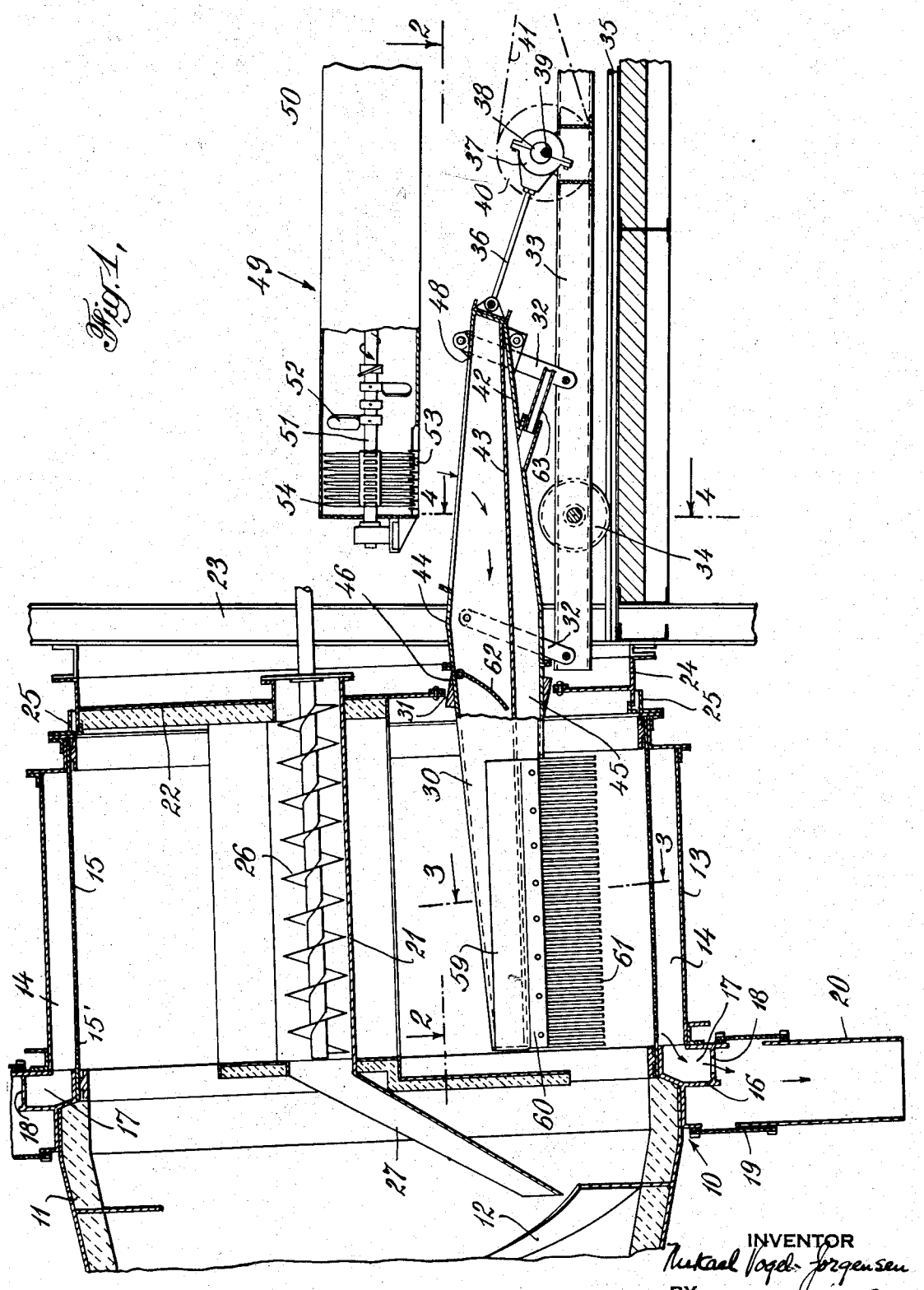
Sept. 17, 1940. M. VOGEL-JORGENSEN 2,215,201

DISTRIBUTING APPARATUS

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Fig. 1.



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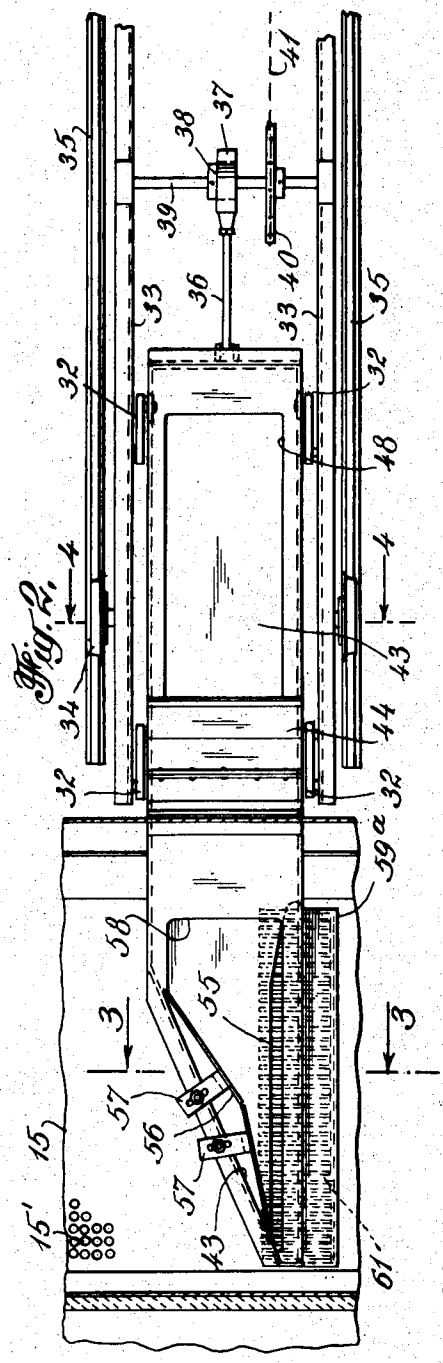


Fig. 2.

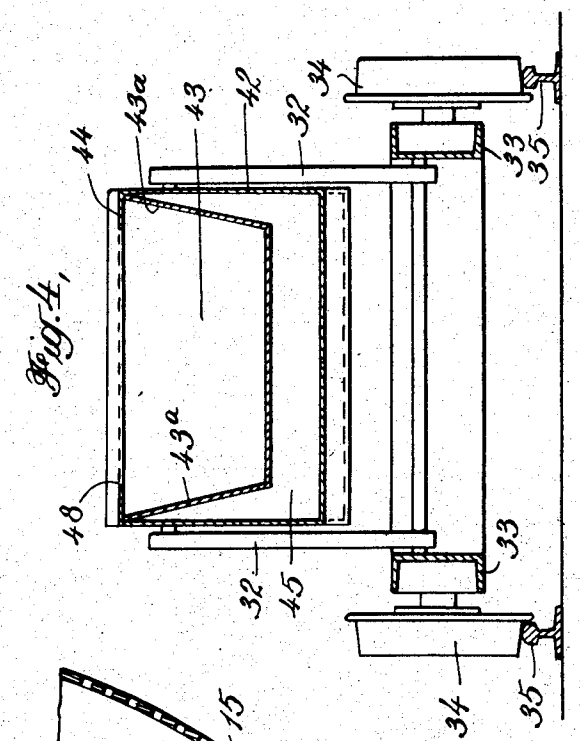


Fig. 4.

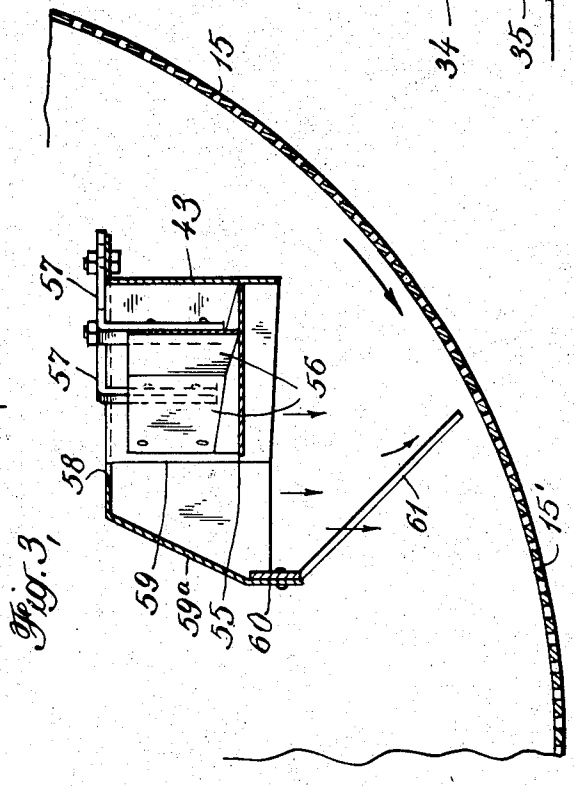


Fig. 3.

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2,215,201

DISTRIBUTING APPARATUS

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Application February 24, 1938, Serial No. 192,257

12 Claims. (Cl. 209—236)

This invention relates to apparatus for distributing finely divided materials, and is concerned more particularly with a novel distributing apparatus by which a layer of such materials of substantially uniform thickness and of considerable width may be deposited on a surface during relative movement of the surface and the apparatus. The new apparatus may be used for the handling of materials of numerous kinds, but since the device affords special advantages in the feeding of cement raw materials in moist condition into kilns wherein the materials are preliminarily dried by hot gases passing through a layer thereof, an embodiment of the invention suitable for that purpose will be illustrated and described in detail for purposes of explanation. It is to be understood, however, and will be readily apparent, that the utility of the invention is not limited to that particular application.

In the manufacture of cement by means of the kilns disclosed in my United States Patent No. 2,024,453, issued December 17, 1935, the cement raw materials to be burned are first fed into a pug mill where they are moistened and mixed together, the output from the mill being deposited in a layer upon the interior of a cylindrical grate or carrier formed as an extension at the entrance end of the kiln. The hot gases pass through the layer of material on the grate to effect a preliminary drying of the material, and when the materials have been carried through substantially a complete revolution of the grate, they are discharged therefrom and introduced into the kiln where the calcination and sintering takes place. The construction of the grate is such that the layer of materials is maintained thereon by the gases passing through the layer and in order that the layer may be maintained in position and the materials properly dried, it is important that the materials be deposited upon the grate in a layer of substantially uniform thickness. It is also desirable that in depositing the layer, the particles or lumps of the material of larger size be deposited in direct contact with the grate, and the particles of smaller size be distributed thereon.

The apparatus of the invention is particularly adapted for the handling of the materials to be delivered to the grate of a kiln of the type referred to and the distribution of the materials in a layer of uniform thickness on the grate. The new apparatus may also be so constructed that it produces a layer in which the coarser particles are in contact with the grate or other pervious support and the finer particles form the outer surface of the layer, the distribution of the materials in this manner insuring that the finer particles will not pass through the grate.

In the new apparatus, the material to be distributed is placed upon a support between the side walls near one end of the support and is advanced along the support by the endwise reciprocation of the latter to a discharge opening near the other end, the opening being formed partly in the support and partly in one wall. The walls are of uniform spacing at the point of deposit of the material upon the support, but adjacent the discharge opening, the solid wall is inclined toward that containing the opening, and deflector plates are mounted on the inclined wall in such arrangement that the advancing material is thrown laterally through the opening by its contact with the plates. If it is desired to produce a layer in which particles of one size lie near one surface of the layer and particles of a different size near the other surface, a series of teeth, similar to a comb, are mounted to underlie the discharge opening, the spacing between the teeth being such that the finer particles will pass between the teeth and the larger ones will slide down along the teeth and pass off the ends thereof.

In the use of the distributing apparatus with materials which are liable to adhere to the sidewalls and support, the support and the walls may be made double to provide a chamber through which hot gases may be passed. The heating of the support and walls in this manner prevents the adherence of the material thereto and thus increases the efficiency of the apparatus.

For a better understanding of the invention, reference may be made to the accompanying drawings, in which

Fig. 1 is a vertical sectional view through part of a rotary kiln, showing one form of the new apparatus for distributing cement raw materials on the grate or carrier of the kiln;

Fig. 2 is plan view of the distributing apparatus shown in Fig. 1;

Fig. 3 is a partial sectional view on the line 3—3 in Fig. 2, and

Fig. 4 is a sectional view on the line 4—4 in Fig. 2.

In the apparatus shown in Fig. 1, the inlet end of the kiln is designated generally by the numeral 10 and comprises a conical section 11 leading to the usual cylindrical section, not shown, and containing flights 12 on its inner surface, for advancing the raw material. The conical sec-

tion terminates in a cylindrical extension 13 which carries radial plates 14 supporting a cylindrical grate 15. The grate 15 and the extension 13 rotate with the drum, being connected thereto by an annular casting or ring 16 which closely surrounds the end of the conical section 11 and is provided with webs 17 aligned with the plates 14, the webs and plates together forming longitudinal passages leading away from the space surrounding the grate.

Cement raw materials deposited on the inside of the grate 15 are held against the grate by the pressure of the hot gases from the kiln which pass through the grate and the layer of material thereon. The gases are then conducted through the longitudinal passages formed by the plates 14 and webs 17 and through openings 18 in the periphery of ring 16 to a mantle 19 surrounding the ring 16. The portion of the mantle 19 in direct contact with the ring is movable to accommodate expansions and contractions of the kiln, while the lower part of the mantle is provided with an outlet duct 20 leading to an induced draft fan, not shown.

As the kiln rotates, the raw materials are distributed continuously on the grate and are carried thereby through substantially a complete revolution, whereupon the materials are discharged from the grate by suitable means, not shown, and fall into a trough 21. The latter extends through and is supported by a stationary end wall 22 supported by a standard 23, the end wall being formed with a circular flange 24 which fits closely within a circular flange 25 mounted on the extension 13. The space between the concentric flanges 24, 25 may be sealed by suitable means, not shown, to prevent the escape of gas from the interior of the cylindrical grate while permitting rotation of the kiln relative to the end wall 22. A screw conveyor 26 within the trough 21 advances the materials along the trough to a chute 27, from which they pass by gravity into the main compartment of the kiln.

The apparatus described above is disclosed in substantially identical form in my Patent No. 2,024,453 and forms no part of the present invention, the apparatus being described herein only for the purpose of illustrating one application of the new distributing apparatus, which in the present instance operates to distribute the cement raw materials on the rotary grate 15.

The distributing apparatus illustrated comprises an elongated casing 30 which projects through an opening 31 in the stationary end wall 22 and into the grate 15. The casing is mounted for longitudinal movement in the opening 31 on supporting arms 32 arranged in pairs on opposite sides of the casing, the arms being pivotally connected at their upper ends to the casing and at their lower ends to a pair of parallel supporting beams 33. The beams 33 are interconnected and mounted on flanged wheels 34 movable on a track 35, so that the distributing apparatus may be withdrawn when desired. A link 36 pivotally connected at one end to the outer end of casing 30 is attached at its other end to a sleeve 37 mounted on an eccentric 38 on a shaft 39 journaled on the beams 33, and the rotation of the shaft by sprocket wheel 40 mounted on the shaft and driven through a chain 41 by any suitable power source, causes endwise reciprocation of the casing 30.

The casing in the construction shown includes an outer shell 42 of U-shaped cross-section which extends into the grate beyond the stationary end wall 22, and a trough 43 having upwardly diverging side walls 43a and a top 44. The trough is supported in the shell with its bottom above the bottom of the shell and with the top edges of its side walls meeting the top edges of the side walls of the shell, so that a chamber 45 is formed which is open to the interior of the grate 15. From the outer end of the casing, the top of the trough and the bottom of the shell diverge toward the kiln so that the casing is of greatest height just outside the end wall 22, and from there, the top of the trough and the bottom of the shell converge toward the inner end of the casing. The portion of the casing in the opening 31 is provided with wedges 46, the outer faces of which extend in the direction in which the casing is reciprocated on the arms 32. If desired, suitable sealing means, not shown, may be employed to seal the opening 31 completely around the casing while permitting reciprocation of the casing in the opening.

The cement raw materials are introduced into the trough 43 through an elongated opening 48 in the top thereof, preferably from a pug mill 49, which comprises a casing 50 containing a shaft 51 provided with blades 52 and rotated by any suitable means. The materials are moistened in the mill by a suitable discharge pipe and the action of the mill produces a mixture which is fine-grained and porous. The materials in this condition pass through discharge openings 53 in the bottom of the mill and enter the trough 43, the opening 48 being of sufficient length to permit the material to fall in the trough while the casing 30 is reciprocating. If desired, sets of closely spaced teeth 54 adapted to extend into the discharge openings 53 may be mounted on shaft 51 to prevent clogging of the openings by the discharging materials.

The bottom of trough 43 slopes slightly downwardly into the grate 15 and at its discharge end, is cut away along one side to form a discharge opening 55. At the opposite side of the trough, the side wall is inclined toward the opening 55, and mounted in front of the inclined portion is a baffle formed by a pair of plates 56 supported by brackets 57 secured to the top of the trough and extending through an opening 58 therein, the brackets being adjustable to vary the position of the baffle. The side wall of the trough adjacent the opening 55 is provided with an opening 59, overlying which is a hood 59a, open at the bottom. Secured to the lower edge of the hood is a comb 60 having teeth 61 inclined downwardly in a direction opposite to that in which the bottom of the grate moves in the normal rotation of the kiln. The teeth 61 are spaced relatively closely and the comb is positioned so that the particles and lumps of raw material passing through the discharge opening 55 fall on the comb and, depending on their size, either pass between the teeth or slide down their inclined surfaces to the grate. The comb is so constructed that, during the operation of the device, the teeth vibrate to such an extent as to prevent particles of material from clogging the comb.

In order to prevent escape of gases from the interior of the kiln through the distributing apparatus, a flexible flap 62 may be mounted across the trough so that its free lower edge engages the surface of the material advancing along the trough. The gases which enter the chamber between the trough and casing are withdrawn through a pipe 63 communicating with the chamber and connected to a fan, if desired, and

these gases heat the bottom and sides of the trough and prevent the moist raw materials from adhering thereto. While the use of the casing and trough, providing the gas chamber, is desirable in an apparatus used for the distribution of material which is likely to adhere to the trough, the casing may be omitted if heating of the bottom and sides of the trough is not desired.

In the apparatus illustrated, the teeth of the comb are so directed, with relation to the discharge opening and the direction of travel of the grate, that the larger particles, which pass down the teeth, are deposited in direct contact with the grate and the finer particles deposited thereon. If the grate were traveling in the opposite direction, the comb would be placed at the opposite side of the discharge end with its teeth inclined in the opposite direction. Similarly, if it were desirable to produce a layer in which the fine particles are in contact with the supporting surface and the coarse particles deposited thereon, this result could be obtained by suitable disposition of the comb, and the comb could be omitted altogether if stratification by particle size in the layer were not desired.

In the operation of the new distributing apparatus, the materials deposited in the trough are advanced along the trough by the reciprocating movement of the casing and trough to the baffle plates which are so adjusted as to throw the materials laterally through the discharge openings. The materials fall upon the teeth of the comb, and the coarser particles or lumps slide down the teeth and fall off the ends thereof upon the grate, while the finer particles pass between the teeth and are distributed evenly over the layer of coarser particles. In the layer thus formed, the coarser particles form a bed for the finer particles which would otherwise pass through the grate.

While I have described the use of the new distributing apparatus in connection with my kiln, it will be apparent that it may be used for many other purposes, and the relative movement of the apparatus and the surface may be effected either by moving the surface while the apparatus remains stationary as explained above or by moving the apparatus along the stationary surface.

I claim:

1. In a distributing apparatus the combination of a surface having an opening along one side, means for reciprocating the surface to move material placed thereon toward the opening, means in the path of the advancing material for directing it laterally to pass out through the opening, and a comb connected to the surface and movable therewith, the comb lying near said opening in a position to intercept the material passing through the opening and acting as a classifier therefor.

2. In a distributing apparatus, the combination of a trough having side walls and a bottom, a discharge opening formed partly in the bottom along one side and partly in the adjacent wall, the opposite wall having a portion inclined toward the opening, means for reciprocating the trough to advance material placed thereon toward the opening, and means mounted adjacent the inclined portion of said opposite wall and lying in the path of the advancing material, said means acting to direct the material laterally to pass out said opening.

3. A distributing apparatus comprising a trough having a bottom and side walls and a discharge opening formed partly in the bottom and partly in one side wall near one end, the walls lying at substantially uniform spacing at the opposite end of the trough and the solid wall near the discharge end being inclined toward the wall containing the opening, means for reciprocating the trough endwise to move material therein toward the discharge end, and deflector members mounted on the inclined wall and operable to throw the advancing material laterally through said opening.

4. A distributing apparatus comprising a support for conveying material therealong and having a discharge opening near one end, means for reciprocating the support endwise to move material thereon toward the discharge opening, and a comb mounted on the support with its teeth extending obliquely downwardly under said opening, the teeth having free ends.

5. A distributing apparatus comprising a trough having a discharge opening near one end, means for reciprocating the trough endwise to move material therein toward the discharge end, a baffle in the trough operable to throw the advancing material through said opening, a hood mounted on the trough over the discharge opening and open at the bottom, and a plurality of closely spaced teeth on the hood extending obliquely downwardly under said opening.

6. In combination, a surface on which material is to be distributed, a discharge device for depositing material by gravity on the surface, a comb mounted on said device for intercepting material falling therefrom toward the surface, the comb having teeth extending obliquely downwardly toward the surface, and means for relatively moving the discharge device and surface in a direction parallel to said teeth.

7. In apparatus for distributing material on a moving surface, a discharge device for depositing material by gravity on the surface, and a comb positioned to intercept material falling from said device and with its teeth extending obliquely downwardly toward the surface in a direction opposite to the direction of movement of the surface.

8. In a distributing apparatus, the combination of a trough defined by side and bottom walls and having a discharge opening in at least one of the walls adjacent a line of junction of the bottom wall and a side wall, the opposite side wall having a portion inclined toward the opening, means for reciprocating the trough to advance material placed thereon toward the opening, and a baffle mounted adjacent said inclined portion and lying in the path of the advancing material, the baffle being adjustable relative to said inclined portion and acting to direct the material laterally to pass out said opening.

9. In a distributing apparatus, the combination of a trough defined by side and bottom walls and having a discharge opening in at least one of the walls adjacent a line of junction of the bottom wall and a side wall, the opposite side wall having a portion inclined toward the opening, means for reciprocating the trough to advance material placed thereon toward the opening, means mounted adjacent said inclined portion and lying in the path of the advancing material, said means acting to direct the material laterally to pass out said opening, and a comb connected to the trough to be reciprocated therewith and extending obliquely downwardly from under the opening in position to intercept mate-

rial passing through the opening, the comb classifying the material into two parts.

10. In a distributing apparatus, the combination of a support for conveying material and having a discharge opening, means for reciprocating the support to move the material thereon toward the opening, and a comb mounted on the support in position to intercept material passing through the opening and operable to classify the material into two parts, the comb having flexible teeth adapted to vibrate relative to the support when the support is reciprocated.

11. In a distributing apparatus, the combination of a trough defined by side and bottom walls and having a discharge opening in at least one of the walls adjacent a line of junction of the bottom wall and one side wall, the opposite side wall having a portion inclined toward the opening, an outer shell for the trough forming therewith a chamber adjacent the bottom and side walls of the trough, the chamber having an opening in one of its walls for passage of a fluid, means for reciprocating the trough to advance material placed thereon toward the discharge opening, and means mounted adjacent said inclined portion and lying in the path of the advancing material, said means last named acting to direct the material laterally to pass out said opening.

12. A distributing apparatus comprising a discharge device, means for reciprocating said device, and a comb connected to said device and having flexible teeth vibrated by the reciprocation of said device and extending obliquely downwardly and free at their ends, the comb being so positioned that the teeth intercept material falling from said device.

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