the proprietor has frequently found it necessary to employ assisting personnel in such establishments to measure out the soap and add it to the washing machines for the patrons. This, of course, results in the expenditure of many working hours in handling the soap powder, supervising the operation of the machines, and in actually performing a portion of the washing operation for the patrons.

More recently, coin-operated machines which automatically dispense the soap powder to the customer have been developed and installed in washing establishments. These machines generally contain a quantity of the powdered soap stored in a bin or hopper and are further characterized by some type of measuring device and valve through which the soap powder is passed prior to delivery to the customer. Such machines generally work well enough so long as the type of soap powder utilized is of the small, granular, non-porous variety and the humidity of the atmosphere surrounding the machines is not high. However, since the presence of damp clothes and drying machines, etc., tend to increase the humidity obtaining in such laundry establishments, the latter condition is often not realized.

Moreover, when the soap powder which is to be dispensed is characterized by individual particles which are porous or hollow in nature (known as regular detergent), complications in the dispensing operation have been encountered. The measuring and valve mechanisms of previous types of soap powder dispensers have been characterized by a multiplicity of moving parts separated from each other by small clearances or, in some cases, moving in frictional contact with each other. For ex-

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ample, one type of dispenser is characterized by a hollow rotary valve turning within a closely fitting sleeve which is open at the top and bottom thereof to permit the soap powder to fill the hollow valve under the influence of gravity and to be discharged therefrom in like manner. In this type of soap dispenser, as well as in most other prior types of dispensers with which applicant is familiar, the particles of the soap powder are trapped between adjacent moving parts, such as the rotary valve and its encompassing sleeve in the case mentioned. If the granular particles are porous or hollow, they are rolled and compressed between such parts and tend to agglomerate or gum up so that such parts cannot move relatively to each other in the manner intended. Moreover, agglomeration of the powder tends to result in inaccurate measurement of the quantity of soap to be delivered, thus defeating one of the major purposes of installing such dispensing devices. Since particulate soap powders generally display hygroscopic properties, high humidity conditions in the vicinity of the dispenser will increase the tendency of the particles to form agglomerate masses and malfunctioning of the dispensing device will, accordingly, be accelerated.

The disadvantage of previous types of dispensers which has been discussed above will obviously necessitate frequent maintenance of such machines and will result in unsatisfactory service and unsatisfied patrons. Moreover, the complexity of the measuring and valve mechanisms generally employed in such dispensers has made the cost of such machines disproportionate to the quality of service obtained therefrom.

The present invention contemplates a novel dispensing apparatus for dispensing a precise amount of particulate material, and is particularly well adapted for dispensing hollow, porous or hygroscopic particulate material which tends to agglomerate when rolled under compression. By virtue of the latter feature, the dispensing apparatus of this invention is especially well suited for use in dispensing a precisely measured amount of powdered or granular soap for use in automatic washers or the like. The invention comprises a hopper for storing a quantity of the particulate material and a novel reciprocating valve device at the lower end of the hopper which will measure and dispense a predetermined amount of the particulate material with each operation of the valve. In a preferred embodiment of this invention, the novel reciprocating valve device is automatically operated by the insertion of a coin in a coin-operated switch.

An important object of this invention is to provide a dispensing device which will dispense an accurately measured quantity of hollow or porous particulate material without becoming clogged or inaccurate over long periods of constant usage.

Another object of this invention is to provide a device for dispensing particulate material in predetermined quantities, said device being easily adjustable to permit the quantity of material dispensed to be varied as desired.

A further object of this invention is to provide a soap powder dispensing mechanism which may be automatically operated by the insertion of a coin.

Another object of the present invention is to provide a device for dispensing soap powder in which the powder will not become packed or agglomerated in the operating mechanism of the device, even under high humidity conditions.

Another object of this invention is to provide a soap powder dispensing device having relatively few moving parts which contact each other over a relatively small area during operation of the device.

Yet another object of this invention is to provide a

novel electrical timing circuit for actuating a soap powder dispensing device.

Another object of this invention is to provide a particulate material dispensing device in which none of the particulate material is permitted to leak from the device following dispensation of a precisely determined amount of material.

Another object of this invention is to provide a soap powder dispensing device which is simple in construction, may be economically manufactured, and will have a long service life.

Other objects and advantages of the invention will be evident from the following detailed description, when read in conjunction with the accompanying drawings which illustrate my invention.

In the drawings:

FIGURE 1 is a vertical section taken through a cabinet in which the dispensing apparatus of the present invention may conveniently be mounted and showing the dispensing apparatus in elevation.

FIGURE 2 is a vertical sectional view taken through the center of the hopper and associated apparatus of the present invention.

FIGURE 3 is a schematic wiring diagram of the electrical control circuit for the dispensing mechanism.

Referring to the drawings in detail, and particularly to FIG. 1, reference character 10 designates generally the dispensing device of the present invention. In an exemplary application of the present invention for dispensing powdered soap, the dispensing apparatus 10 is mounted within an appropriate housing 11. Soap powder from the dispensing apparatus 10 is directed by a chute 12 into a container 13 which is accessible to the customer using the device. In a preferred embodiment of the dispensing apparatus 10 of the present invention, the apparatus is fully automatic in operation and is actuated by a coin-operated switch. Thus, in FIG. 1 a coin slot or receptacle extending through housing 11 is indicated by reference character 14. The coins fall into a receptacle 15 and are collected there until removed by the operator of the laundry establishment.

The elements of the novel dispensing apparatus of the present invention are more clearly illustrated in FIG. 2. The apparatus comprises a funnelform hopper 16 of inverted conical configuration whose side walls 18 slope downwardly and inwardly toward its lower end. The degree of inclination of the side walls 18 to the vertical has been found to be important to the efficient operation of the dispensing apparatus, and should be such that the walls 18 form an angle with the vertical of from 30° to 50°.

Disposed at the lower end of the hopper 16 is a tubular discharge spout 20. The discharge spout 20 carries external threads 21 and is secured to the hopper 16 with its upper end portion 22 extending through the lower end of the hopper. The discharge spout terminates inwardly of the hopper apex a short distance, thus forming a cylindrical valve seat 24.

A tubular sleeve 26 is telescoped over the discharge spout 20 with one of its end portions 28 extending below the lower end of the discharge spout and shaped to form an upwardly and inwardly tapered valve seat 29. The sleeve 26 is threaded around its inner wall as indicated by reference numeral 30 and makes threaded engagement with the external threads 21 of the discharge spout 20. A set screw 32 extends through the sleeve 26 and frictionally engages the discharge spout 20 so that the sleeve 26 may be locked in its position relative to the discharge spout 20. The discharge spout 20 and its associated sleeve 26 constitute a variable volume conduit through which soap powder is discharged from the hopper. It has been found that optimum operation of the dispensing device for use in dispensing hygroscopic particulate material results when the inside diameter of discharge spout 20 is maintained between a minimum dimension of approxi-

mately one inch and a maximum dimension of approximately four inches.

A cross member 34, which may conveniently be formed in the shape of an inverted channel, extends across the top of the hopper 16 between its side walls 18, passing through the vertical axis of the hopper. An elongated shaft 36 extends coaxially through the hopper 16, the discharge spout 20 and the sleeve 26. The lower portion of the shaft is threaded, as indicated by reference character 38, and a conical valve 40 is threaded coaxially upon the shaft adjacent its lower end. The valve 40 is tapered inwardly and upwardly at an angle to make sealing engagement with valve seat 29 when the valve is closed. A locking nut 41 is employed to retain the plug 40 upon the shaft 36. A second valve 42, comprising a disc 43 having a downwardly depending circumferential flange 44, is coaxially threaded upon shaft 36 in axially spaced relation to valve 40. The diameter of the disc 43 is slightly larger than the diameter of the cylindrical valve seat 24 so that the valve 42 acts as a closure cap fitting over the cylindrical valve seat 24 when the valve is closed as hereinafter described.

It will be apparent in referring to FIG. 2 that the distance by which the valve 42 is spaced from valve 40 along shaft 36 is greater than the distance from valve seat 29 to valve seat 24. This relationship of distances is essential to the operation of the dispensing apparatus of the present invention, as will be explained below. However, so long as this general relationship is maintained, the distance separating valves 40 and 42 measured axially along the shaft 36 may be adjustably varied to suit operating conditions.

The shaft 36 carries a transverse pin 46 adjacent its upper end, and a compression spring 48 is coaxially mounted on the shaft 36 between pin 46 and the cross member 34. A pivoted rocker arm 50 is connected at one of its ends to the upper end of the shaft 36 by a pivot pin 52. The rocker arm 50 is pivoted intermediate its length about a pin 54 supported by a bracket 54a mounted on the cross member 34, and the outer end 53 thereof is pivotally secured to a connecting arm 56. The connecting arm 56 is in turn attached to the armature 58 of a solenoid 60. The solenoid 60 may be conveniently bolted to a bracket 62 attached to the side of the hopper 16.

As previously indicated, the dispensing apparatus 10 is preferably automatically operated by a coin-controlled system. The electrical circuitry through which automatic operation in response to the insertion of a coin is accomplished is shown schematically in FIG. 3. A source of electrical power is indicated by reference character 64. A coin-operated switch 66 is connected by lead 68 to one terminal of the power source and by lead 70 to a first terminal lug 72. The coil 74 of a normally open relay 76 is connected by lead 78 to the terminal lug 72, and by lead 80 to a second terminal lug 82 which is in turn connected to the second terminal of the power source 64. Thus, a series circuit containing coin-operated switch 66 and the coil of normally open relay 76 is formed.

From the second terminal lug 82, a lead 84 is connected to one end of the coil 86 of a normally closed time relay 88 and a lead 90 is connected between the other end of the coil 86 and the first terminal lug 72. The solenoid 60 is connected via the leads 94 and 96 to the first and second terminal lugs 72 and 82, respectively. Thus, the solenoid 60 and the coil 86 of normally closed time relay 88 are connected in parallel with each other and with the coil 74 of normally open relay 76.

One end of a circuit-breaking armature 98 in normally closed time relay 88 is connected via lead 100 to a terminal lug 102 in the lead 68 between switch 66 and the power source 64. The other end of the circuit-breaking armature 98 is connected via lead 104 to one end of the armature 106 of normally open relay 76. The other end of the armature 106 is connected by lead 108 to ter-

minal lug 72. In summary, the armature 98 of normally closed time relay 88 and the armature 106 of normally open relay 76 are connected in series with each other and in parallel with switch 66.

Operation

To operate the dispensing apparatus of the present invention in the fully automatic manner suggested by the depicted preferred embodiment, a customer of the laundry establishment inserts a coin in the coin receptacle 14 and thereby momentarily closes switch 66 contained therein. When switch 66 is momentarily closed, the coil 74 of normally open relay 76 is energized and the armature 106 of relay 76 is actuated to closed position. Simultaneously with the energization of coil 74, the coil 86 of the normally closed time relay 88, and also the solenoid 60, which are both connected in parallel with the coil 74, are energized. The flow of current in the coil 86 of normally closed time relay 88 starts the timing mechanism which is set to open the circuit-breaking armature 98 after a desired time delay.

With the closure of armature 106 of the normally open relay 76 upon insertion of a coin in switch 66 as described above, current is permitted to flow via the lead 100, circuit-breaking armature 98, lead 104, armature 106 and lead 108 to terminal lug 72. At terminal lug 72 the current is split to the parallel circuits containing coil 74 of the normally open relay 76 and the solenoid 60, respectively, and therefore both coil 74 and the solenoid 60 are energized so long as circuit-breaking armature 98 is in its normally closed position. From this it follows, of course, that armature 106 of normally open relay 76 will also be closed as long as the circuit-breaking armature 98 is in its normally closed position.

When the time period of the normally closed time relay 88 has passed, circuit-breaking armature 98 is actuated to the open position by the timing mechanism of the relay 88. No current can then flow to the coil 74, the coil 86 or the solenoid 60 and all of these return to their normal de-energized status. The circuit through the solenoid 60 has been completed and maintained by time relay 88 for a period of time sufficient to allow a desired amount of soap powder to be delivered from hopper 16 into the discharge spout 20 and its associated sleeve 26 in a manner which will next be described.

As the armature 58 of the solenoid 60 is moved downwardly, the shaft 36 is moved upwardly by means of the mechanical linkage comprising rocker arm 50 and connecting arm 56 which extends between the shaft and the armature 58 of solenoid 60. As the shaft 36 is moved upwardly, valve 40 is moved into sealing engagement with valve seat 29 at the lower end 28 of the sleeve 26, and valve 42 is lifted upwardly a sufficient distance to allow the circumferential flange 44 to rise above the cylindrical valve seat 24 at the upper end 22 of discharge spout 20. This actuation of the shaft 36 will obviously permit soap powder contained within the hopper 16 to pass downwardly into the discharge spout 20 and sleeve 26. As has previously been explained, the period which shaft 36 is vertically actuated will be of sufficient duration to permit the discharge spout 20 and sleeve 26 to become completely filled with the particulate soap powder material.

As has been indicated, the quantity of soap powder which will be dispensed is determined by the total volume included within the discharge spout 20 and the sleeve 26. For various reasons, such as the utilization of different types of soap powder, or the particular types of laundry machines which are employed, it may frequently be desirable to vary the quantity of soap which is to be dispensed upon each operation of the dispensing mechanism. When such is the case, such variation of quantity can be easily obtained by merely adjusting the sleeve 26 in its vertical relation to the discharge spout 20. Since the

shaft 36 is moved a fixed distance upon operation of the solenoid 60, it is also necessary to adjust the axial spacing of valves 40 and 42 along shaft 36 to compensate for the adjustment of sleeve 26 with respect to discharge spout

20. Positioning of the distance between the valves 40 and 42 is easily accomplished by merely rotating the threadedly engaged valves 40 and 42 on the shaft 36 until the desired axial spacing therealong is attained.

Since the shaft 36 is moved vertically in opposition to the bias of compression spring 48, it will be apparent that when solenoid 60 is de-energized, the shaft 36 will be biased downwardly by the spring 48 so that valve 42 sealingly engages valve seat 24 and valve 40 moves downwardly to open the lower end of sleeve 26, thereby permitting the soap powder contained within sleeve 26 and discharge spout 20 to fall under the influence of gravity into the chute 12. The seal established between the valve seat 24 and the valve 42 is effective to prevent the leakage of any of the powder from the hopper 16 into the discharge spout 20, since the disc 43 bears flatly against the seat 24, and the flange 44 surrounds the upper portion 22 of the discharge spout, thus assuring that no powder can find its way past the valve seat 24 into the spout 20.

The design of the dispensing apparatus of the present invention assures that agglomeration or "balling up" of the soap powder is given little chance to occur as a result of compression of the powder between closely adjacent moving parts. Thus, a sizable opening is provided between the valve 42 and its cooperating valve seat 24 when the valve is opened to permit the soap powder to freely fill discharge spout 20 and sleeve 26. In addition, as has been previously indicated, the walls of the hopper are rather steeply inclined, preferably at an angle of from 30° to 50° from the vertical, so that the soap powder has little tendency to accumulate and cake thereon.

From the foregoing it will be apparent that the dispensing apparatus of the present invention provides a novel mechanism which will dispense a precise amount of particulate material upon each operation of the mechanism. The dispensing apparatus is characterized in having relatively few moving parts which are simple in construction and provide little opportunity for the particulate material to become caked or clogged therein. The amount of particulate material which will be dispensed upon each operation of the device may be easily varied to suit the needs of the user, and in a preferred embodiment of the apparatus, fully automatic operation may be effected through the closure of a coin-operated switch.

Changes may be made in the combination and arrangement of parts or elements as heretofore set forth in the specification and shown in the drawings, it being understood that changes may be made in the precise embodiment disclosed without departing from the spirit and scope of the invention as defined in the following claims.

I claim:

1. Apparatus for dispensing particulate material comprising an open-ended, vertically extending funnel-shaped hopper for retaining a supply of particulate material, said hopper being circular in horizontal cross section and having its side walls sloping downwardly and inwardly toward its lower end at an angle of from 30 degrees to 50 degrees from the vertical; an externally threaded tubular discharge spout having its upper end extending into the lower end of said hopper so that its outer surface is continuous with the inner surface of said hopper, whereby a peripheral ledge is formed by the walls of said tubular discharge spout adjacent the lower end of said hopper; a tubular sleeve coaxially threaded on said discharge spout for adjustable vertical movement thereon, said sleeve having a portion extending below the lower end of said discharge spout; a set screw threaded through said sleeve and frictionally engaging said discharge spout for locking said sleeve in its adjusted position on said spout; a cross member extending across the top of said hopper from one side, through the vertical axis, to the other side

thereof; a vertical shaft extending through said cross member and coaxially through said hopper, said discharge spout and said sleeve; a compression spring coaxially mounted on said shaft and abutting said cross member whereby said spring is placed in compression when said shaft is moving upwardly with respect to said cross member; a conical valve of a size to effect closure of said sleeve mounted on the lower end of said shaft below said sleeve and being axially adjustable thereon; a generally disc-shaped valve of a size to mate with said ledge mounted on said shaft and spaced axially along said shaft from said conical valve a distance greater than the distance from the lower end of said sleeve to said ledge, said disc-shaped valve being axially adjustable on said shaft; means vertically actuating said shaft against the bias of said compression spring whereby when said shaft is vertically actuated said conical valve closes the opening at the lower end of said tubular sleeve and said disc-shaped valve is lifted above said ledge to permit the particulate material in said hopper to flow into said discharge spout and sleeve; and timing means connected to said actuating means for controlling the duration of the vertical actuation imparted to said shaft by said actuating means.

2. Apparatus for dispensing particulate material including a hopper; a generally vertical discharge spout at the lower end of said hopper extending through the walls of said hopper and projecting from the lower end of said hopper toward the top thereof; a sleeve telescoped over the portion of said discharge spout outside said hopper and being axially adjustable with respect thereto, said sleeve having a portion extending below the lower end of said discharge spout; and reciprocating valve means adapted to close the upper open end of said discharge spout at one limit of the reciprocating movement and to seal the lower open end of said sleeve while simultaneously placing said discharge spout in communication with said hopper at the other limit of the reciprocating movement, said reciprocating valve means including a shaft extending coaxially through said discharge spout and said sleeve, a first valve of a size and shape to effect closure of the lower open end of said sleeve mounted coaxially on the lower end of the shaft below said sleeve, a second valve mounted coaxially on said shaft and spaced axially

along said shaft from said first valve by a distance greater than the distance from the lower open end of said sleeve to the upper end of said tubular discharge spout, said second valve having a flat disc-shaped member of larger diameter than said tubular discharge spout coaxially secured to said shaft and adapted to sealingly cover the upper open end of said tubular discharge spout when said shaft is reciprocated, and means for axially reciprocating said shaft whereby the lower open end of said sleeve and the upper open end of said tubular discharge spout are respectively closed and opened by first and second valves, respectively, during the upward movement of said shaft and are respectively opened and closed by said first and second valves, respectively, during the downward movement of said shaft, said means for axially reciprocating said shaft including a rocker arm hingedly connected to the upper end of said shaft, means for pivotally mounting said rocker arm on said hopper, a connecting arm hinged to said rocker arm, a solenoid connected to said connecting arm, and an electrical control circuit for energizing said solenoid, said electrical control circuit including a source of electrical power, a switch, a normally open relay having its coil connected in series with said switch and in parallel with said solenoid, and further having its armature connected in parallel with said switch, and a normally closed time relay of the type which opens after a predetermined time period, said normally closed time relay having its coil connected in parallel with the coil of said normally open relay and further having its armature connected in series with the coil and armature of said normally open relay.

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