April 3, 1956 P. A. COFFMAN, JR 2,740,561

PNEUMATICALLY OPERATED HOPPER AGITATOR

Filed March 27, 1953 2 Sheets-Sheet 1

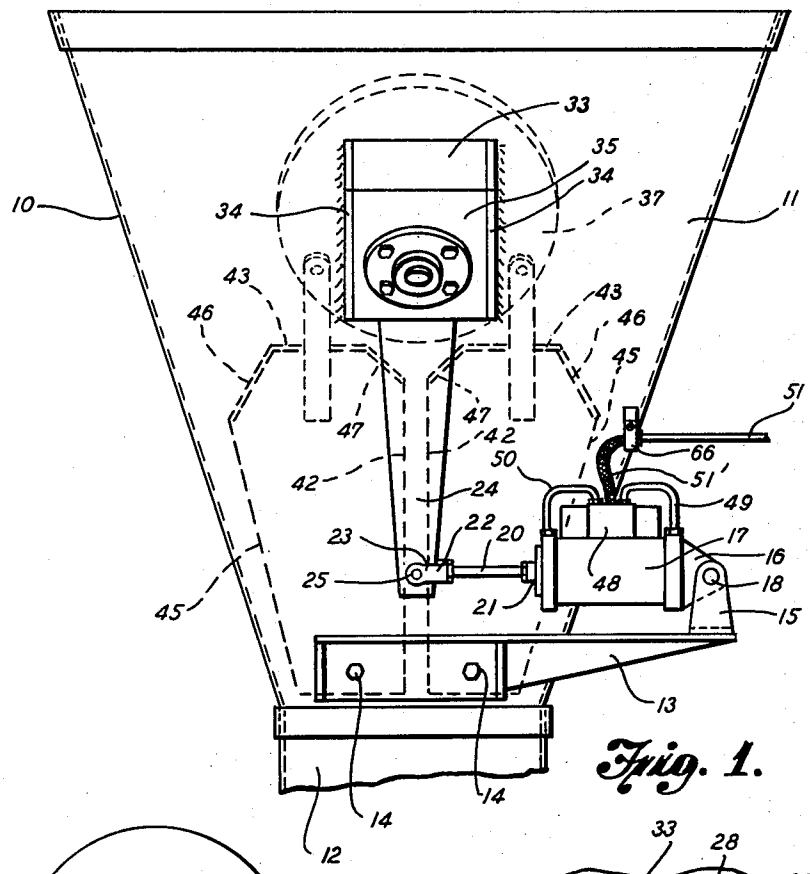


Fig. 1.

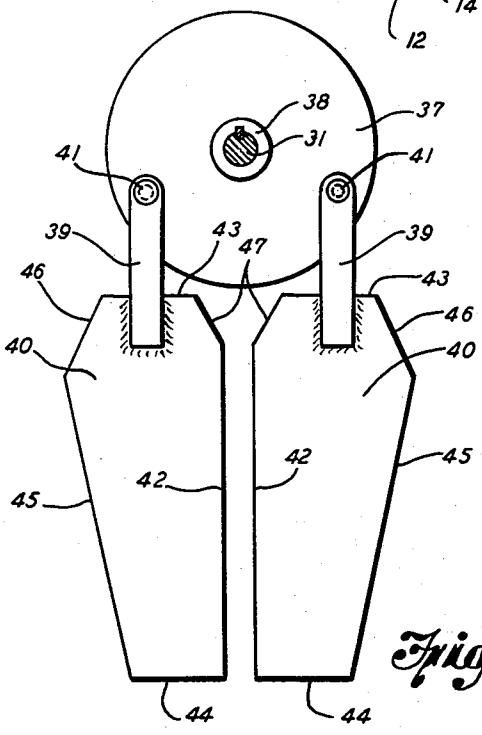


Fig. 3.

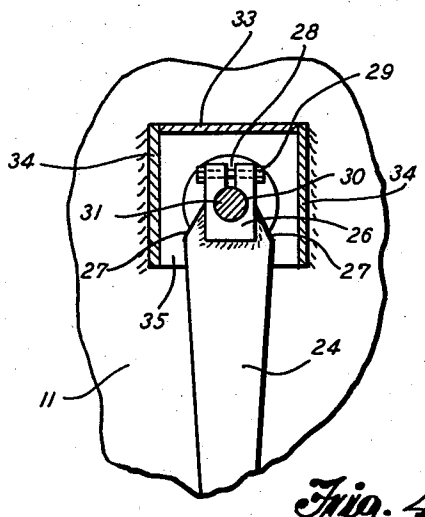


Fig. 4.

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2 Sheets-Sheet 2

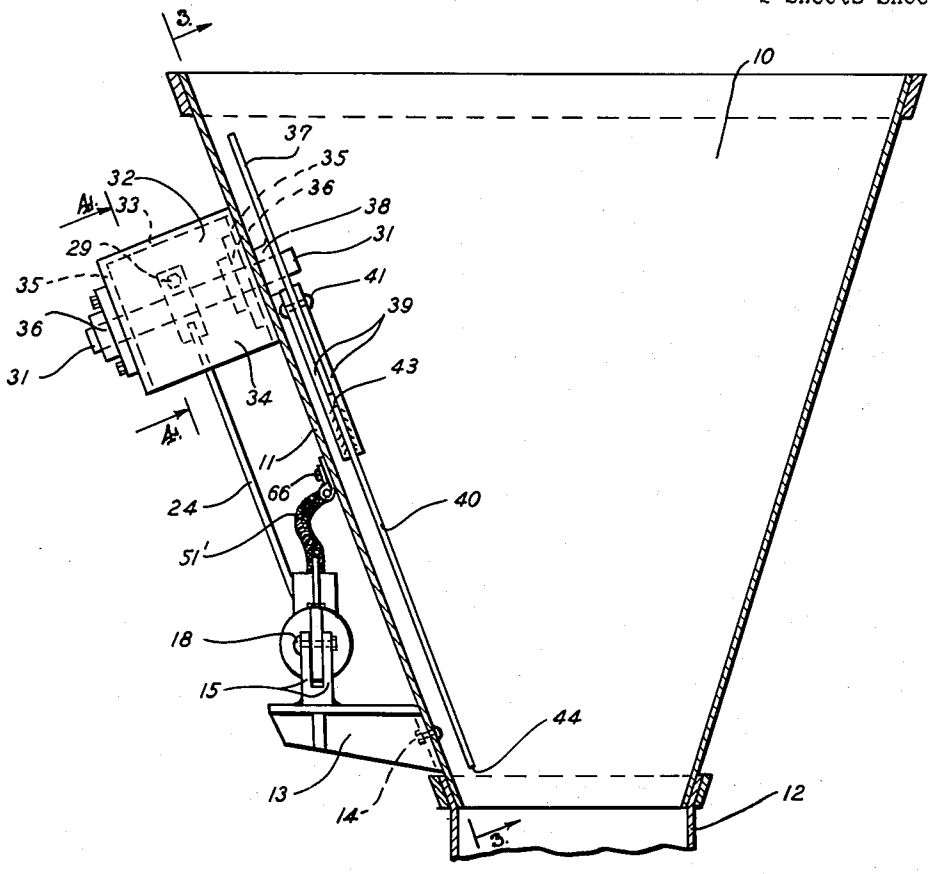


Fig. 2.

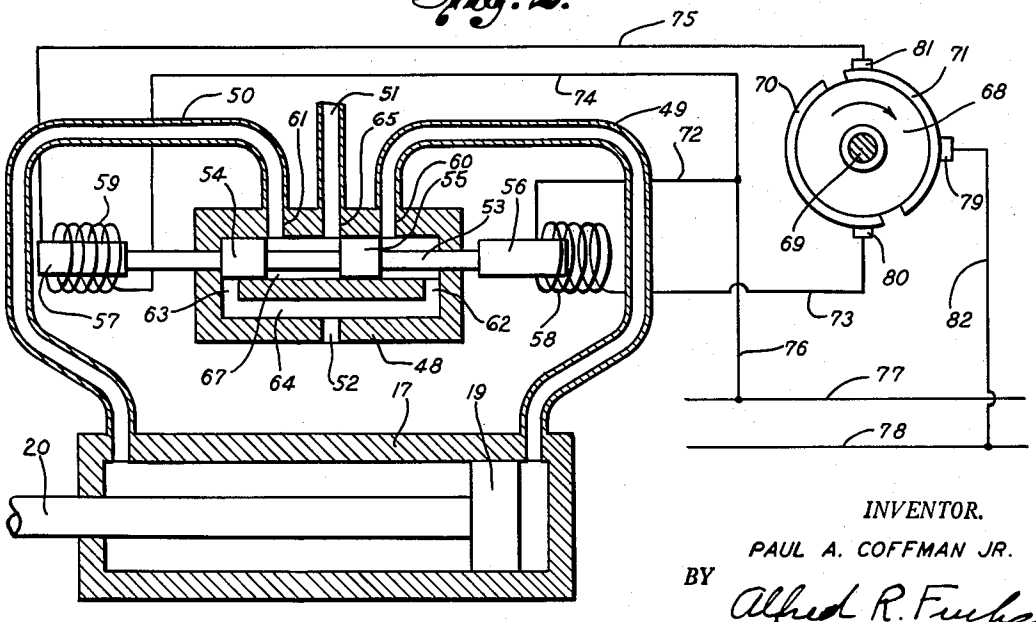


Fig. 5.

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PNEUMATICALLY OPERATED HOPPER AGITATOR

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Application March 27, 1953, Serial No. 345,143

11 Claims. (Cl. 222—409)

My invention relates to agitating devices, and more particularly to pneumatically operated hopper agitators.

It is a purpose of my invention to provide agitating means that is so constructed that it can be supplied as a unit for mounting on a hopper or storage bin with the agitating means inside said hopper or storage bin without making any alterations in the hopper or storage bin itself except to provide a mounting for the operating means and a shaft opening through the wall of the hopper, thus making it possible to mount the agitating means in any hopper or storage bin that has been previously constructed and which it is desired to supply with agitating means.

It is a further purpose of my invention to provide agitating means of the above mentioned character that is actuated by means of air under pressure operating on a piston in a cylinder, which has the advantage of limiting the amount of force that can be brought to bear on the agitator assembly, so that if the agitating means is overloaded no damage will be caused to any of the parts of the agitating means, as the air cylinder will automatically stall under such conditions.

It is a further purpose of my invention to provide agitating means of the above mentioned character which is inexpensive, inasmuch as the air pressure power unit requires no expensive mechanical or electrical equipment for the operation thereof and thus no such expensive mechanical or electrical equipment is required for operating the agitating means. The air pressure that is required to operate the agitating means is relatively low even in relatively large storage bins or hoppers, the air pressure ordinarily used being between twenty-five and thirty pounds per square inch.

Any suitable means for operating the pneumatic drive means for the agitating device can be provided, but preferably the air under pressure is supplied to the operating cylinder by means of a valve which is operated by means of a pair of solenoids, which solenoid valve means is controlled by a rotatable contact member, which may be rotated by any suitable means, such as by means of a feeding mechanism having a rotatable part to which the hopper or bin supplies material, or the rotatable contact means may be actuated by a synchronous motor that has a uniform speed, as is common in electric clock and similar mechanisms. If the rotatable contact member is operated from the feeding device the rate of agitation is obviously proportional to the rate of feeding, which is highly desirable.

More specifically it is a purpose of my invention to provide agitating means comprising a member mounted for oscillation about an axis and means for oscillating said member which is preferably pneumatic means, and agitating means suspended from said member that is mounted for oscillation in such a manner that said agitating members have a movement that is substantially up and down in the bin or hopper in which the agitating means is located. Preferably the mounting of the agitating means is such that the agitating members are

mounted so as to be pivotally suspended from the member that is mounted for oscillation and operate in a path that is substantially parallel to a wall of the hopper or similar member in which the agitating means is located.

It is a further purpose of my invention to provide agitating means comprising a disk-like member mounted to oscillate about an axis that is substantially perpendicular to the wall of a hopper or similar container having a pair of elongated plate-like members pivotally suspended from said disk-like member in a manner that these plate-like members move substantially edgewise of themselves near said wall and approximately parallel to said wall.

Because of the character of said agitating means and the manner in which the same is driven from air pressure actuated means, any desired number of said agitating devices can be associated with a hopper or bin as may be found desirable, that is, such agitating means may be provided on only one wall of a hopper or a pair of opposite walls, or all of the walls, or any number thereof, as may be found desirable, inasmuch as each agitating means and its drive as well as the controlling means therefor is a unit that is independent of the other agitating units.

Other objects and advantages of my invention will appear as the description of the drawings proceeds. I desire to have it understood, however, that I do not intend to limit myself to the particular details shown or described, except as defined in the claims.

In the drawings:

Fig. 1 is a view in side elevation of a hopper, showing my improved agitating means applied thereto and showing a fragmentary portion of a feeding device to which said hopper is adapted to supply material.

Fig. 2 is a vertical sectional view, partly broken away, of a hopper showing my improved agitating means applied thereto.

Fig. 3 is a view of the agitating means within the hopper, taken substantially on the line 3—3 of Fig. 2, the hopper itself being omitted.

Fig. 4 is a section taken on the line 4—4 of Fig. 2 and showing a fragmentary portion of the hopper wall, the driving means for the agitating device being partly broken away, and

Fig. 5 is a diagrammatic view of the air pressure cylinder and piston and controlling means therefor, on an enlarged scale.

Referring in detail to the drawings, my improved agitating means is shown as being applied to a hopper **10** having inclined walls, such as the wall **11**, and which hopper is adapted to supply material to any suitable device such as a feeding device for the material in the hopper, a fragmentary portion of said feeding device being indicated at **12** in Figs. 1 and 2, the feeding means utilized in said feeding device not being shown, as the particular type of feeding device that may be provided is of no particular importance to the invention.

Mounted in any suitable manner on the wall **11** is a bracket **13**, which may be of suitable design for securement in a convenient manner to the hopper wall **11**, the particular shape, size and character of the bracket being variable as may be desired to suit the requirements of the user and the type of bin or hopper wall to which the same may be secured. Said bracket is secured in any suitable manner, as by means of the bolts **14**, to the hopper wall **11**, and has a pair of upstanding ears **15** thereon, which are provided for pivotally connecting an endwise extending ear **16** on an air pressure cylinder **17** to the bracket. Any suitable pivot means, such as the headed pivot member **18**, may be provided for this purpose.

The air cylinder **17** has a piston **19** therein of any suitable character, there being many pneumatic or air

pressure cylinders of the type that may be utilized for this purpose commercially available that have suitable sealing means between the piston and the cylinder, and other refinements that are not shown and are not of any particular importance in connection with this invention. Connected with the piston 19 is a piston rod 20, which is mounted for reciprocation in the direction of the axis of the cylinder with the piston 19 and which operates through a suitable stuffing box 21 provided at one end of the cylinder 17.

Secured to the outer end of the piston rod 20 is a bracket 22, which has a pair of ears 23 thereon that extend on opposite sides of an arm 24 and are pivotally connected with said arm 24 by means of a pivot pin 25. The arm 24 is preferably made of a piece of flat metal and has a tapering form so as to decrease in width downwardly toward its connection with the piston rod 20. As will be apparent from Fig. 2, the arm 24 extends substantially parallel to the inclined wall 11 of the hopper 10, and it will be noted that the upper end of the arm 24 has a split block 26 welded thereto, said block being shown as being welded in a recess in the upper end of the arm 24 and the upper end of said arm 24 having tapering edges 27 that extend to the side edges of the block 26. Said block 26 is provided with a slot 28 therein to provide a pair of ears through which a clamping bolt 29 extends, and is provided with an arcuate opening 30 therein that is substantially a circle, except for the slot 28, and which receives a shaft 31. It will be obvious that the arm 24 can be clamped to the shaft 31 by means of the clamping bolt 29 so that movement of the arm 24 will move the shaft 31 therewith.

Secured to the outer face of the wall 11 in any suitable manner, as by welding, is a combined bearing bracket and housing 32, which is provided with a top wall 33, side walls 34 and end walls 35, one of which is secured to the inclined wall 11. Secured to the inner face of one of the walls 35 and the outer face of the other wall 35 are the bearings 36 for the shaft 31. Said shaft 31 thus is mounted for rotation about an axis perpendicular to the inclined wall 11.

The shaft 31 extends through an opening in the wall 11 and a predetermined distance into the hopper. Preferably the shaft 31 only extends a short distance into the hopper sufficient for mounting of the agitating means thereon. Said agitating means comprises a disk-like member 37, which has a hub portion 38 and which is keyed to the shaft 31. Thus the disk-like member, which is preferably made of a plate-like material, or heavy gauge sheet metal, is mounted to rotate with the shaft 31 about an axis perpendicular to the hopper wall 11 and is spaced only far enough from the wall 11 that the hub 38 can be accommodated between said wall 11 and the disk-like body portion of said member 37. It is desirable and necessary that the disk-like member 37 be spaced a predetermined distance from the hopper wall so that the agitating members, to be described below, can be provided adjacent the wall 11, but out of contact therewith. Also, while the parts 24 and 37 are adapted to rotate about the axis of the shaft 31, the movement that actually takes place of these parts is only a short oscillating movement due to the fact that the arm 24 is only moved through a relatively small arc by means of the reciprocable piston rod 20. The arcuate movements of the arm 24 are furthermore positively limited by the walls 34 of the combined housing and bracket 33.

Pivotally mounted on the disk 37 are paired bracket members 39, each pair of bracket members 39 being welded to an agitating plate 40 and each pair of bracket members 39 being secured pivotally to the disk 37 by means of headed pivot pins 41. The pivot pins 41 extend through openings in the disk 37 near but spaced from the periphery thereof and spaced equal distances

from the shaft 31 and thus from the axis of oscillation of the disk 37. Also said members are mounted, in the installation of the apparatus, so that in a mid position said pivot pins are below or on opposite sides laterally of the shaft 31, as will be obvious from Fig. 3. Thus, as one of the agitating members 40 is moved upwardly by rotation of the disk 37 in one direction about its axis, the other agitating member 40 will be moved downwardly due to such rotation of the disk 37, while upon rotation in the opposite direction the reverse movement of said members 40 will take place. Also, for any given arc of oscillation of the disk 37 the agitating members 40 will each move up and down the same amount. It will be obvious also that said agitating members 40 are of a plate-like character and are adapted to move up and down substantially parallel to the wall 11 as the disk 37 is oscillated, inasmuch as the same are suspended freely from the pivots 41, permitting such movement but confining the path of movement of the plate-like members 40 to such a path that these will not scrape or drag on the wall 11. The brackets 39 are preferably welded to the plate-like members 40 in the manner illustrated in Figs. 2 and 3, there being sufficient bearing between the flat faces of the bracket members 39 and the face of the disk 37 to hold the plate-like members 40 in substantially the position shown in the drawings.

Said plate-like agitating members 40 may be varied in shape, but preferably are provided with one longitudinal side edge 42 that extends perpendicularly to the end edges 43 and 44, and said edges 42 are adjacent so that said edges of the plate-like agitating members 40 will be substantially parallel and extend in a generally up and down direction relative to the hopper wall 11 during their up and down movements due to oscillation of the disk-like member 37. The opposite longitudinal edges 45 of said plate-like members preferably incline toward the edges 42 in the direction toward the bottom end edge 44 of each of said agitating members so that said edges 45 will be spaced substantially uniform distances from the walls of the hopper, that extend perpendicularly to the wall 11, during their up and down movements due to oscillation of the disk 37. The oscillation of the disk 37 is through a relatively small arc and thus, while the plate-like members 40 and the disk 37 lie in the same inclined plane, or substantially the same inclined plane, the end walls 43 will never engage with the peripheral edge of the disk 37 during movement of the parts. Preferably the edge portions between the inclined edge 45 and the end edge 43, as well as between the longitudinal edge 42 and the end edge 43 of each of said disks is inclined, said inclined edges being indicated by the numerals 46 and 47, respectively, said inclined edges serving to facilitate movement of the agitating means in an upward direction in the body of material in the hopper.

Suitable valve means 48 is mounted on the pneumatic cylinder 17, being provided with ducts 49 and 50 leading therefrom to opposite ends of the cylinder 17 to supply compressed air to and discharge air from said cylinder 17 in a well known manner. The valve mechanism 49 is preferably a double solenoid valve of suitable character, which is operated by suitable controlling means so as to operate the valve means in timed relation to a suitable rotatable controlling member, which may be driven in any suitable manner, as by means of part of a feeding mechanism to rotate in timed relation with said feeding means, or which may be rotated at a uniform rate in any suitable manner, as by means of a motor similar to an electric clock motor. The particular valve means 48 and the particular type of pneumatic cylinder 17 utilized may be varied as may be found desirable, and these parts are shown only in a diagrammatic manner in Fig. 5 of the drawings, it being understood that no particular commercial double solenoid valve device nor any particular commercial pneumatic cylinder is intended to be illustrated in said diagrammatic view. The ducts

49 and 50 are shown as entering opposite ends of the cylinder 17 so that air under pressure passing through the duct 49 will move the piston 19 to the left, as shown in Fig. 5, while air under pressure entering through the duct 50 will move the piston 19 toward the right, as shown in Fig. 5.

The valve 48 is shown as having an inlet pipe 51 for air under pressure leading onto the same and an air discharge opening 52 leading from the same. A movable valve assembly 53 is shown diagrammatically in Fig. 5 as having a pair of slide valve members 54 and 55 mounted thereon in predetermined relative relationship to each other, and as being provided with cores 56 and 57 for the solenoids that have the windings 58 and 59, respectively. The valve body is also shown as being provided with passages 60 and 61 leading, respectively to the conduits or pipes 49 and 50, and with passages 62 and 63 leading to the common passage 64 to the discharge outlet 52, as well as a passage 65 leading from the air pressure inlet pipe 51 into the body of the valve, in which the valve members 54 and 55 are slidably mounted.

The inlet pipe includes a flexible conduit portion 51', which extends from the bracket 66 mounted on the wall 11 to the valve member 48 and is provided with sufficient slack therein to permit the necessary movements of the cylinder 17 about the pivot 18. It will be obvious that when the winding 58 is energized the core 56 will be moved to the right from the position shown in Fig. 5, moving the valve members 54 and 55 to the right until the valve member 55 engages the end of the housing for the valve, while, when the winding 59 is energized the core 57 will be moved into the position shown in Fig. 5 from the position it would assume when the member 55 is in engagement with the end of the valve casing or housing. When the parts are in the position shown in Fig. 5 it will be obvious that a connection is provided between the compressed air line 51 through the bore 67 in the valve body to the conduit 50 and this causes air under pressure to be introduced into the cylinder at the left hand end thereof, moving the piston 19 to the right, as shown in Fig. 5. At the same time the conduit 49 is open through a portion of the bore 67 and the passages 62 and 64 to the outlet 52. Upon energization of the winding 58 the position of the parts is changed so that the compressed air conduit 51 is connected with the conduit 49 and the piston 19 is moved from the position shown in Fig. 5 to the right hand end of the cylinder 17, while the conduit 50 is connected with the discharge opening 52 through the bore 67 and the openings 63 and 64 in an obvious manner. The pipe or conduit 51 is connected with any suitable source of air under pressure.

Any suitable means can be provided for energizing the windings 58 and 59 alternately. Preferably this is accomplished by means of a rotatable member 68, which may be rotated along with some rotating part of the feeding mechanism of the feeder 12, if desired, or by any other suitable driving means that rotates the shaft 69 on which the rotatable member 68 is mounted. The rotatable member 68 is shown as being provided with a pair of contacts 70 and 71, which may be of any desired length to provide for energization of the solenoids for the necessary length of time to properly operate the valves for operating the air pressure cylinder 17 to cause reciprocation of the piston rod 20 and thus oscillation of the disk 37 and the up and down reciprocating movement of the agitating members 40.

As shown diagrammatically in Fig. 5, conductors 72 and 73 extend from the winding 58 and conductors 74 and 75 extend from the winding 59. A common conductor 76 connects the conductors 72 and 74 with one of the line wires 77. The other line wire 78 has a conductor extending therefrom to a stationary contact member 79. A stationary contact member 80 is connected with the conductor 73 and a stationary contact member 81 is connected with the conductor 75. In the position of the parts shown in Fig. 5 the winding 59 has been energized and is still being energized, this being accomplished due to the fact that the circuit from the line wire 78 is completed to the contacts 79 through the conductor 82, then through the movable contact member 71 to the stationary contact 81 and the conductor 75 to the winding 59, and the other line wire 77 is connected with the other end of the winding 59 through the conductors 76 and 74. This would continue until the movable contact member 71 has left the stationary contact 81, whereupon the winding 59 is de-energized. However, the winding 58 will not be energized until the contact member 71 has reached the position where it would bridge the gap between the stationary contacts 79 and 80, whereupon the circuit would be completed from the line wire 78 through the conductor 82, stationary contact 79, movable contact 71, stationary contact 80 and conductor 73 to one end of the winding 58 and through the conductors 72 and 76 from the other line wire 77 to the other end of the winding 58. Similarly the other contact member 70 would operate to bridge the contacts 81 and 79 after the contact member 71 has passed to such a position as to break the circuit between the contacts 79 and 80 and said contact member 70 will bridge the contacts 79 and 80 after it has left the contact 81 in a similar manner to that described in connection with the contact member 71. As a result, the windings 59 and 58 will be alternately energized by rotation of the contact carrying member 68 carrying the movable contact members 70 and 71, and if said rotatable contact member 68 is rotated in proportion to the operation of a feeding device the frequency with which the piston 19 is reciprocated and thus the agitating members 40 are reciprocated would be in proportion to the feeding action of the feeding device.

What I claim is:

1. Agitating means comprising an elongated flat plate-like member and means for moving said plate-like member up and down longitudinally edgewise of itself comprising a flat, plate-like member mounted in longitudinal alignment with said plate-like member for oscillation about an axis extending transversely to the direction of movement of said plate-like member, means for oscillating said last mentioned member, pivot means on said last mentioned member spaced from said axis and paired brackets rigidly mounted on said plate-like member and embracing said last mentioned member, said brackets being mounted on said pivot means to suspend said elongated plate-like member from said last mentioned member.

2. Agitating means comprising a flat plate-like member and means for moving said plate-like member up and down edgewise of itself comprising a flat disk mounted for oscillation about an axis extending transversely to the direction of movement of said plate-like member, means for mounting said plate-like member in the same plane as said disk, means for oscillating said disk and pivot means on said disk spaced from said axis, from which said plate-like member is suspended by said mounting means.

3. Agitating means comprising an elongated flat plate-like member and means for moving said plate-like member up and down longitudinally edgewise of itself comprising a flat disk mounted in longitudinal co-planar alignment with said plate-like member for oscillation about an axis extending transversely to the direction of movement of said plate-like member, means for oscillating said disk and pivot means on said disk spaced from said axis, from which said plate-like member is suspended in spaced relation to said disk, said pivot means having its axis parallel to the axis of oscillation of said disk.

4. The combination with a hopper of agitating means therein adjacent a wall thereof comprising a member mounted in said hopper adjacent said wall for oscillation about an axis extending substantially perpendicularly to said wall, means for oscillating said member, and agitat-

ing members suspended from said first mentioned member to extend substantially parallel to said wall adjacent the inner face thereof.

5. The combination with a hopper of agitating means therein adjacent a wall thereof comprising an elongated flat plate-like member and means for moving said plate-like member up and down adjacent said wall substantially parallel to said wall edgewise of itself comprising a member extending parallel to said wall and mounted adjacent said wall for oscillation about an axis extending perpendicularly to said wall, means for oscillating said last mentioned member and pivot means on said last mentioned member spaced from said axis, from which said plate-like member is suspended in spaced relation to said last mentioned member in co-planar alignment therewith.

6. The combination with a hopper of agitating means therein adjacent a wall thereof comprising a plate-like member adjacent said wall, a member from which said plate-like member is suspended, a shaft extending through said wall having said last mentioned member fixed thereto within said hopper adjacent said wall to rotate therewith, means externally of said wall for mounting said shaft, an arm fixed to said shaft externally of said wall, and means for oscillating said arm comprising a longitudinally reciprocable member pivotally connected with said arm and air pressure actuated means for reciprocating said reciprocable member.

7. The combination with a hopper of agitating means therein adjacent a wall thereof comprising a plate-like member, a member from which said plate-like member is suspended, a shaft extending through said wall having said last mentioned member fixed thereto adjacent said wall to rotate therewith, means for mounting said shaft externally of said wall, an arm fixed to said shaft, and means for oscillating said arm comprising a reciprocable member pivotally connected with said arm and air pressure actuated means for reciprocating said reciprocable member including a cylinder pivotally mounted on said hopper.

8. The combination with a hopper of agitating means therein adjacent a wall thereof comprising a plate-like member, a member from which said plate-like member is suspended, a shaft extending through said wall having said last mentioned member fixed thereto adjacent said wall to rotate therewith, means for mounting said shaft externally of said wall, an arm fixed to said shaft, and

means for oscillating said arm comprising a reciprocable member pivotally connected with said arm, air pressure actuated means for reciprocating said reciprocable member pivotally mounted on said hopper and driven means controlling the operation of said air pressure actuated means.

9. The combination with a hopper having a flat wall, of agitating means therein adjacent said wall comprising a flat, plate-like member mounted in said hopper adjacent the inner face of and parallel to said wall for oscillation about an axis, air pressure actuated means for oscillating said member, and flat plate-like agitating members suspended from said first mentioned member to extend substantially parallel to said wall adjacent the inner face thereof.

10. The combination with a hopper having an inclined wall, of agitating means therein adjacent said wall comprising a flat disk adjacent the inner face of said wall, extending parallel thereto and mounted for oscillation about an axis extending substantially perpendicularly to said wall through the center of said disk, means for oscillating said disk, and agitating members adjacent the inner face of said wall suspended from said disk below said axis and extending substantially parallel to said wall.

11. The combination with a hopper, of agitating means therein adjacent a wall thereof comprising a plate-like member adjacent the inner face of said wall, a member from which said plate-like member is suspended, a shaft extending through said wall having said last mentioned member fixed thereto within said hopper adjacent the inner face of said wall to rotate therewith, means externally of said wall for mounting said shaft, an arm fixed to said shaft externally of said wall, and means for oscillating said arm.

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