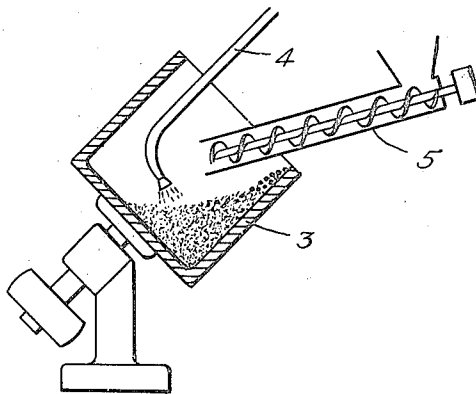


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METHOD OF AGGLOMERATING FINELY DIVIDED MATERIAL.
APPLICATION FILED SEPT. 5, 1916.

1,239,221.

Patented Sept. 4, 1917.



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METHOD OF AGGLOMERATING FINELY-DIVIDED MATERIAL.

1,239,221.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, HUGH RODMAN, a citizen of the United States, and a resident of Edgewood, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Methods of Agglomerating Finely-Divided Material, of which the following is a specification.

This invention relates to the pebbling or agglomerating of powdered material and discloses a new and improved process therefor.

In agglomerating or pebbling crushed or finely divided material by tumbling it with a binding agent, it has generally been necessary to employ batch methods and to screen out the oversize and undersize pebbles for reprocessing.

For instance pills have been made by alternately moistening and dusting small nuclei or centers till pills of the average size desired were produced. Over size and undersize pills were then removed by screening and the process repeated.

I secure a continuous process and avoid the screening of the batch process by using a tumbling or agitating device so operated that there is a marked grading action of the material being processed, and with the feed so arranged that the agglomerating or building up takes place only upon the undersize pills, the pills of full size meantime being out of the building up zone and, preferably, being continuously removed. In this way I secure a more efficient method of manufacturing and a far greater uniformity of product than can be gotten from the old batch method, or from a method in which the grading action is not taken advantage of.

The method I have described may be carried forward in several mechanical ways but the way I find best suited to the purpose is as follows:

A tub about two feet deep and two feet diameter with parallel sides is mounted to revolve upon its axis held at about thirty degrees from the horizontal. Finely divided material and binding agent are fed into this device by screw conveyer and sprinkler, or in any suitable way, care being taken to insure the binding agent falling only upon the material tumbling at the back or bottom of the tub. Nuclei may be added unless the tumbling material makes its own nuclei. The size and number of the nuclei

formed by the tumbling mass may be regulated by varying the amount of binding agent added. The tumbling material rapidly and completely separates into a uniformly graded mass, all of the larger pills or agglomerates coming to the elevated or outer portion of the tub and grading from there, through smaller and smaller agglomerates, to the back or bottom of the tub where only the small agglomerates and finely divided material or dust remain. It follows that if the binding agent is applied only to the region or zone occupied by the very small agglomerates and dust there will be no building up of any but the small agglomerates and that these, as soon as they are larger than other agglomerates in the tub, will travel rapidly out of the building up zone. In this way the agglomerates are produced of very uniform size, only those being acted upon which are smaller than others.

As an improved method of manufacturing pills or agglomerates I make use of the process described to secure a continuous manufacturing method rather than a batch process, though the method of building up only the small size agglomerates may also be used as a batch method. For continuous manufacturing I use the device described, continuously feeding the binding agent into the back of the tumbling mass and continuously feeding the powdered material into the mass somewhat nearer the mouth of the tub and letting the finished pills or agglomerates continuously discharge over the lip of the tub. I find the best place to spray or sprinkle the binding agent is vertically over the lower edge of the bottom of the tub, and the best place to feed the powdered material to be about half way back from the mouth of the tub. Any excess powder will be quickly carried to the bottom of the tub and will not escape with the finished pills. Nuclei may be added if the material does not form its own.

I have used the device described to make small agglomerates or pills for carburizing steel, the powder being a mixture of finely divided carbonaceous materials and alkaline materials and the binding agent being molasses solution, glutrin, etc. I have also used the device to make agglomerates of other materials, as starch, macaroni flour, etc.

The grading action of the device described

is positive and rapid, but I am not able to give a satisfactory mechanical explanation for it. The action is much more positive than that secured by revolving the frustum of a cone upon its axis held in a horizontal position; and is different in that the cone frustum tends to carry the larger agglomerates to the bottom of the frustum, where the mass is deepest, while the inclined straight sided tub carries the larger agglomerates to the upper edge of the tub, where the mass is shallowest. I might add that the ordinary tumbling barrel made of the frustum of a cone and revolved upon its axis held at an angle of about thirty degrees from the horizontal, just about balances the two grading tendencies already described, so that there is little or no grading action obtained from these commercial machines. That is the shape of the device tends to force the larger agglomerates to the bottom of the frustum, while the angle of the axis tends to force them to the mouth and the two tendencies closely balance.

I believe that I am the first to make use of a process of making agglomerates or pills in which the agglomerates are graded as they are formed, and in which the smaller agglomerates only are subjected to the building up action. In other words I believe that I am the first to make agglomerates or pills, in which the agglomerates are graded as formed, the larger agglomerates being removed or moved out of the building up zone and the smaller agglomerates only being subjected to the building up action of the binding agent and dust or finely divided material.

I have shown in the accompanying drawing a device which may be employed in carrying out my improved process.

The device includes a tumbling barrel 3 having parallel sides and a diameter about equal to its depth. This is arranged to revolve upon its axis held at about 30° from the horizontal. A spraying or dripping device 4 is mounted so as to introduce a binding agent into the barrel and near the inner end thereof. Finely divided or powdered material, which may include nuclei if desired, is introduced into the barrel by means of apparatus such as a screw conveyor 5, which delivers the dry material at a point about midway between the inner end and the lip of the barrel. The larger agglomerates, as formed, move to the front of the barrel and, in a continuous process discharge over the lip of the barrel, whereas the dust and smaller agglomerates move to or remain at the inner end of the barrel and are eventually built up into agglomerates of such size that they move to the front of the barrel and are discharged. The final size of agglomerates discharged may be closely regulated by the number and size of nuclei

added or formed. It will be apparent to those skilled in the art that other apparatus may be employed in carrying out my process.

What I claim is:

1. The method of building up pills or agglomerates which consists in agitating finely divided material and nuclei in a grading device and adding a binding agent only to the smaller of the agglomerates formed.

2. The continuous method of building up pills or agglomerates, which consists in agitating finely divided material and nuclei in a grading device, continuously adding a binding agent to the smaller agglomerates only, and continuously removing the larger agglomerates.

3. The method of building up pills or agglomerates which consists in tumbling finely divided material and nuclei in a tumbling and grading device and adding a binding agent only to the smaller of the agglomerates formed.

4. The continuous method of building up pills or agglomerates which consists in tumbling finely divided material and nuclei in a tumbling and grading device, continuously adding a binding agent to the smaller agglomerates only and continuously removing the larger agglomerates.

5. The method of building up pills or agglomerates which consists in tumbling finely divided material and nuclei in an inclined tumbling and grading device and adding a binding agent to the smaller agglomerates only.

6. The process of producing agglomerates, which consists in agitating dry finely divided material and nuclei, in adding a liquid binding agent to the agitated mass, causing the agglomerates to move away from the zone receiving the binding agent as they increase in size and finally discharging the agglomerates from the agitated mass.

7. The process of forming agglomerates, which consists in agitating finely divided material, continuously introducing a binding agent into a definite zone of agitation of the mass grading the agglomerates formed by causing them to move farther away from the zone receiving binding agent as they increase in size, and adding additional quantities of dry material to the agitated mass at a zone other than the zone receiving the binding agent.

8. The process of increasing the size of agglomerates which consists in agitating a mass of nuclei and finely divided material, introducing a binding agent to a definite zone of agitation of the mass and grading the agglomerates as they are formed, by moving them so that the smaller agglomerates only are subjected to the building up action of the dry material and binding agent.

9. The process of increasing the size of agglomerates, which consists in agitating a mass of nuclei and finely divided material, grading the agglomerates as they are formed by moving agglomerates of different sizes to different zones of agitation and subjecting the smaller agglomerates only to the building up action of a binding agent and finely divided dry material.
10. The method of producing pebbles which consists in agitating fine material and causing the larger agglomerates as formed to travel in one direction, while the smaller agglomerates and fine material travel in another direction, and subjecting the smaller agglomerates only to the action of a finely divided material and a binder.
11. The method of producing pebbles which consists in agitating fine material in a bed of varying depth and causing the larger pebbles as formed to travel toward the shallow edge of the bed, subjecting the deeper

portion of the bed to the action of a binding agent, and removing the larger pebbles formed from the shallow edge of the bed.

12. The method of agglomerating material which consists in maintaining a mass of fine material in a bed of varying depth, adding a binding agent to the material at some point within the bed and thereby forming agglomerates, agitating the mass and causing a continuous flow of the smaller agglomerates and material toward the deeper portion of the bed and the larger agglomerates of material toward the shallower portions of the bed, in removing the larger agglomerates and wetting the smaller agglomerates only with binding agent while continuing the agitation.

In testimony whereof, I have hereunto subscribed my name this 2nd day of September, 1916.

HUGH RODMAN.