

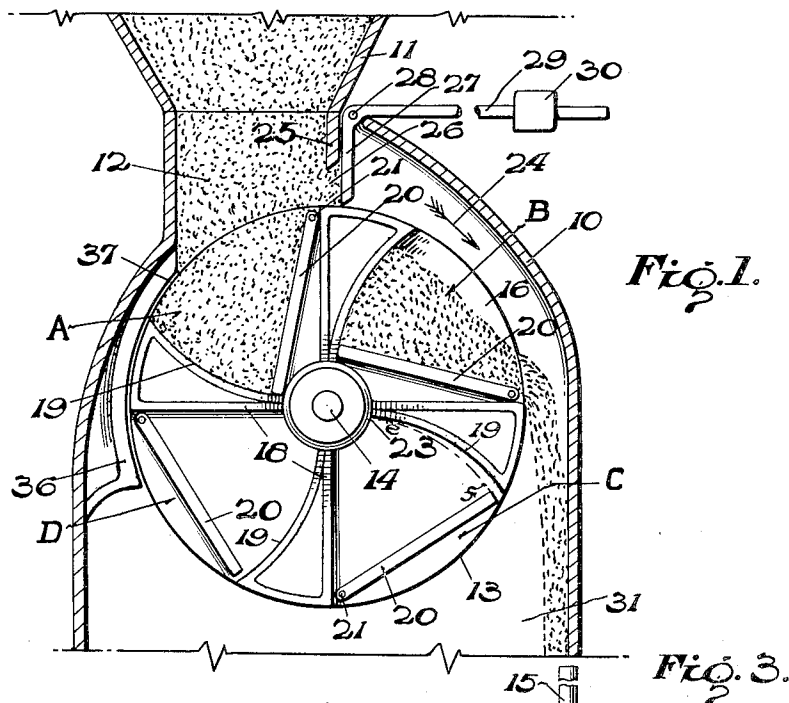
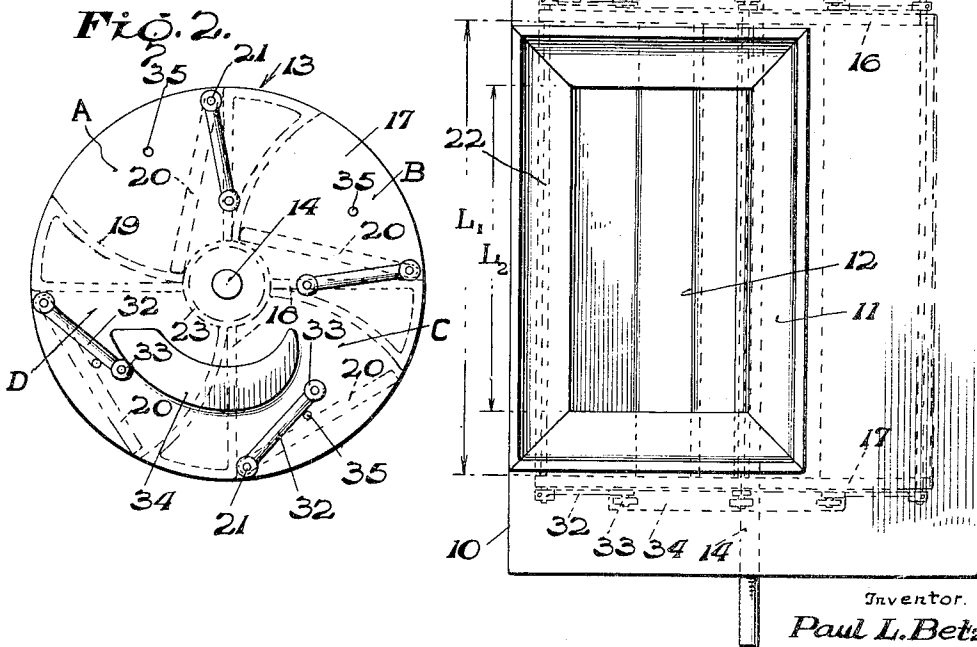
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MATERIAL FEEDING DEVICE

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MATERIAL FEEDING DEVICE

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This invention relates to material feeding devices, and more particularly to material feeding devices of the drum type including buckets, pockets, or the like, hereinafter referred to generically as "buckets," for receiving and transporting the material to be fed.

In the feeding of coal in power plants using pulverized fuel, it is desirable if not necessary that the fuel be supplied to the fuel preparation equipment at a substantially uniform rate, and to this end coal feeding devices are employed for delivering the coal from any suitable source to appropriate pulverizing mills. In feeding devices of this character there is an increasing tendency for the coal to cake as the degree of fineness of the coal increases, and this is especially true if the moisture content of the coal increases, so that a point may be reached at which, due to caking, the feeders fail to deliver coal at anything approximating a uniform rate. Various proposals have heretofore been made to overcome this difficulty, including the use of compressed air to aid in emptying the buckets, but so far as I am aware no entirely satisfactory solution for this problem has heretofore been disclosed.

It is an object of the present invention to provide an improved material feeding device which, while of wide utility in feeding a variety of granular materials as will hereinafter appear, is particularly adapted to overcoming the difficulties heretofore encountered in the feeding of fuel as above referred to.

Another object of this invention is to provide a device of the type just characterized wherein at least one wall of each bucket is movable with respect to other walls when emptying position is reached so as to assure full discharge of the transported material from the bucket.

Another object of this invention is to provide a device of the type last characterized wherein the movable wall normally displaces the material from the bucket by gravity but means are provided for positively actuating said movable wall in the event that the bucket is not properly emptied when emptying position is reached because of caking of the material or for other reasons.

Another object of this invention is to provide a device of the type first characterized wherein provision is made for leveling the material in each bucket when the bucket is filled but including provisions whereby such leveling action avoids increasing the tendency of the material to cake or stick.

Another object of this invention is to provide a

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device of the type last characterized wherein the leveling device is made yieldable so that the feeding device will not jam in the event that there are non-displaceable lumps projecting above the mouth of the bucket.

Another object of this invention is to provide a device of the type above characterized which includes provisions for removing from the displaceable wall of each bucket material adhering thereto.

Another object of this invention is to provide a device of the type characterized which is strong and rugged, but simple in construction, and certain and efficient in operation.

Other objects will appear as the description of the invention proceeds.

The invention is capable of receiving a variety of mechanical expressions one of which is illustrated diagrammatically on the accompanying drawings, but it is to be expressly understood that the drawings are for purposes of illustration only, and are not to be constructed as a definition of the limits of the invention, reference being had to the appended claims for that purpose.

Referring in detail to the drawings wherein the same reference characters are employed to designate corresponding parts of the several figures,

Fig. 1 is a diagrammatic vertical section of an embodiment of the present invention;

Fig. 2 is a diagrammatic end view of the drum of the embodiment of Fig. 1 with its associated cam for positively displacing the movable wall of each bucket; and

Fig. 3 is a plan view of the embodiment of Fig. 1.

In the form shown the material feeding device of the present invention includes a casing 10 of any suitable size, construction and material provided with an inlet passage 11, shown as a hopper leading to a throat 12, said hopper being in communication with any suitable source of the material to be fed, such as coal. Mounted within the interior of said casing 10 is a drum 13 of any suitable size, construction and material and so disposed that the throat 12 of the inlet passage is eccentrically disposed with respect thereto. Drum 13 is mounted on and for rotation with a suitable shaft 14 which extends through the wall of the casing 10, as shown at 15, where it is provided with any suitable means for rotating the same. As shown, said drum comprises circular end members 16 and 17 between which extend walls 18 suitably fixed to said end members and dividing the space therebetween into any suitable

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number of buckets, here shown as four in number and designated A, B, C and D.

Each bucket is provided with a movable wall 20, shown as pivotally mounted at 21 adjacent to the mouth of the bucket. As here illustrated each movable wall 20 is mounted on a shaft 22 providing the pivotal axis 21, said shaft extending through and to the outside of the end members 16 and 17 for a purpose hereinafter explained. Each movable wall 20 is mounted so that it can move by gravity to a material discharging position as hereinafter pointed out, but when in the position providing maximum receiving capacity for the bucket, as shown at positions A and B in Fig. 1, the free end of the movable wall 20 rests on a sleeve 23 concentric with and carried in any suitable way by the shaft 14, as by spiders (not shown). Therefore, as shown at position A in Fig. 1, each bucket in its material receiving position is defined by the end members of the drum 16 and 17, the stationary wall 19 (described below) carried by said end members, and the pivotally mounted movable wall 20 also carried by said end members.

In its movement from material receiving to material discharging position, the free end of the movable wall 20 describes an arc about axis 21 as a center. This is shown for bucket C in Figure 1 by dot-dash line *e-f*. Each bucket is also provided with a fixed wall 19 that cooperates with the free end of movable wall 20. While wall 19 may be shaped in any suitable manner, a preferred construction is indicated in Figs. 1 and 2 and provides that the intervening space between wall 19 and the arc *e-f* swept out by the end of movable wall 20 increases in thickness toward the circumference of drum 13, thereby reducing the tendency of the material to jam between the said wall 19 and the free end of movable wall 20.

Drum 13 is mounted, in the embodiment illustrated in the drawings, for rotation in a clockwise direction as indicated by the arrow 24, and the wall 25 defining the throat on that side thereof toward which the drum is rotating is terminated short of the periphery of the drum so as to provide an opening 26. Opening 26 is normally closed by a movably mounted gate member 27, here shown as pivoted at 28 in any suitable way, and normally urged in any appropriate manner toward its position for closing said opening 26. While a spring or the like may be used for this purpose, the embodiment illustrated on the drawings includes an arm 29 projecting approximately at right angles from said gate and carrying a counterweight 30 which may be adjusted lengthwise of the arm so as to interpose the desired resistance to the displacement of the gate 27. In normal operation the material which has filled a bucket at position A in Fig. 1 is leveled by the gate member 27 as the drum rotates in a clockwise direction with respect thereto. However, if a large lump of the transported material, such as coal, projects beyond the periphery of the drum 13 and is so embedded in the material in the bucket that the gate 27 cannot displace the same, rotary displacement of the drum will cause such lump to contact and displace the gate member 27 against the action of the counterweight 30, thereby avoiding any jamming of the feeding device as might otherwise occur.

When a bucket reaches the position designated B in Fig. 1 the material therein if free to flow normally starts to pour out of the bucket to and

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through the outlet passage 31 of the casing, and if the material flows freely, the movable wall 20 of each bucket will swing, by the action of gravity, around its pivot 21, from the position shown at B in Fig. 1 to the position shown at C in Fig. 1, said movable wall 20 thereby moving to the mouth of the bucket to effect discharge of the contents thereof.

If, owing to a tendency of such material to cake or stick, the movable wall 20 does not so move to discharging position, means are provided for positively moving such movable wall to said discharging position. To this end each of the movable walls is provided with cam operated means for positively displacing the same. While for some purposes it may be sufficient to provide such cam operated means at one end of the drum, it is preferred to provide cam mechanism at both ends of the drum so as to apply balanced forces to the movable walls 20. As illustrated, each shaft 22 projects beyond the end members 16 and 17 of the drum and has suitably attached thereto, at each end of the shaft, a crank arm 32 shown as provided with a suitable cam follower, as a roller 33. Suitably supported from the walls of the casing 10 at each end of the drum, in position for cooperation with the cam followers 33, is a stationary cam member 34 of a shape such as generally indicated in Fig. 2. As shown in Fig. 2, each arm 32, when the movable wall 20 of the bucket is in the position indicated at A in Fig. 1, extends approximately radially downwardly and inwardly. If the movable wall 20 moves by gravity as heretofore explained, movement of said movable wall 20 to discharging position causes each associated arm 32 to move against a suitable stop 35 provided exteriorly on the end member of the drum, thereby stopping the movable wall 20 at its discharging position, as shown at position C in Fig. 2. If, however, owing to the caking or sticking of the material in the bucket movement of the movable wall 20 to discharging position is prevented, each cam follower 33 associated with a movable wall 20 is thereupon engaged by the periphery of the associated cam 34 and positively displaced so that the associated arm or arms move wall 20 to its discharging position as indicated at position D in Fig. 2.

In order to remove at least the major portion of the material in the event it should adhere to the movable wall 20, in which case the adherent material would project beyond the periphery of the drum, any suitable means such as diagrammatically indicated at 36 may be mounted on the wall of the casing 10 so as to project toward and into proximity with the periphery of drum 13 and thereby scrape away such adherent and projecting material that does not fall by gravity into the outlet passage 31 of the casing. During this scraping action, as will be apparent by comparing Figs. 1 and 2, movable wall 20 is positively held in position for cooperation with the scraper 36 by the coaction of the cams 34 with the associated arms 32.

As shown in Fig. 3, the dimension of the throat 12 in the direction of the axis of the drum is less than the axial dimension of each bucket, as is apparent from comparing the dimensions designated L_1 and L_2 which are respectively the axial length of the bucket and the corresponding dimension of the throat. Thereby the material flowing into each bucket tends to leave an unfilled space at both ends of the bucket, which space will vary with the angle of repose of the

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material being handled and the difference between dimension L_1 and L_2 , but which can be selected with regard to the amount of material which will normally be displaced by the leveling member 27. Such unfilled spaces at the ends of each bucket enable the member 27 to even off the top of the bucket by displacing material into said spaces, without packing the material into the bucket, whereby a more uniform feeding of the material is assured.

In operation the material to be fed flows through throat 12 into a bucket at position A, in which position the movable wall 20 is resting against the sleeve 23, to which position it has moved by the action of gravity or of the incoming material. The bucket is then at its maximum capacity. In this position of the bucket the clearance 37 between the periphery of the drum and the opposed wall of the casing, or suitable means mounted thereon, is such as to minimize escape of material between the drum and the casing wall on the nondischarging side of the drum. As the bucket moves from the position A to the position B the gate 27 levels off the material at the mouth of the bucket, displacing the material into the spaces at the ends of the bucket due to the difference in dimensions L_1 and L_2 above referred to, and assuring that a full bucket carrying a substantially constant predetermined quantity of material shall pass out from under the throat 12. However, if a lump should become embedded in this material so that it cannot be displaced by the gate 27, the latter can yield, as before explained, without jamming the machine.

When the bucket reaches the position B in Fig. 1 the material normally starts to pour therefrom, and as it passes to position C in Fig. 1 the movable wall 20 tends to move by gravity to the mouth of the bucket, displacing the entire content of the bucket, said wall being stopped at the mouth of the bucket by the engagement of its associated arm or arms 32 with the stop or stops 35. However, if the material in the bucket resists the gravity displacement of the movable wall 20 the associated crank arm or arms 32 engage the cam or cams 34 as the bucket moves from position C to position D in Fig. 1, thereby positively displacing the movable wall 20 to its discharging position and assuring that the bucket is emptied. In this latter position and while the movable wall is held stationary by the cam 34 said movable wall cooperates with the scraper 36 to remove material adherent to the wall. The bucket then returns from position D to position A in Fig. 1, the movable wall 20 moving by gravity or otherwise to its fully open position to receive a new charge from the throat 12. Thereby a substantially uniform feed is maintained irrespective of the fineness or moisture content of the material or any tendency it may have to cake or adhere to the walls of the bucket.

Material feeding devices in conformity with the present invention possess the further advantage that they may be readily adapted to installations requiring a pressure sealing construction where, as disclosed in the application of Betz and Karrer, Serial No. 645,864, filed February 6, 1946, pressure sealing chute feeders are desired. In such cases it is necessary to take precautions against air leakage around the bearings of the shaft 14 and at the gate member 27, air leakage through the throat 12 being prevented by the material filling the same.

However, while the present invention is of par-

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ticular utility in feeding coal as heretofore explained, it is to be expressly understood that the invention is not restricted thereto, as it possesses wide utility in feeding a wide variety of other materials, and particularly in overcoming difficulties heretofore encountered in obtaining substantially uniform feeding where the material has a tendency to cake or stick.

It will therefore be perceived that by the present invention a material feeding device has been provided which assures substantially uniform feed by providing each bucket with a movable wall that normally moves to a predetermined discharging position by gravity but which is positively moved to such position in the event that such wall fails to move to such position by gravity because of the characteristics of the material in the bucket. Means have also been provided for leveling the top of the material in the bucket without packing the material therein, and also without causing jamming of the device in the event that embedded material projects above the mouth of the bucket. The device is simple and rugged in construction, and it is certain and efficient in operation.

While the embodiment of the invention illustrated on the drawings has been described with considerable particularity it is to be expressly understood that the invention is not limited thereto, as the same is capable of receiving a variety of mechanical expressions, as will now be apparent to those skilled in the art, while changes may be made in the details of construction, arrangement, proportion, etc., and certain features may be used without other features, without departing from the spirit of this invention. Reference is therefore to be had to the claims hereto appended for a definition of said invention.

What is claimed is:

1. In a material feeding device of the type including a casing providing inlet and outlet passages and a rotatable drum mounted in said casing between said passages, said drum including a plurality of buckets for receiving material from said inlet passage, each of said buckets including at least one movable wall pivoted at one edge on said drum and having its edge opposite said pivoted edge unconnected and free to swing within said bucket, whereby said wall is movable from a position in which the bucket has maximum capacity to a position of minimum capacity for discharging material from said bucket, and means for moving each of said movable walls to its discharging position when the corresponding bucket is in communication with the outlet passage.

2. In a material feeding device of the type including a casing providing inlet and outlet passages and a rotatable drum mounted in said casing between said passages, said drum including a plurality of buckets for receiving material from said inlet passage, each of said buckets including at least one movable wall pivoted at one edge on said drum and having its edge opposite said pivoted edge unconnected and free to swing within said bucket, whereby said wall is movable from a position in which the bucket has maximum capacity to a position of minimum capacity for discharging material from said bucket, and means for moving each of said movable walls to its discharging position when the corresponding bucket is in communication with the outlet passage, each of said movable walls being movable by gravity to its discharging position when the content of the bucket flows freely and displaceable by said last

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named means when full displacement of said movable wall is opposed by the content of the bucket.

3. In a material feeding device of the type including a casing providing inlet and outlet passages and a rotatable drum mounted in said casing between said passages, said drum including a plurality of buckets for receiving material from said inlet passage, each of said buckets including at least one movable wall pivoted at one edge on said drum adjacent the periphery of the latter and having its edge opposite said pivoted edge unconnected and free to swing within said bucket toward and away from the periphery of said drum, whereby said wall is movable from a position in which the bucket has maximum capacity to a position of minimum capacity for discharging material from said bucket, means for moving each of said movable walls to its discharging position when the corresponding bucket is in communication with the outlet passage, each of said movable walls being provided with a crank arm, and a stationary cam mounted exteriorly of the drum and cooperating with each crank arm for positively displacing the associated movable wall to discharging position.

4. In a material feeding device of the type including a casing providing inlet and outlet passages and a rotatable drum mounted in said casing between said passages, said drum including a plurality of buckets for receiving material from said inlet passage, each of said buckets including at least one movable wall pivoted at one edge on said drum adjacent the periphery of the latter and having its edge opposite said pivoted edge unconnected and free to swing within said bucket toward and away from the periphery of said drum, whereby said wall is movable from a position in which the bucket has maximum capacity to a position of minimum capacity for discharging material from said bucket, means for moving each of said movable walls to its discharging position when the corresponding bucket is in communication with the outlet passage, and means cooperating with each bucket as it moves out of communication with said inlet passage for leveling the material at the top of the bucket.

5. In a material feeding device of the type including a casing providing inlet and outlet passages and a rotatable drum mounted in said casing between said passages, said drum including a plurality of buckets for receiving material from said inlet passage, each of said buckets including at least one movable wall pivoted at one edge on said drum adjacent the periphery of the latter and having its edge opposite said pivoted edge unconnected and free to swing within said bucket toward and away from the periphery of said drum, whereby said wall is movable from a position in which the bucket has maximum capacity to a position of minimum capacity for discharging material from said bucket, means for moving each of said movable walls to its discharging position when the corresponding bucket is in communication with the outlet passage, and means cooperating with each bucket as it moves out of communication with said inlet passage for leveling the material at the top of the bucket, the axial length of said inlet passage being less than the axial length of the buckets, whereby end spaces are left in the buckets into which material may be displaced by said leveling means.

6. In a material feeding device of the type including a casing providing inlet and outlet passages and a rotatable drum mounted in said cas-

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ing between said passages, said drum including a plurality of buckets for receiving material from said inlet passage, each of said buckets including at least one movable wall pivoted at one edge on said drum adjacent the periphery of the latter and having its edge opposite said pivoted edge unconnected and free to swing within said bucket toward and away from the periphery of said drum, whereby said wall is movable from a position in which the bucket has maximum capacity to a position of minimum capacity for discharging material from said bucket, means for moving each of said movable walls to its discharging position when the corresponding bucket is in communication with the outlet passage, and means cooperating with each bucket as it moves out of communication with said inlet passage for leveling the material at the top of the bucket, said leveling means including a pivotally mounted gate and means associated therewith for normally holding said gate in leveling position but yieldable when engaged by resistant lumps projecting above the mouth of the bucket.

7. In a material feeding device of the type including a casing providing inlet and outlet passages and a rotatable drum mounted in said casing between said passages, said drum including a plurality of buckets for receiving material from said inlet passage, each of said buckets including at least one movable wall pivoted at one edge on said drum and having its edge opposite said pivoted edge unconnected and free to swing within said bucket, whereby said wall is movable from a position in which the bucket has maximum capacity to a position of minimum capacity for discharging material from said bucket, means for moving each of said movable walls to its discharging position when the corresponding bucket is in communication with the outlet passage, and means cooperating with each movable wall in its last named position for removing material that may adhere to said wall and projecting beyond the periphery of said drum.

8. In a material feeding device of the type including a casing providing inlet and outlet passages and a rotatable drum mounted in said casing between said passages, said drum including a plurality of buckets for receiving material from said inlet passage, each of said buckets including at least one movable wall movable from a position in which the bucket has maximum capacity to a position of minimum capacity for discharging material from said bucket, means for moving each of said movable walls to its discharging position when the corresponding bucket is in communication with the outlet passage comprising, a crank arm associated with each of said movable walls, a stationary cam mounted exteriorly of said drum and cooperating with each crank arm to positively displace said movable wall to its discharging position, and means cooperating with said movable wall for removing material adherent thereto and projecting beyond the periphery of said drum while said wall is held in discharging position by said cam.

9. In a material feeding device of the type including a casing providing inlet and outlet passages and a rotatable drum mounted in said casing between said passages, said drum including a plurality of buckets for receiving material from said inlet passage, each of said buckets including at least one movable wall pivoted at one edge on said drum and having its edge opposite said pivoted edge unconnected and free to swing within said bucket, whereby said wall is movable from

a position in which the bucket has maximum capacity to a position of minimum capacity for discharging material from said bucket, means for moving each of said movable walls to its discharging position when the corresponding bucket is in communication with the outlet passage, each of said movable walls being pivotally mounted on the ends of the drum adjacent the mouth of the associated bucket whereby when the bucket is inverted said movable wall may fall by gravity to the discharging position.

10. In a material feeding device of the type including a casing providing inlet and outlet passages and a rotatable drum mounted in said casing between said passages, said drum including a plurality of buckets for receiving material from said inlet passage, each of said buckets including at least one movable wall movable from a position in which the bucket has maximum capacity to a position of minimum capacity for discharging material from said bucket, means for moving each of said movable walls to its discharging position when the corresponding bucket is in communication with the outlet passage, each of said movable walls being pivotally mounted on the ends of the drum adjacent the mouth of the associated bucket whereby when the bucket is inverted said movable wall tends to fall by gravity to a discharging position, an arm mounted on the pivot of each movable wall exteriorly of said drum, and means in the path of movement of each arm for stopping said arm when the associated movable wall has reached its discharging position.

11. In a material feeding device of the type including a casing providing inlet and outlet passages and a rotatable drum mounted in said casing between said passages, said drum including a plurality of buckets for receiving material from said inlet passage, each of said buckets including at least one movable wall movable from a position in which the bucket has maximum capacity to a position of minimum capacity for discharging material from said bucket, means for moving each of said movable walls to its discharging position when the corresponding bucket is in communication with the outlet passage, each of said movable walls being pivotally mounted on the ends of the drum adjacent the mouth of the associated bucket whereby when the bucket is inverted said movable wall may fall by gravity to a discharging position, an arm mounted on the pivot of each movable wall exteriorly of said drum, a stationary cam exteriorly of said drum cooperating with each arm for positively displacing said arm to the discharging position of the associated movable wall if said wall does not move to that position by gravity, and means in the past of movement of each arm for stopping said arm when the associated movable wall has reached its discharge position.

12. In a material feeding device of the type including a casing providing inlet and outlet passages and a rotatable drum mounted in said cas-

ing between said passages, said drum including a plurality of buckets for receiving material from said inlet passage, each of said buckets including at least one movable wall pivoted at one edge on said drum and having its edge opposite said pivoted edge unconnected and free to swing within said bucket, whereby said wall is movable from a position in which the bucket has maximum capacity to a position of minimum capacity for discharging material from said bucket, means for moving each of said movable walls to its discharging position when the corresponding bucket is in communication with the outlet passage, each of said movable walls being pivotally mounted at its edge adjacent the mouth of the associated bucket and movable by gravity to said position affording maximum capacity for the bucket, and means cooperating with the free edge of each movable wall for predetermining its position affording maximum capacity.

13. In a material feeding device of the type including a casing providing inlet and outlet passages and a rotatable drum mounted in said casing between said passages, said drum including a plurality of buckets for receiving material from said inlet passage, each of said buckets including a movable wall pivoted at one edge on said drum adjacent the periphery of the latter and having its edge opposite said pivoted edge unconnected and free to swing within said bucket toward and away from the periphery of said drum, whereby said wall is movable from a position in which the bucket has maximum capacity to a position of minimum capacity for discharging material from said bucket and each of said buckets including a fixed wall cooperating with the free edge of said movable wall to define with the end walls of the bucket the capacity thereof, said fixed wall having an arcuate surface conforming approximately with the arc of movement of the free edge of said movable wall but departing progressively from the arc of movement of said free edge to provide a radially increasing space between said arcuate surface and the free edge of said movable wall as the latter approaches its position defining the minimum capacity of said bucket, and means for moving each of said movable walls to its discharging position when the corresponding bucket is in communication with the outlet passage.

PAUL L. BETZ.

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