Sept. 11, 1962 P. V. HOLOPAINEN 3,052,996

DEVICE FOR RECEIVING, TRANSPORTING AND DISCHARGING GRANULAR AND POWDERY MATERIALS

Filed Jan. 18, 1960 3 Sheets-Sheet 1

Fig. 1.

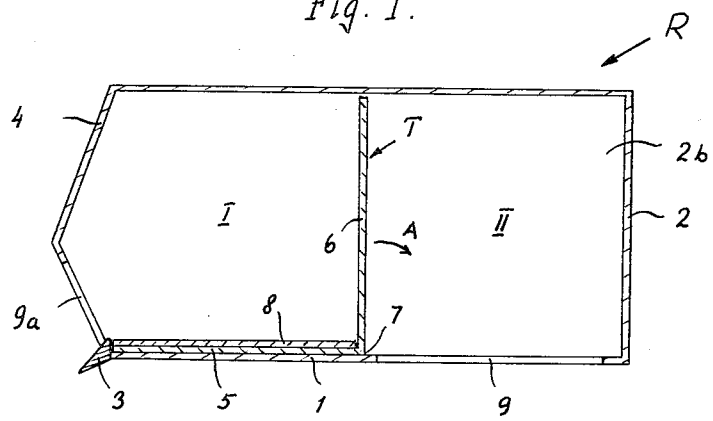
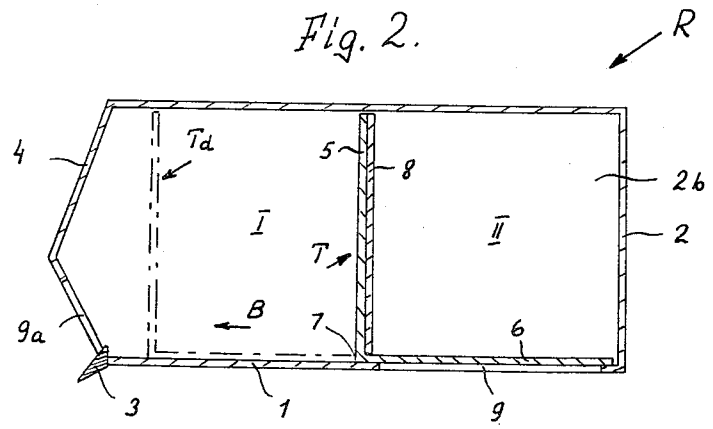


Fig. 2.



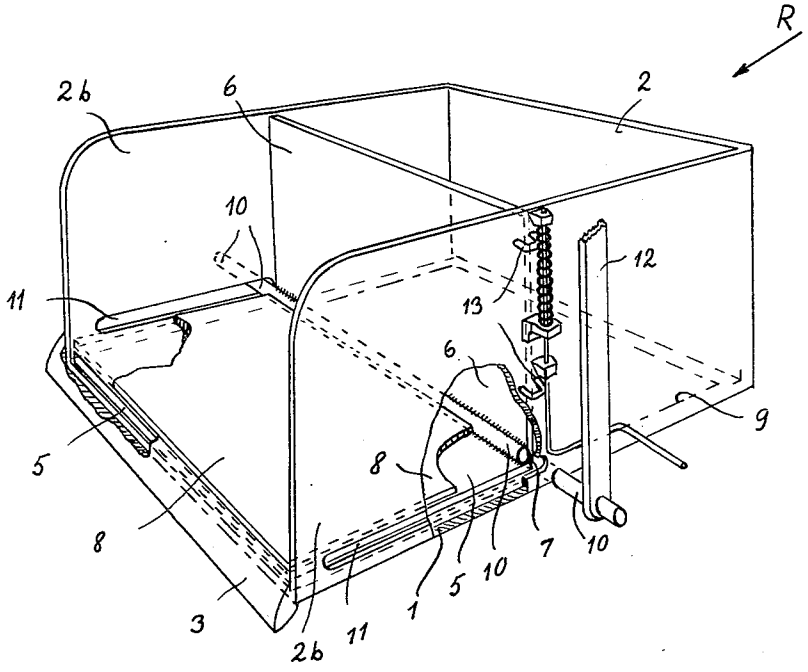
Inventor:
Pekka Ville Holopainen
By Kurt Kelman
Agent

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Fig. 3.



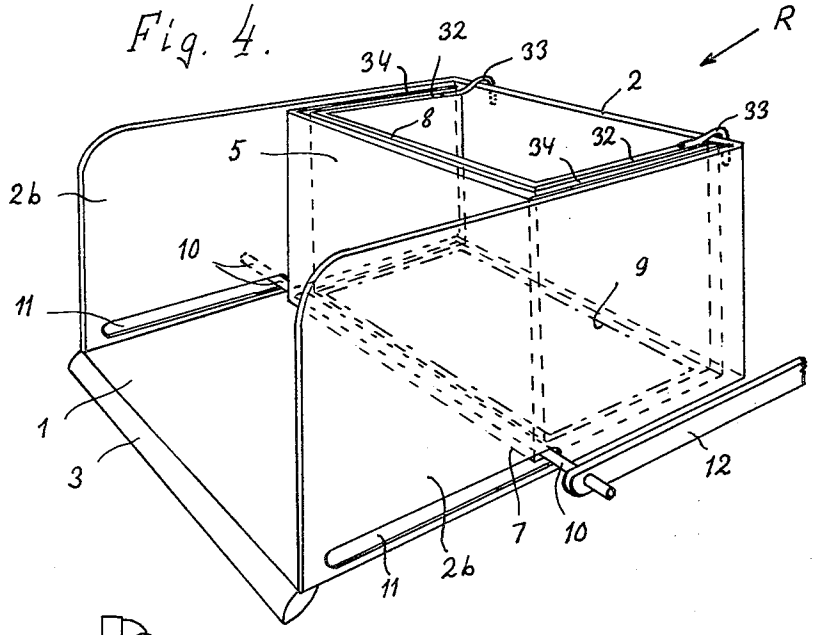
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DEVICE FOR RECEIVING, TRANSPORTING AND DISCHARGING GRANULAR AND POWDERY MATERIALS

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Fig. 4.



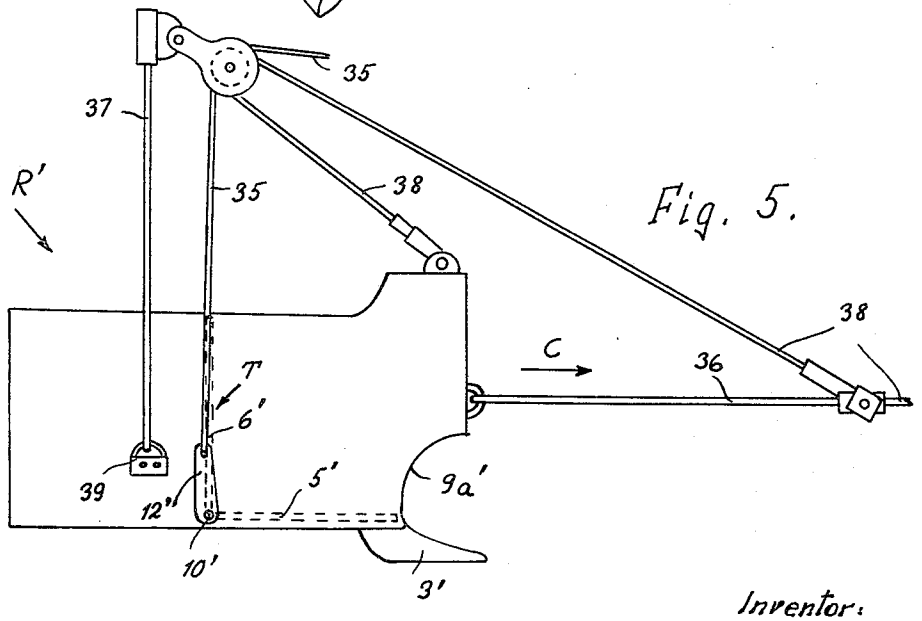


Fig. 5.

Inventor:
Pekka Ville Holopainen
By Kurt Kelman
Agent

United States Patent Office 3,052,996 Patented Sept. 11, 1962

3,052,996

DEVICE FOR RECEIVING, TRANSPORTING AND DISCHARGING GRANULAR AND POWDERY MATERIALS

Pekka Ville Holopainen, Kruunuvuorenkatu 3A8, Helsinki, Finland

Filed Jan. 18, 1960, Ser. No. 2,949
Claims priority, application Finland Jan. 5, 1957
8 Claims. (Cl. 37—118)

The present invention relates to apparatus for receiving, transferring and discharging granular, powdery and like materials, and more particularly to improvements in receptacles for scrapers, dragline buckets and similar earth handling units.

This is a continuation-in-part of my application Serial No. 701,782, filed December 10, 1957, now abandoned.

The filling of receptacles or bowls of presently known earth scrapers, dragline buckets and like material loosening, digging, transporting and unloading apparatus is brough about by moving the apparatus in a forward direction whereby the material is caused to enter the bowl between the customary apron and the scraper blade. At first, the filling of a conventional bowl presents no particular problems but, as the bowl becomes partially filled, the material already contained therein resists the entry of additional material with a progressively increasing force which is proportional to the degree to which the bowl is already filled. Consequently, many earth scrapers require pusher help, e.g. a pusher crawler tractor or the like. It was also proposed to increase the output of the scraper's engine in order to more completely fill the material receiving bowl. However, all such attempts are either too expensive or cannot insure satisfactory filling of the material receiving bowl.

An important object of the present invention is to provide an improved receptacle or bowl for earth scrapers, dragline buckets and like material handling apparatus which is provided with very simple and efficient means insuring that the bowl may be completely filled with a comminuted granular, lumpy or powdery material without requiring a greater force for such operation.

Another important object of the invention is to provide a receptacle of the above outlined characteristics which embodies means for rapidly evacuating the material from its interior.

A further object of the invention is to provide a receptacle of the above described type in which the means for assisting filling of the same with a powdery or granular material also assists in rapid evacuation of collected material.

A concomitant object of the instant invention is to provide a receptacle for earth scrapers, dragline buckets and like earth handling apparatus which is capable of discharging the collected material at more than one point; which requires comparatively little force for the discharge of material from its interior; which may be readily embodied in the earth handling apparatus of presently known design; and which may be operated in a fully automatic way.

The above and many other objects of the present invention are attained by the provision of a tilting or material transferring device which is hingedly installed in the receptacle, e.g. in the bowl of a scraper, dragline bucket or a like earth handling unit, by means of which the granular, lumpy, and/or powdery material accumulated in the front compartment adjacent to the inlet of the receptacle may be transferred to the rear compartment thereof, whereby the front compartment of the receptacle is evacuated and may receive additional material. The tilting device consists essentially of two rigidly connected platelike components disposed substantially at right angles

to each other and pivotally installed in the receptacle in such a way that each component may be brought into substantial parallelism with the bottom of the receptacle while the other component then assumes a position substantially at right angles to the bottom. When the component closer to the inlet of the receptacle is parallel with the latter's bottom, its free edge is adjacent to the inlet and to the cutting blade if the receptacle is a bowl of the type customarily utilized in earth scraping machines. The other component which is more distant from the inlet then constitutes a temporary wall or partition in the receptacle. When the material transferring device is tilted through about ninety degrees, the position of its components with respect to the bottom of the receptacle is reversed and the component closer to the inlet transfers the material which was deposited thereon into the rear compartment of the receptacle and deposits the same onto the other component which is then parallel with the bottom of the receptacle.

According to another important feature of my invention, the material transferring device is installed in the receptacle in such a way that it may be pushed toward the inlet after having deposited the material in the rear compartment of the receptacle, and that it may again move to the rear after the material is discharged from the receptacle. In this manner, the component closer to the inlet may push the material from the front compartment through the inlet for rapidly evacuating the receptacle, i.e. this component also constitutes a material discharging means in that its movement toward the inlet, while positioned at right angles to the bottom of the receptacle, causes the contents accmumulated in the front compartment of the receptacle to advance toward and through the inlet. Side walls or skirts may be installed between the components of the material transferring device whereby the latter constitutes a dipper or container within the receptacle proper.

According to a further feature of my invention, a platelike material evacuating member may be combined with the tilting device. This member is disposed between the components constituting the tilting device and is capable of following the tilting movements of that component which is closer to the inlet but remains locked in a position substantially at right angles to the bottom of the receptacle when the other component is tilted into parallelism with the bottom. The bottom is provided with at least one discharge opening in the rear compartment of the receptacle; such discharge opening is normally covered by that component which is more distant from the inlet, but is progressively exposed when the tilting device moves toward the inlet whereby the material transferred into the rear compartment of the receptacle is free to drop by gravity through the discharge opening. The discharge of material from the rear compartment is assisted by the aforementioned evacuating member which slides along the component more distant from the inlet while this last mentioned component is parallel with the bottom of the receptacle and while the tilting device moves toward the inlet.

When the receptacle, e.g. the bowl forming part of an earth scraper, of a dragline bucket or like earth handling machine, is provided with such a tilting device, the earth need not be caused to accumulate in a pile as high as, for example, in the present-day scraper bowls, because the bowl can be built longer and lower without increasing its width. The pulling or pushing force needed for scraping, loosening or digging the earth need not be increased.

The invention will be described in greater detail with reference to the accompanying drawings, in which:

FIG. 1 is schematic longitudinal section through a receptacle embodying the tilting device and the evacuating member of my invention;

FIG. 2 is a similar section through the receptacle

showing the tilting device and the evacuating member in different positions;

FIG. 3 is a perspective view of the receptacle shown in FIGS. 1 and 2 with certain parts omitted and further showing means for pivoting the tilting device together with one form of locking means for the evacuating member;

FIG. 4 is a perspective view of a slightly modified receptacle whose tilting device and evacuating member are provided with skirts, further showing a different form of locking means for the evacuating member; and

FIG. 5 illustrates a dragline bucket comprising a slightly modified receptacle which embodies the elementary form of my invention.

Referring now in greater detail to the drawings, and first to FIGS. 1 and 2, there is shown a receptacle R, e.g. a scraper bowl, which comprises a plate-like bottom **1** formed with a discharge opening **9**, a rear wall **2**, a cover plate **2***a*, two side walls **2***b*, and an apron **4**, the latter defining with the side walls **2***b* and with the bottom **1** an inlet opening **9***a*. Adjacent to this inlet opening, the bottom **1** supports a scraper blade **3**. In the following part of this description, the receptacle R will be called a bowl.

The side walls **2***b* pivotally mount a tilting or material transferring device T which comprises a pair of plate-like components **5**, **6** each of which is pivotable about the edge **7** into parallelism with the bottom **1**. Plates **5**, **6** are preferably perpendicular to each other. When the bowl R is about to be put to use, the tilting device T assumes the position of FIG. 1 in which the plate **5** is parallel with the bottom **1** and its front edge is adjacent to the inlet opening **9***a*, while the other plate **6** extends between the bottom **1** and cover plate **2***a* to divide the interior of the bowl into a front compartment or zone I and a rear compartment or zone II. The width of the plates **5**, **6** preferably approximates the distance between the side walls **2***b* and their combined length normally approximates the length of the bottom **1**. The length of the discharge opening **9** preferably equals or is slightly less than the length of the plate **6** and the width of this opening may be only slightly less than the distance between the side walls **2***b* of the bowl R. Instead of a single discharge opening **9**, the bottom plate may be formed with two or more openings in communication with the rear compartment II.

When in the position of FIG. 1, the tilting device T may be swung about the edge **7** in the direction of the arrow A to assume the full-line position of FIG. 2 in which the plate **6** covers the discharge opening **9** and the plate **5** constitutes a vertical partition between the compartments I and II in the interior of the bowl R. The mounting of the tilting device is such that it may be shifted into the phantom-line position T_d by sliding the plate **6** along the bottom **1** in the direction of the arrow B, i.e. toward the inlet opening **9***a*. The means for moving the tilting device T in the directions indicated by arrows A, B will be described in greater detail hereinafter.

The bowl R further comprises a plate **8**, hereinafter called the material evacuating member, whose mounting is such that it can follow all pivotal movements of the tilting device T from the position of FIG. 1 into the full-line position of FIG. 2 but remains locked in the position of FIG. 2 when the tilting device is advanced into and beyond the phantom-line position T_d. The evacuating member is always parallel with the plate **5** but the latter is movable toward and away from the member **8** when in the angular position of FIG. 2.

FIG. 3 shows the means **10**—**12** for pivoting and shifting the tilting device T as well as a locking assembly **13** which releasably retains the evacuating member **8** in the position of FIG. 2. The cover plate **2***a* and the apron **4** are omitted in FIG. 3 for the sake of clarity. These parts are not essential for the operation of the bowl R.

The tilting device T is connected with a transverse shaft **10** which is aligned with the meeting edge **7** of plate-like components **5**, **6** and extends through elongated closed slots **11** formed in the side walls **2***b* adjacent to the bottom **1**. The shaft **10** may be pivoted by a handle or lever **12** in order to swing the tilting device in and counter to the direction of arrow A (FIG. 1). A second lever may be connected with the rear end of the shaft **10** to assist the lever **12** in moving the shaft about the latter's axis and also in the guide slots **11** toward and away from the blade **3**.

Regarding the construction and mounting of the shaft **10**, FIG. 3 shows that this shaft is connected to the tilting device T and that its end portions extend all the way through the slots **11** in both end walls **2***b*. Thus, shaft **10** is aligned with the meeting edge **7** of the components **5**, **6**, i.e., the shaft **10** is parallel with the edge **7**. Of course, it is possible to form the shaft **10** of two portions whose common axis coincides with the edge **7** in the manner shown in FIG. 5. However, the components **5**, **6** of the tilting device T need not fit with great precision into the chamber defined by the bowl R so that the tilting device is free to pivot about the shaft **10** even if the axis of this shaft does not coincide with but is only aligned (parallel) with but rather close to the edge **7**, as shown in FIG. 3. Furthermore, the slots **11** may permit some play of the shaft **10** in vertical direction so that the tilting device will be free to pivot in and counter to the direction indicated by the arrow A.

The shaft **10** shown in FIG. 3 may be welded or otherwise secured to the tilting device.

As stated above, it is equally possible to connect the shaft **10** with the tilting device in the manner suggested by FIG. 5. However, it is conceivable that such connection would be somewhat weaker than the connection shown in FIG. 3 which might be undesirable if the bowl R is intended to handle large quantities of material.

The bowl R may be utilized as follows:

At the start of a scraping or digging operation, the tilting device T assumes the position of FIG. 1 in which the component **6** divides the interior of the bowl into aforementioned compartments I and II. By moving the bowl R in a forward direction, the material scraped up by the blade **3** enters through the inlet opening **9***a* below the apron **4** and is deposited on the evacuating member **8** to at least partially fill the front compartment I. By turning the handle **12** through about 90 degrees, the operator pivots the tilting device T about the shaft **10** and causes the member **8** to transfer the material from the compartment I into the rear compartment II. The second component **6** simultaneously seals the discharge opening **9** to temporarily prevent evacuation of material from the compartment II.

By swinging the lever **12** in clockwise direction, the operator simultaneously causes the locking device **13** to retain the evacuating member in the position of FIG. 2 because the lever, after having moved the device T into the full-line position of FIG. 2, depresses the bar **26** and the latter, by means of actuating elements **29**, **30** and plates **17**, **17***a*, causes the locking studs **15**, **16** to project into the bowl R. By continuously advancing the latter along the ground, additional material is accumulated on the front half of the bottom **1** and again at least partially fills the front compartment I. Thus, in addition to the material already transferred into the compartment II, the bowl may receive a second batch of material in the evacuated front compartment I. Of course, the tilting device T may be swung into the position of FIG. 2 while the bowl R continuously receives material through the inlet opening **9***a*, i.e. the scraping operation need not be interrupted when the lever **12** is actuated.

When the compartment I, too, is sufficiently filled with earth or other material, the bowl is transferred to the unloading place and the evacuating operation may begin

as follows: Without releasing the crank portion **28** of the bar **26**, the lever **12** is pushed toward the scraper blade **3** whereby the plate **5** (now in the position of FIG. 2) expels the material contained in the front compartment I along the bottom **1** in a direction toward and through the inlet opening **9***a*. At the same time, the second plate **6** slides along the bottom **1** and exposes the discharge opening **9** to permit evacuation of material from the rear compartment II. The evacuating member **8** is held in the position of FIG. 2 by the locking studs **15**, **16** and scrapes the material accumulated in compartment II off the second plate **6** as the latter advances toward the inlet opening **9***a*. As soon as the material is completely evacuated from the compartments I and II, the tilting device is caused to return into the full-line position of FIG. 2 and the lever **12** is thereupon rotated in a direction counter to that indicated by the arrow A to release the locking device **13** and to pivot the tilting device back into the position of FIG. 1. The evacuating member is free to follow pivotal movements of the plate **5** and returns into parallelism with the bottom **1**.

It will be readily understood that the tilting device T may be utilized without the evacuating member **8**. The material is then deposited directly onto the plate **5** (in the position of FIG. 1) and the evacuation occurs merely by sliding the tilting device from the full-line position into and beyond the phantom-line position T_d of FIG. 2. Such simplified construction, of course, may operate without the locking device **13**.

A different locking device for the evacuating member **8** is shown in FIG. 4 wherein the position of the tilting device T corresponds to that shown in full lines in FIG. 2. The evacuating member **8** is formed with two lateral walls or skirts **32** which are parallel with the side walls **2***b* of the bowl R and guide the evacuating member in its movements between the positions of FIGS. 1 and 2. Each skirt carries a hook-shaped locking member **33** which engages with the rear wall **2** when the evacuating member is moved into the position at right angles to the bottom **1**. Each skirt **32** is preferably of rectangular form whereby two of its meeting edges abut against the plates **5**, **6** of the tilting device excepting when the latter is moved toward the blade **3**. When it is desired to tilt the evacuating member **8** into parallelism with the bottom **1**, the lever **12** swings the components **5** and **6** whereby the latter engages with the skirts **32** and causes the member **8** to pivot about the shaft **10**. The locking hooks **33** describe an arc about the shaft **10** and do not prevent angular movements of the evacuating member. However, by engaging with the rear wall **2**, these locking members hold the evacuating member against linear movements toward the scraper blade **3**.

FIG. 4 also shows a pair of substantially rectangular skirts **34** provided between the transverse edges of components **5** and **6**. Each skirt **34** is located between and is parallel with a side wall **2***b* and one of the skirts **32** on the evacuating member. Thus, the slightly modified tilting device of FIG. 4 actually constitutes a separate container or dipper in the bowl R. The skirts **34** guide the tilting device in its movements between the positions of FIGS. 1 and 2, and prevent entry of material between the edges of plates **5**, **6** and the side walls **2***b*. The two-phase filling and the single-step discharging operation of the bowl is not affected by the presence or absence of skirts **32** and **34**. If desired, a vertically reciprocable second apron may be provided along the forward edge of the plate **5** to prevent discharge of material through the inlet opening **9***a* when the device T is tilted to transfer a batch of material from the front compartment I into the rear compartment II.

Owing to comparatively small weight of the material which is transferred into the compartment II as compared with the overall weight of material receivable in the bowl R, the power necessary for moving the tilting device T need not exceed the power required for the operation of presently known earth scrapers and like machines. Also, since the plate **5** must evacuate only that material which accumulates in the front compartment I while the evacuation of material from the compartment II may occur by gravity alone, the power required for the discharge of material from the bowl R also remains within economical limits. An additional advantage of the improved bowl is in that the discharge of material may occur simultaneously at two points (i.e. through the openings **9**, **9***a*) which reduces in half the time necessary for such operation.

FIG. 5 illustrates a dragline bucket comprising a modified receptacle or bowl R′ having a series of teeth or a single blade **3′** and an inlet opening **9***a′*. This bowl operates without a discharge opening such as would correspond to the opening **9** shown in FIGS. 1 to 4. Its front end is connected with a traction cable or chain **36**. A pair of spreader chains or cables **37** is connected to the side walls of the member R′. The assembly further comprises the customary balancing cable **38**. The exact mounting of the bowl R′ forms no part of my invention and may be such as disclosed, for example, in U.S. Patent No. 2,814,890 of December 3, 1957. The shaft **10′** of the tilting device T′ is rotatably mounted in the side walls of the bowl R′ and is operable by a lever **12′**. The latter is connected with a control cable **35** which constitutes a means for locking the device T′ in the position of FIG. 5, i.e. in a position in which the plate **5′** is adjacent to the bottom of the bowl and the second plate **6′** divides the bowl into two compartments.

The dragline bucket of FIG. 5 may be operated as follows:

Cable **36** is assumed to move the bowl R′ in the direction of the arrow C whereby the material scraped or loosened up by the blade **3′** enters through the inlet opening **9***a′* and fills the front compartment all the way to the vertical plate **6′**. The tilting device T′ is maintained in its illustrated position by the control cable **35** which is under tension. When the front compartment is filled with earth or a like material, the tension in the cable **35** is relaxed whereby the incoming material automatically tilts the device T′ into a position (see FIG. 2) in which the plate **6′** is parallel with the bottom of the bowl R′. The tilting device thereby transfers the material from the front compartment into the rear compartment whereupon the continuously advancing bowl scoops up additional material which fills the space in front of the plate **5′**, the latter being now in a position at right angles to the bottom plate. The discharge of material may occur by gravity alone when the bowl R′ is free to pivot forwardly about the hinges **39**. When so tilted, the bowl first discharges material amassed in front of the plate **5′**, whereupon the weight of material in the rear compartment causes the device T′ to return into the position of FIG. 5 and to transfer the material from the rear compartment back into the front compartment whence the material may be discharged by gravity through the opening **9***a′*. It will be seen that, in its elementary form, the bowl embodying my invention need not be provided with slots **11** which would permit the tilting device to travel along the bottom plate. The tilting device merely pivots about the meeting edges of its components, either by application of rotary force to the shaft **10′** or solely under the weight of material filling the front compartment or the rear compartment.

It will be understood that certain minor changes in the size, form and construction of the various parts of my improved bowl may be made and substituted for those herein shown and described without departing from the spirit of the invention, the scope of which is set forth in the appended claims.

What I claim and desire to protect by Letters Patent is:

1. In a device for receiving, transporting and discharging granular, powdery and like materials, in combination:

a receptacle comprising a bottom having a forward end and a rear end, a pair of spaced side walls connected to and extending between the ends of said bottom, and a rear wall between said side walls connected to and located at the rear end of said bottom, the receptacle having an inlet opening at the forward end of said bottom; a tilting device comprising a pair of rigidly connected plate-like components disposed substantially at right angles to each other and having a common edge; and means pivotably mounting the tilting device in said receptacle in such manner that said edge extends transversely of and above the bottom between said side walls whereby the tilting device is pivotable between a first position in which one of said components is adjacent to the bottom and extends toward said inlet opening and the other component is perpendicular to said bottom, and a second position in which the other component is adjacent to the bottom and extends toward said rear wall and one component is perpendicular to said bottom, the component perpendicular to the bottom dividing the interior of the receptacle into a front compartment communicating with said inlet opening and a rear compartment terminating at said rear wall, the material introduced into said front compartment when the tilting device is in said first position being transferred into said rear compartment when the tilting device is pivoted into said second position whereupon additional material may be introduced into said front compartment.

2. The combination as set forth in claim 1, wherein said bottom is of rectangular contour and the components of said tilting device are rectangular plates, the combined area of said plates equaling the area of said bottom.

3. The combination as set forth in claim 1, further comprising a pair of skirts connected with said components and each adjacent to one of said side walls for guiding the tilting device between said first and second positions.

4. The combination as set forth in claim 1, wherein the means pivotally mounting said tilting device comprises a transverse shaft connected to the tilting device rotatably mounted in said side walls, each of said side walls having an elongated slot adjacent to the bottom and extending toward said inlet opening whereby the shaft is movable along the bottom to reciprocate the tilting device in directions toward and away from the inlet opening, said one component evacuating the material from the front compartment when the tilting device is in its second positon and is moved toward said inlet opening.

5. The combination as set forth in claim 4, wherein said bottom is formed with a discharge opening adjacent to said rear wall, said discharge opening being closed by the other component when the tilting device is in said second position, and said discharge opening being exposed to permit evacuation of material from said rear compartment when the tilting device is in its second position and is moved toward said inlet opening.

6. The combination as set forth in claim 5, further comprising a plate-like material evacuating member located between the components of said tilting device and pivotable by the latter between a positon adjacent to the bottom in said front compartment and a positon at right angles to the bottom in said second compartment; and means for releasably locking the evacuating member in said last mentioned position whereby the evacuating member scrapes the material off said other component when the tilting device is in its second position and is moved toward said inlet opening.

7. The combination as set forth in claim 6, wherein said evacuating member comprises a pair of skirts each adjacent to one of said side walls for guiding the evacuating member between said first and last-mentioned positions.

8. The combination as set forth in claim 7, wherein said locking means comprises hook means connected with said skirts and engaging with said rear wall when the evacuating member is in said last mentioned position.

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