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STORAGE BIN AND BLENDER THEREFOR

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2 Sheets-Sheet 1

Fig. 2.

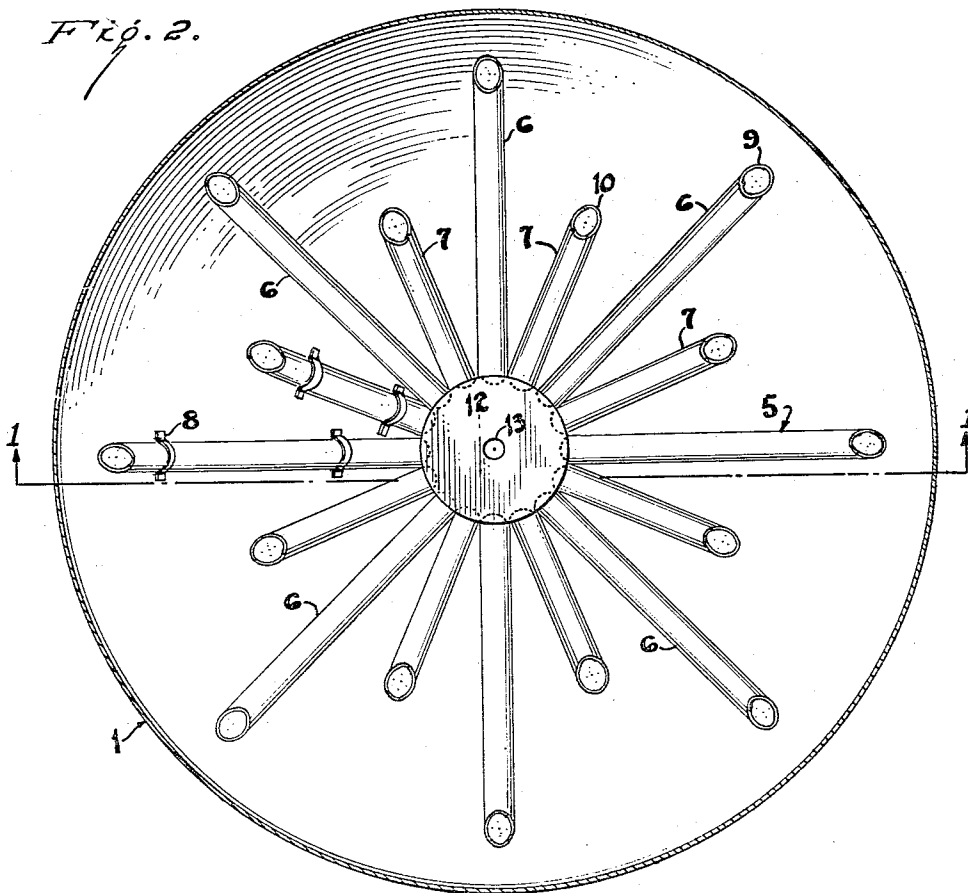
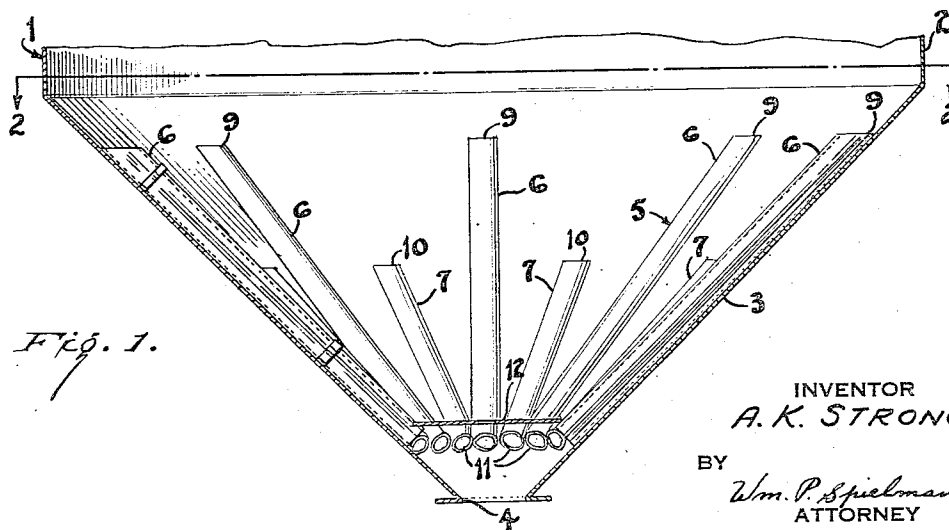


Fig. 1.



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Fig. 4.

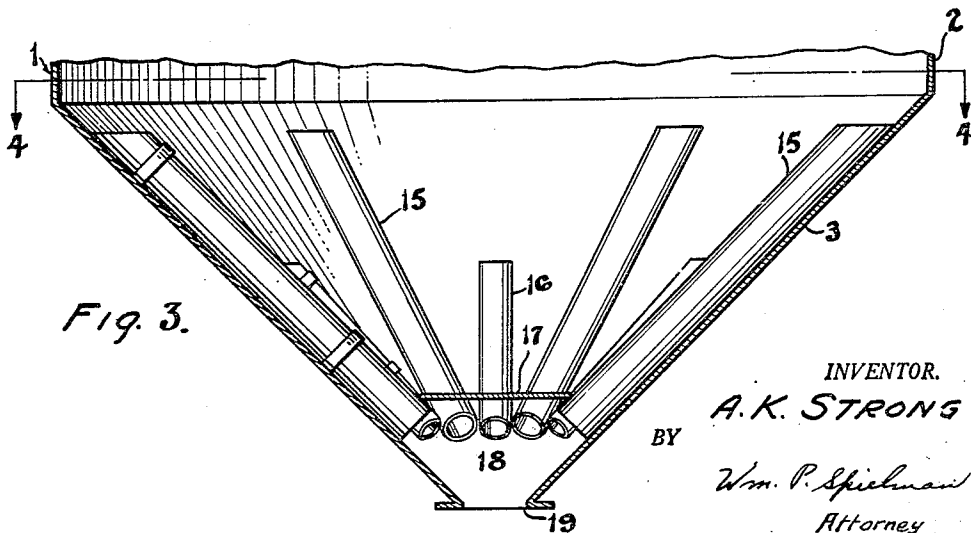
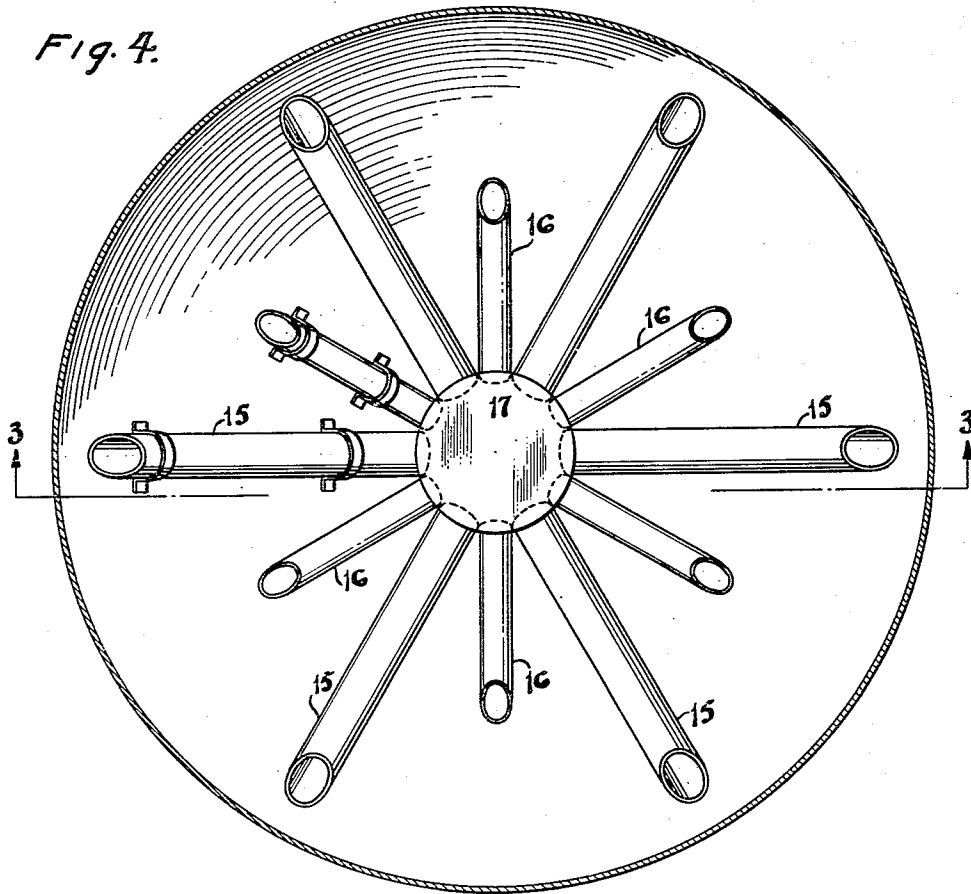


Fig. 3.

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5 Claims. (Cl. 222—564)

This invention relates to an improvement in storage bins adapted to contain granular material and has for its principal object the provision in such bins of a blender for promoting uniformity in the material discharged therefrom.

In the packaging of granular materials such as fertilizers, aluminum sulfate and other inorganic chemicals and the like it is customary to store the material in a large bin or hopper having a conical bottom with a discharge outlet at the apex of the cone. The material is packaged by drawing it from this outlet into bags, barrels, bulk cars or other containers which are then closed and stored or shipped. Considerable difficulty has been experienced in these operations in obtaining uniformity in the quality of the granular material from one such package to another due to the uneven discharge of materials of different particle size or moisture content from the bin. When such bins are emptied through a central outlet at the apex of the conical bottom the material in the axial part of the bin is discharged first and a conical depression or funnel soon forms in the central portion of the bin above this outlet. Larger pieces or lumps of the granular material in the upper portions of the bin are then more likely to roll down the slope while the finer particles are held back, due to their greater angle of repose. The result is that portions of the discharged material have a much greater content of the larger lumps or pieces while others are likely to contain only the finer material.

The present invention provides a relatively inexpensive means of overcoming this difficulty and obtaining uniformity in the granular material from such bins during the entire discharging operation. It is based on the concept of providing multiple points of withdrawal in the conical bottom of the bin which, when the central outlet is open, will create a number of relatively small exit funnels in the material instead of the single large funnel that would otherwise be formed. The materials withdrawn through these multiple points are reblended at a common area of discharge adjacent the outlet, whereby greater uniformity in the discharged material is promoted. The desired multiple points of withdrawal are obtained, in accordance with the invention, by providing a plurality of sets of open discharge pipes in the conical bottom of the bin, these pipes having their upper ends distributed at different levels and at spaced areas within the bottom cone and their lower ends terminating in a reblending area adjacent the outlet. Preferably a covering baffle or other suitable means is provided to prevent direct vertical flow of material from the axial areas of the bin through the outlet, so that most of the material is discharged through the pipes. This cover or baffle may be imperforate, or it may be provided with one or more openings to permit granular material from the central portion of the bin to mix with that flowing from the peripheral portions through the discharge pipes.

The invention will be further described with reference to the accompanying drawings, wherein preferred embodi-

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ments thereof are illustrated. Referring to these drawings, Fig. 1 is a vertical section on the line 1—1 of Fig. 2 showing the lower portion of a bin equipped with a blender embodying the above-described principles of the invention and Fig. 2 is a horizontal section of the line 2—2 of Fig. 1 showing the blender in plan view. Figs. 3 and 4 are similar section and plan views, respectively, showing the bin equipped with a modified blender wherein discharge pipes of different diameters are provided.

Referring to Figs. 1 and 2, the storage bin indicated generally by reference numeral 1 consists of a cylindrical body portion 2 and a conical bottom 3 adapted to be filled with granular material such as papermaker's alum ($\text{Al}_2(\text{SO}_4)_3 \cdot 14\text{H}_2\text{O}$) and the like. The lower end of the conical bottom 3 terminates in an outlet 4 provided with a discharge valve that is not shown. The blender or mixing device indicated generally by reference numeral 5 is made up of a plurality of sets of open discharge pipes, two such sets being used in the device shown on the drawing. The pipes of one set, indicated by reference numeral 6, are longer than the pipes of another set, indicated by reference numeral 7, and the pipes of the first set are therefore adapted to withdraw material from a higher level in the conical bottom than are the pipes 7 of the second set. The pipes of the several sets are so spaced, and if necessary or desirable are so calculated as to size, that the movement of granular material out of the bin will be fairly uniform over its entire diameter when the outlet 4 is opened.

The pipes of the several sets are preferably spaced uniformly along the inner side of the conical wall of the bottom of the bin and may be attached thereto by straps 8, by spot welding or by other suitable means. The open upper ends 9 and 10 of the discharge pipes are therefore distributed at spaced areas within the conical bottom of the bin, and preferably in the outer portions thereof, with the upper ends of the pipes of different sets located at different levels therein. The lower ends 11 of these pipes are brought together adjacent the outlet 4 so that the granular material flowing therethrough will be blended as it passes through this outlet and material of uniform particle size distribution and moisture content will be obtained.

It will be seen that the several sets of discharge pipes 6 and 7 serve to draw off granular material from the outer portions of the bin at substantially uniform rates, the material so withdrawn being mixed or blended at the bottom of the cone adjacent the outlet 4. In order to avoid a rapid discharge of material from the axial portions of the bin a baffle 12 or other suitable cover for the lower ends 11 of the distributing pipes is provided; this baffle may be imperforate or it may contain a central opening 13 or a number of such openings depending on the size of the bin and the particular nature of the granular material being handled. The baffle 12 preferably is in the form of a plate fitting over the lower ends of the distributing pipes but leaving open the spaces between these pipes so that a certain proportion of material from the central part of the bin will be discharged. The open spaces between the pipes also permit the bin to be completely emptied for purposes of cleaning.

Figs. 3 and 4 of the drawings illustrate an embodiment of the invention wherein a set of discharge pipes 15 of one diameter and a second set of pipes 16 of smaller diameter are illustrated. This provision of pipes of varying diameter is useful in promoting a more uniform movement of granular material out of the bin. The larger pipes 15 are preferably longer than the smaller pipes 16 and therefore have their upper ends located at a higher level in the conical bottom, but otherwise the blender is similar in structure and operation to the embodiment of Figs. 1 and 2 of the drawings.

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The lower ends of the pipes of Figs. 3 and 4 are shown as being covered by an imperforate baffle 17 which forms therewith a discharge chamber 18 wherein the material from the several pipes is blended together before passing through outlet 19 into the bags or barrels in which it is to be stored or shipped.

Referring to the plan views of the blender shown on Figs. 2 and 4 of the drawings it will be noted that the provision of open pipes of different lengths extending from an area adjacent the outlet of the conical bottom to spaced areas higher up in this bottom results in the provision of a number of spaced points of withdrawal serving the entire cross sectional area of the storage bin. These withdrawal points are so located that small exit funnels centering on each point will intersect shortly after the outlet of the bin is opened. Following such intersection the mean level of granular material in the bin will drop uniformly over its entire cross section, and the formation of a large central cone or funnel will be prevented. Segregation of larger pieces or lumps of the granular material in one portion of the discharge is therefore substantially completely avoided.

Although the invention has been described and illustrated with reference to certain preferred embodiments thereof it will be understood that modifications and substitutions of equivalents may be resorted to within the scope of the appended claims. Thus, for example, although all of the discharge pipes are shown as being parallel to the conical bottom of the bin it will be understood that discharge pipes extending from the outlet area at a different angle to the bottom portion may be suitable in some cases and may be utilized. The invention in its broader aspects is therefore not limited by the embodiment shown, but should be construed broadly within the scope of the following claims.

What I claim is:

1. In a storage bin having a conical bottom adapted to be filled with granular material and an outlet at the apex thereof, a blender promoting uniformity in the material discharged from said bin comprising a plurality of sets of open discharge pipes extending from an area adjacent said outlet to spaced areas higher up in said conical bottom, the pipes of one set having their upper ends located at a level higher than the pipes of another set, and a baffle covering the lower ends of said pipes and forming therewith a discharge chamber wherein granular material from different horizontal and vertical portions of said conical bottom is blended when said outlet is opened.

2. In a storage bin, a conical bottom adapted to be filled with granular material, an outlet at the apex thereof, a plurality of sets of open discharge pipes spaced uniformly along the inner side of the conical wall of said bottom with the upper ends of the pipes of different sets located at different levels, the lower ends of all the pipes being brought together in a ring adjacent said outlet, and

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a baffle covering the lower ends of said pipes and forming therewith a discharge chamber wherein granular material from different horizontal and vertical portions of said conical bottom is blended when said outlet is opened.

3. In a storage bin having a conical bottom adapted to be filled with granular material and an outlet at the apex thereof, a blender promoting uniformity in the material discharged from said bin comprising a plurality of sets of open discharge pipes extending from an area adjacent said outlet to spaced areas higher up in said conical bottom, the pipes of one set being larger in diameter and having their upper ends located at a level higher than the pipes of another set, and a baffle covering the lower ends of said pipes and forming therewith a discharge chamber wherein granular material from different horizontal and vertical portions of said conical bottom is blended when said outlet is opened.

4. In a storage bin having a conical bottom adapted to be filled with granular material and an outlet at the apex thereof, a blender promoting uniformity in the material discharged from said bin comprising a plurality of sets of open discharge pipes spaced uniformly along the inner side of the conical wall of said bottom from an area adjacent said outlet to spaced areas higher up therein, the pipes of one set being larger in diameter and having their upper ends located at a level higher than the pipes of another set, the lower ends of all the pipes being brought together in a ring, and a baffle covering said lower ends of the pipes and forming therewith a discharge chamber wherein granular material from different horizontal and vertical portions of said conical bottom is blended when said outlet is opened.

5. In a storage bin having a conical bottom adapted to be filled with granular material and an outlet at the apex thereof, a blender promoting uniformity in the material discharged from said bin comprising a plurality of sets of open discharge pipes having their upper ends spaced uniformly along the inner side of the conical wall of said bottom with the ends of the pipes of different sets located at different levels and the lower ends of all the pipes being brought together in a reblending area adjacent said outlet, and a cover over said reblending area adapted to prevent unimpeded vertical flow of material from the axial areas of the bin through said outlet.

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