May 15, 1934. R. A. MILLER 1,959,212

PROCESS AND APPARATUS FOR GRADING FINELY DIVIDED MATERIAL

Filed Nov. 17, 1931

Fig. 2.

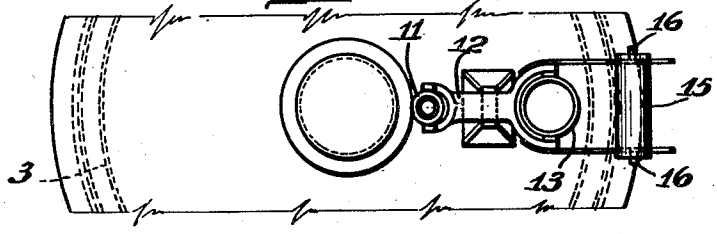


Fig. 1.

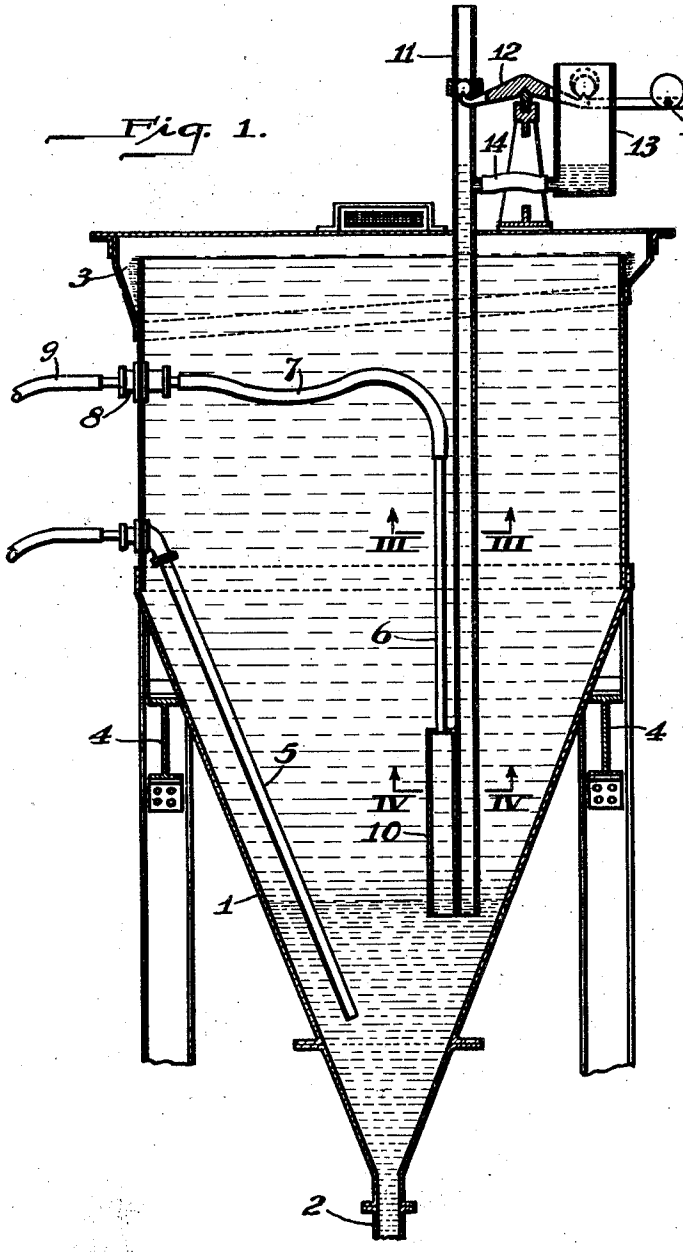


Fig. 3.

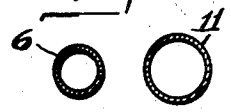
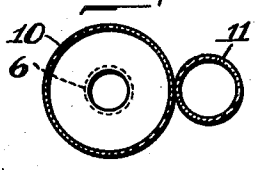


Fig. 4.



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PROCESS AND APPARATUS FOR GRADING FINELY DIVIDED MATERIAL

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Application November 17, 1931, Serial No. 575,545

5 Claims. (Cl. 209—160)

The invention relates to a guarding process and apparatus designed particularly for grading abrasives for use in the grinding of plate glass, although not limited to use with abrasives or to use in such relation. The abrasive commonly used in surfacing plate glass is sand, which will be referred to hereafter as the specific example of the finely divided material to be graded. Different stages of the grinding operation require abrasive particles of different sizes, finer and finer abrasive being used as the grinding operation progresses. It is highly desirable, for reasons well known to those skilled in the art, that at each stage of the operation the grade of abrasive be maintained uniform and it is the object of the present invention to provide a process and apparatus which will act automatically to insure this result, regardless of changing conditions of mixture density in the grading receptacle, such as the cone which is ordinarily employed. One embodiment of the invention is illustrated in the accompanying drawing, wherein:

Figure 1 is a vertical section through the apparatus. Fig. 2 is a plan view. And Figs. 3 and 4 are sections on the lines III—III and IV—IV respectively of Fig. 1.

Referring to the drawing, 1 is a grading receptacle preferably in the form of a cone having an inlet 2 at its lower end and an overflow trough 3 at its upper end, from which the excess water and material too fine for use are conducted to a sewer by means of a pipe which is not shown. The cone or tank is preferably of sheet metal construction and is supported upon the I-beams 4, 4 or in any suitable manner. The cone is filled with a mixture of water and abrasive, such as sand, and the grading is accomplished by means of an upward flow of liquid under pressure from the pipe 2. This serves to separate the abrasive into grades, the position of each of which grades in the cone, is dependent upon its fineness, the coarsest grades occupying a position at the bottom of the grader and the grades thereabove being finer and finer, from the bottom up. This positioning of the grades at different levels depending upon fineness is due to the varying upward velocity in the cone incident to its shape, the velocity thus decreasing from the lower end of the cone up. The abrasive in the cone may be supplied thereto in any desired manner either by placing it in the top of the cone or supplying it with the liquid which flows upward through the pipe 2, the latter being the course usually pursued. A pipe 5 projecting to a point adjacent the lower end of the cone serves to deliver therefrom the coarsest material. In the case of a material which is an abrasive to be used in the grinding of glass, this portion of the abrasive is used in the coarse or rough grinding operation to which the glass is subjected in the first state of the surfacing operation.

Only one pipe or tube 6 is illustrated for delivering one of the finer grades of material from the cone, but it will be understood that a number of these fine sand delivery pipes may be employed in the grader, depending upon the number of grades which it is desired to utilize and that they will lie with their lower ends at different levels in the cone. The pipe 6 has its upper end connected to a rubber hose 7 leading to the fitting 8 which conducts the mixture through the wall of the cone. The fitting 8 is connected at its outer end to the delivery pipe 9 whose outlet end lies at a point below the bottom of the grader, the pipes 6, 7 and 9 thus constituting a siphon tube which will continue to deliver after the flow through this tube is started. The lower end of the pipe 6 is in the form of an enlarged cylindrical part 10. The lower end of this tube is positioned at exactly the level occupied by the grade of sand which it is desired to deliver from the pipe 6 and which is in equilibrium at the lower end of the part 10.

The purpose of the enlargement 10 is to prevent any particles of material which are oversize with respect to the grade normally in equilibrium at the level of the lower end of the enlargement 10, from being carried up through the tube 6. If it so happens that the velocity in the tube 6 due to the action of the siphon is higher than the upward velocity of the liquid in the cone at the lower end of the part 10, any oversize particles entering the tube would be carried on through such tube so that the grade delivered from the tube would be no-uniform to this extent. The cylindrical end 10 is made of such diameter that the upward velocity therethrough due to the siphon action in the tube is equal only to the upward velocity of the liquid in the cone at the lower end of the part 10. Therefore, if any oversize particles enter the part 10, they will not be carried up into the tube 6, but on the contrary will settle down therein and drop into the body of the liquid in the cone.

A second important feature of the invention consists in the provision of means whereby the vertical position of the inlet end 10 of the tube 6 is automatically regulated depending upon the density of the mixture in the cone. If the density of the mixture in the cone increases beyond

a certain point, an increase in the upward velocity of the liquid in the cone or tank is produced, which results in a change in position of the various grades in the tank, the shift being upward, in the instance given, due to the increase in velocity. The reverse of this, of course, occurs, when the density of the mixture in the cone drops down below a certain point. It is very difficult to maintain the density of the mixture constant, and the present invention is, therefore, directed toward taking care of the varied density by automatically varying the vertical position or level of the lower end of the part 10. To this end, the tube 11 is employed, preferably open at both ends and secured at its lower end to the enlargement 10 of the tube 6. This tube is supported at one end upon the scale beam 12, and upon the other end of such scale beam is hung the container 13 which acts as a counterbalance. This container is connected to the tube 11 by means of the rubber hose 14. Due to the density of the mixture in the cone at the lower end of the tube 11, the level of the liquid in such tube is raised above that of the level of the mixture in the tank, and partially fills the container 13. For the purpose of counterbalance adjustment, the weight 15 is provided, such weight being slotted to receive the bars 15 constituting the end of the lever 12. Screws 16 serving to hold the weight in adjusted position. The tube 11 is so counterbalanced that under nominal conditions, the level of the lower end of the part 10 will be at the position necessary to deliver the required grade to the tube 6. If now the density of the material in the tank increases beyond a certain point, the grade which it is desired to remove from the cone rises above the level previously occupied, due to the increased velocity produced by the increased density, and if no adjustment were made, the grade delivered to the tube 6 would be coarser than that previously delivered. The increased density of the mixture, however, causes the level of the liquid in the tube 11 to rise so that more liquid flows into the container 13, thus adding additional weight on the right hand end of the beam 13 and causing the tube 11 to move upward. This moves the inlet end 10 of the delivery tube 6 up to the proper level for removing the grade of material which had been previously removed from a lower level. When the density of the liquid decreases, a reverse action occurs, and the tube 11 moves down, so that the delivery to the inlet end 10 of the tube 6 is from a lower level. Compensation is thus made for variations in density in the mixture and for variations in the level of the grades which it is desired to deliver so that a very uniform grade of material is insured from each delivery pipe regardless of variations in density in the cone.

What I claim is:

1. A process of removing a desired grade of material from a grading receptacle containing a mixture of finely divided material and a liquid and in which an upward flow of liquid at decreasing speed through the receptacle separates the material into grades which are finer and finer from the lower portion of the receptacle up, by means of a siphon tube whose open inlet end extends down into the receptacle to the depth to which the desired grade is raised in such receptacle, which consists in maintaining in the inlet end of said tube an upward velocity which approximates the upward velocity of the liquid in the tank at the level of said inlet end of the tube, and in utilizing the density of the mixture to adjust the vertical position of said inlet end.

2. In combination, with a grading receptacle to which finely divided material and liquid are supplied and which has a flow upward therethrough at decreasing velocity to grade the material, of a siphon delivering tube whose inlet end is mounted for vertical movement and extends down into the receptacle to the level at which the grade to be removed reaches an equilibrium, and means regulated by the density of the mixture in the receptacle for adjusting the inlet end of the tube up and down.

3. In combination, with a grading receptacle to which finely divided material and liquid are supplied and which has a flow upward therethrough at decreasing velocity to grade the material, of a siphon delivery tube whose inlet end is mounted for vertical movement and extends down into the receptacle to the level at which the grade to be removed reaches an equilibrium, means regulated by the density of the mixture of the liquid for adjusting the inlet end of the tube up and down, and means whereby the upward velocity in said inlet end is maintained at a velocity of approximately the same as that of the upward velocity of flow of the liquid in the receptacle at the level of said inlet end.

4. In combination, with a grading receptacle to which finely divided material and liquid are supplied and which has a flow upward therethrough at decreasing velocity to grade the material, of a siphon delivery tube whose inlet end is mounted for vertical movement and extends down into the receptacle to the level at which the grade to be removed reaches an equilibrium, and means regulated by the density of the mixture in the receptacle at the inlet end of the tube for adjusting such end up and down.

5. In combination, with a grading receptacle to which finely divided material and liquid are supplied and which has a flow upward therethrough at decreasing velocity to grade the material, of a siphon delivery tube whose inlet end is mounted for vertical movement and extends down into the receptacle to the level at which the grade to be removed reaches an equilibrium, a second tube attached to the said inlet end of the siphon tube open at its lower end and extending upward through the receptacle, a container adjacent the upper end of the second tube having communication therewith and means whereby the container and said second tube are supported so that the container acts as a counterbalance for said tube.

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