A container (1) for transporting bulk material, such as gravel or asphalt with fractions of varying particle sizes, has at least in a discharge portion a symmetrical bottom wall and inwardly inclined side walls. The discharge is meant to take place by raising the main portion of the container relatively the discharge portion. According to the invention the trough-shaped bottom wall is provided with a discharge outlet (10) having its greatest extension at the centre of the discharge outlet and narrowing therefrom towards the sides, so that the flow of material will be less at the sides than at the centre of the discharge outlet, the discharge outlet facing essentially downwards when the main portion of the container has been raised into its discharge position.
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APPARATUS RELATING TO A CONTAINER FOR TRANSPORTING BULK MATERIAL

TECHNICAL FIELD

The present invention relates to a container for transporting bulk material, such as gravel or asphalt, having fractions of varying particle sizes. At least in a discharge portion the container has a trough-shaped bottom part symmetrical to a vertical centre plane, and inwardly slanting side walls. The discharge is meant to take place by raising the main portion relatively to the discharge portion.

THE STATE OF THE ART

Bulk material, such as gravel and asphalt, contains a conglomeration of fractions of different particle sizes. In most instances it is desirable that the various fractions are homogeneously distributed within the total bulk of material. However, bulk goods of said kind show a tendency of separating into different fractions, particularly in connection with transportation and handling.

For instance, in the handling of gravel a separation problem arises when the gravel is dumped out of a storage pocket onto the platform of a truck. Then a tip of fine material is formed, whereas coarse material rolls down the slopes and is assembled along the flap sides. Thus the gravel has separated - lost its original structure. During the transport to the place of use still more coarse material is shaken down along the flap sides. When the material thus separated is let out onto a roadway, the fine material will land at the centre and the coarse material closer to the way sides, causing an inferior road coating. Said problems can be reduced by replacing the flat platforms by rounded container bottoms. Then the slopes of the gravel tip will be shorter than with a conventional platform, but there are nevertheless new separation problems in the discharge according to previously known art, partly due to spontaneous separation along the slanting sides of the gravel string laid out, partly due to a horizontal motion component of the gravel occuring as it drops off.
the platform, whereby coarser particles are separated out and thrown further out than the finer material.

Corresponding problems arise also when handling way coating material consisting of composed stone material and asphalt. When dumping into the spreading trough, in principle the same separation mechanisms appear as when spreading gravel upon a roadway. When the trough then lets out the material upon the roadway, the structure of the mixture will deteriorate, involving imperfections of the finished coating in the same shape of cracks and clearances. Said problems would shorten the life of the roadway by 20 per cent or more and require premature reasphaltation, which in its turn involves great additional costs.

BRIEF DISCLOSURE OF THE INVENTION

The object of the invention is to eliminate the above-mentioned problems, limitations and drawbacks of known designs.

Said object can be reached by providing the trough-shaped bottom wall with a discharge outlet and narrowing towards the sides, so that the flow of material will be less at the sides than at the centre of the discharge outlet, the discharge outlet facing essentially downwards when the main portion of the container has been raised into its discharge position.

Preferably an end wall, shutter, flap, screen or similar barring member is arranged in the discharge portion of the container, said end wall etc. being so positioned as to form an obstruction rearwards and prevent material flowing out through the outlet from assuming a substantial horizontal motion component.

Preferably the discharge outlet is formed by an arc- or polygon-shaped recess in the discharge end of the discharge portion, symmetrical relatively to the vertical centre plane. Preferably the recess has the approximate shape of a moon crescent.
Further characteristics and aspects of the invention will appear from the appended claims and the following description of preferred embodiments.

5 BRIEF DESCRIPTION OF THE DRAWINGS

In the following description, reference will be made to the enclosed drawing figures, in which

Fig. 1 is a perspective view of the discharge portion of a container for bulk material, as seen obliquely from the back side,

Fig. 2 is a perspective view of the discharge portion, as seen obliquely from the front side,

Fig. 3 is a lateral view of the semi-cylindrical container and its discharge portion,

Fig. 4 shows the container and its discharge portion, as seen from above, an end wall in the discharge portion being set vertically,

Fig. 5 shows the same container and discharge portion as viewed from above, the end wall of the discharge portion taking an inclined position,

Fig. 6 is a lateral view illustrating the laying of a gravel string by means of the apparatus according to the embodiment of Fig. 1 to 5,

Fig. 6A is a section taken along the line A-A in Fig. 6 and showing a cross-section of a gravel string laid out upon a roadway by means of the apparatus of Fig. 6, and

Fig. 7 is a perspective view taken obliquely from the back, of a carriage comprising an apparatus being an embodiment of the
invention somewhat modified in respect of the discharge portion.

In the figures, and particularly in Figs. 1 to 5, merely parts essential to the understanding of the invention have been shown, whereas other details have been omitted in order to expose the essence of the invention more clearly.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to Figs. 1 to 5, the numeral 1 designates a semi-cylindrical container for bulk material. The container consists of a semi-cylindrical shell of sheet metal or other suitable material, which forms the bottom wall and side walls of the container. Reinforced plastic material may be mentioned as an example of other materials suitable for the container. The container can be used e.g. as a tipping platform of a truck. In such a case the part of the container 1 shown in Fig. 1 constitutes the rear discharging portion of the tipping platform. In the transporting position the container normally takes a horizontal position, i.e. the bottom line of the container is horizontal.

The container is provided with an adjustable semi-circular end wall 2, the top of which is connected to a holding rod 5. The ends of said rod constitute holding pins 6. The radius of the semi-circular end wall 2 is slightly less than the inner radius of the shell of the semi-cylindrical container 1.

In the upper edges of the container 1 there are a number of mainly U-shaped notches constituting seats 8 for the holding pins 6. Figs. 1 to 5 show an embodiment having six pairs of seats 8. The seats 8 are placed in pairs in such a manner that the holding rod 5 will be directed truly perpendicular to the length direction of the container when the pins 6 are placed in a pair of corresponding seats 8. Thus, the end wall can be placed in different positions, either in forward or backward positions in the container 1.
The endwall 2 is equipped with two locking devices 3, each comprising a bolt 4 insertable in holes 7 in the shell of the container 1.

With the container 1 held in the horizontal position the end wall 2 can be given a forward or backward slanting position by inserting the bolts 4 in holes 7 situated in front of or backward of the pair of seats 8 in which the holding pins 6 are placed. If the bolts are placed in holes 7 situated vertically below those seats 8 in which the holding pins are placed, the end wall 2 will be held in a position in which its plane is vertical and perpendicular to the length direction of the container.

At the discharge end of the container shell there is an arcuate recess 9 which in cooperation with the end wall 2 delimits the size of a discharge outlet 10. Fig. 3 is a lateral view of the container 1, showing that the arcuate recess 9 (or border edge) in the shown embodiment can be formed by cutting the shell of the cylindrical container 1 at the discharge end along a plane forming an angle of about 45 degrees to the bottom generatrix of the shell of the container 1. Cutting the shell along a plane will give a recess 9, the edge of which follows an elliptically curved line. Actual tests have shown that a cutting angle of about 45 degrees gives an arcuate recess 9 and a discharge outlet 10, which in the dumping of gravel and asphalt material have a good homogenizing effect in connection with the discharge. For other materials with a different friction coefficient governing the slide along the container and of other size fractions, other cutting angles may be found to be more suitable.

If the end wall is held vertical and if the holding pins 6 at the same time are moved to seats 8 further away in the discharge direction, the size of the discharge outlet 10 increases. However, the size of the discharge outlet can be increased or diminished without having to move the holding pins 6. If the end wall 2 is tilted so that its lower part is displaced in the discharge direction, the size of the discharge outlet increases. The size of the discharge outlet can be diminished
by moving the lower part of the end wall 2 forwardly while leaving the position of the pins 6 in the seats 8 unchanged.

In the figures, the holes 7 have been shown in positions placed along a generatrix of the shell of the container 1. When tilting the end wall 2 the bolts 4 will be raised, and therefore the holes 7 have to be made wider than the diameter of the bolts 4, so that the bolts 4 can be inserted without difficulty when the end wall 2 should be set in an inclined position. As a rule the inclinations of the end wall 2 would be moderate, and therefore the diameter of the holes 7 need not be too oversized to allow insertion of the bolts 4 when the end wall 2 takes the inclined position.

In Fig. 4 and Fig. 5 the container is shown from above. In Fig. 5 the end wall 2 has been tilted by moving the holding pins to an other pair of seats 8 than in Fig. 4. By displacing the pins in the discharging direction the end wall is brought into an inclined position, in which the holding rod 5 is situated farther back in the discharging direction than the lower part of the end wall 2.

In the embodiment described with reference to Figs. 1 to 5 the end wall 2 is built to allow its adjustment in different positions. Such an embodiment is particularly suitable when material of different kinds should be handled, which would require adjustment of the inclination of the end wall or the size of the discharge outlet 10. When merely one kind of material should be transported or otherwise handled, it may be preferable to attach the end wall 2 permanently in a best position tried out by tests.

Modifications of the above-described embodiments are possible without reaching beyond the limits set by the following claims. For instance, the bolts 4 upon the end wall 2 might be replaced by a pair of bolts arranged upon the exterior of the container 1, one on each side thereof and beyond the holes 7. Said bolts may be displaceable in a slide or similar and be spring-actuated, so that they are insertable
by snap action into a desired hole 7 to effect the desired positioning of the end wall etc. According to an other modification a fixed end wall at the discharge end of the container may be combined with a movable flap at the lower part of the end wall for controlling the size of the discharge outlet or for shutting the same. Fig. 7 shows a modification of the means of adjusting the end wall 2'. In this case the holes in the shell of the container have been replaced by a longish slit 7' in either side wall of the container and a pair of locking lips 4' which are insertable in desired positions into the same slits 7' back of the end wall 2' in order to keep the same in the desired angle of inclination. In this embodiment the upper holding pins of the end wall 2' are displaceable lengthwise of the container.

The end wall might preferably be provided with a movable lower part in order to shut the discharge outlet completely during transport, without changing the general position of the end wall.

The function of the apparatus of the invention and the advantages obtained thereby will be described more fully in the following. When the bulk material is dumped into the round-bottomed container 1, a tip or ridge will be formed along the centre line of the container. As all slanting flanks of a filling of bulk material of varying particle sizes involve the risk of separation, it is desirable to avoid or reduce all such tips or ridges. On account of the container of the invention having a rounded bottom, said effect is obtained simply by the fact that the space of the container situated close to and along the centre line will receive a comparatively greater share of the total volume than the flank spaces. The ridge will, so to speak be turned upside down, which is favourable. In conventional discharge devices, either the container has a rounded or plane bottom, there is a risk of separation on account of the bulk material getting a horizontal motion component, the path of fall assuming more or less the shape of a throw parabola. Therefore, when dumping the bulk material a backwardly directed slope will be formed, where the coarser particles will roll down and get an increased velocity with ensuing
longer parabolic throw paths than the finer particles, involving a tendency of the coarser particles to collect at the surface of the string laid out. Then when the string is smoothed, the coarser surface layer is pushed towards the edges. According to the invention said tendency is prevented by the end wall 2, 2' serving as an obstacle which diverts the bulk material straight downwardly against the roadway, Fig. 6, or into an asphalt spreader or similar, whereby no horizontal motion component will appear and produce a separating effect.

The crescent-shaped outlet 10 is of a width, as seen in the direction of discharge, which increases towards the centre line of the container, involving that the flow of discharged material, when the container has been raised into its dumping position, Fig. 6 and Fig. 7, is greater at the centre than along the flanks. This may seem unfavourable but is, in fact, favourable, as the the angle of inclination of the ridge formed upon the roadway or in the asphalt layer gets so small that it is far from approaching the sliding angle, Fig. 6A. On the other hand, if the string laid out would have the same thickness over its entire width, the sliding angle would be reached at the flanks resulting in unfavourable separation. This is the case when discharging material from a conventional flat platform as well as from containers with a rounded bottom, wherein the discharge outlet is of the same height along its entire width.

Furthermore, the above-mentioned ridge-formation or other grounds of separation during the transport from the loading to the dumping location should not be disregarded. Such fractionation normally results in a share of the coarser material being assembled along the side walls of the container. When dumping conventional platforms or round-bottomed containers having the conventional design of the discharge end a disproportionately large share of the coarser fraction will flow out as a last remainder, which is unfavourable because it causes an inhomogeneity in the finished roadway. According to the invention said effect is eliminated by placing the end wall 2, 2' in
an angle of inclination not perpendicular to the bottom of the container, Fig. 5 and Fig. 7. Due to said inclination there is also formed a narrow gap 10a, Fig. 2, between the end wall 2 and the other container walls in the range between the upper edge of the container and the discharge outlet 10. A certain quantity of the material will pass through said narrow gap 10a, thereby preventing the collection in the space adjacent to said gap, of a remainder of material containing a greater share of coarse material than elsewhere in the material, which remainder would be discharged as a last final batch causing inhomogeneity in the roadway.
CLAIMS

1. Apparatus relating to a container (1) for transporting bulk material, such as gravel or asphalt with fractions of varying particle sizes, at least a discharge portion of said apparatus having a trough-shaped bottom part symmetrical to a vertical centre plane and having inwardly slanting side walls, wherein the discharge is meant to take place by raising the main portion of the container relatively to the discharge portion, characterised in that the trough-shaped bottom part is provided with a discharge outlet (10) having its greatest extension at the centre of the discharge outlet and narrowing towards the sides, so that the flow of material will be less at the sides than at the centre of the discharge outlet, and in that the discharge outlet is facing essentially downwards when the main portion of the container has been raised into its discharge position.

2. Apparatus according to claim 1, characterised in that an end wall (2, 2'), shutter flap, screen or similar baring member is arranged in the discharge portion of the container, the end wall etc. being so positioned as to form an obstruction in the backward direction and prevent material flowing out of the outlet from assuming a substantial horizontal motion component.

3. Apparatus according to claim 2, characterised in that the end wall (2) etc. is so positioned or apt to be so positioned that its plane intersects said recess (9) at two points which are symmetrical relatively to the vertical centre plane.

4. Apparatus according to claim 4, characterised in that the discharge outlet is formed by an arc- or polygon-shaped recess (9) in the discharge end of the discharge portion, symmetrical relatively to the vertical centre plane.

5. Apparatus according to claim 4, characterised in that said arc- or polygon-shaped recess follows the line of intersection
between the shell of the trough-shaped bottom and a plane forming an angle of 30 to 60 degrees to the length direction of the container, and preferably an angle of 40 to 50 degrees to the horizontal plane.

6. Apparatus according to any of the claims 1 to 5, characterized in that the discharge outlet has the approximate shape of a moon crescent.

7. Apparatus according to any of the claims 1 to 6, characterized in that the downwardly facing part of the contour of said end wall etc. essentially corresponds to the line of intersection between an imaginary plane perpendicular to the length direction of the container.

8. Apparatus according to claim 7, characterized in that said imaginary plane of intersection is perpendicular to the side walls and bottom walls of the discharge portion.

9. Apparatus according to any of the preceding claims, characterized in that the trough-shaped part of the discharge portion of the container has a cylindrical shell surface, preferably a surface of a semi-tubular shape.

10. Apparatus according to any of the preceding claims, characterized in that the end wall etc. is pivotal about a horizontal axis, preferably by providing the discharge portion of the container with seats cooperating with pins coaxial to the pivoting axis of the end wall etc., and in that locking means (4, 7) preferably are provided for setting the end wall etc. in different positions of inclination.

11. Apparatus according to claim 10, characterized in that the locking means (4, 7) are designed for securing the end wall etc. in the different positions relatively to the container.
12. Apparatus according to any of the claims 1 to 9, characterized in that the end wall etc. is rigidly connected to the container.

13. Apparatus according to any of the claims 1 to 12, characterized in that the outlet (10) is arranged to be shut tight.
AMENDED CLAIMS
[received by the International Bureau on 30 May 1988 (30.05.88); original claims 1-2 replaced by new claim 1; claims 3-13 renumbered as 2 to 12 (3 pages)]

1. Apparatus relating to a container (1) for transporting bulk material, such as gravel or asphalt with fractions of varying particle sizes, at least a discharge portion of said apparatus having a trough-shaped bottom part symmetrical to a vertical centre plane and having inwardly slanting side walls, wherein the discharge is meant to take place by raising the main portion of the container relatively to the discharge portion, characterized in that the trough-shaped bottom part is provided with a discharge outlet (10) having its greatest extension at the centre of the discharge outlet and narrowing towards the sides, so that the flow of material will be less at the sides than at the centre of the discharge outlet, and that an end wall (2, 2'), shutter flap, screen or similar barring member is arranged in the discharge portion of the container, the end wall or corresponding member being so positioned that the discharge outlet will face essentially downwards when the main portion of the container has been raised into its discharge position, said barring member obstructing in the backward direction preventing material flowing out of the outlet from assuming a substantial horizontal motion component.

2. Apparatus according to claim 1, characterized in that the end wall (2) etc. is so positioned or apt to be so positioned that its plane intersects said recess (9) at two points which are symmetrical relatively to the vertical centre plane.

3. Apparatus according to claim 4, characterized in that the discharge outlet is formed by an arc- or polygon-shaped recess (9) in the discharge end of the discharge portion, symmetrical relatively to the vertical centre plane.

4. Apparatus according to claim 3, characterized in that said arc- or polygon-shaped recess follows the line of intersection between the shell of the trough-shaped bottom and a plane forming an angle of 30 to 60 degrees to the length direction of the container, and preferably an angle of 40 to 50 degrees to the horizontal plane.
5. Apparatus according to any of the claims 1 to 4, characterized in that the discharge outlet has the approximate shape of a moon crescent.

6. Apparatus according to any of the claims 1 to 5, characterized in that the downwardly facing part of the contour of said end wall etc. essentially corresponds to the line of intersection between an imaginary plane perpendicular to the length direction of the container.

7. Apparatus according to claim 6, characterized in that said imaginary plane of intersection is perpendicular to the side walls and bottom walls of the discharge portion.

8. Apparatus according to any of the preceding claims, characterized in that the trough-shaped part of the discharge portion of the container has a cylindrical shell surface, preferably a surface of a semi-tubular shape.

9. Apparatus according to any of the preceding claims, characterized in that the end wall etc. is pivotal about a horizontal axis, preferably by providing the discharge portion of the container with seats cooperating with pins coaxial to the pivoting axis of the end wall etc., and in that locking means (4, 7) preferably are provided for setting the end wall etc. in different positions of inclination.

10. Apparatus according to claim 9, characterized in that the locking means (4, 7) are designed for securing the end wall etc. in the different positions relatively to the container.

11. Apparatus according to any of the claims 1 to 8, characterized in that the end wall etc. is rigidly connected to the container.
12. Apparatus according to any of the claims 1 to 11, characterized in that the outlet (10) is arranged to be shut tight.
INTERNATIONAL SEARCH REPORT

I. CLASSIFICATION OF SUBJECT MATTER

According to International Patent Classification (IPC) or to both National Classification and IPC

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II. FIELDS SEARCHED

Minimum Documentation Searched

Documentation Searched other than Minimum Documentation to the extent that such documents are included in the fields searched

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT

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International Searching Authority: Swedish Patent Office

Signature of Authorized Officer: [Signature]

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