

Jan. 24, 1956

G. H. NEEL ET AL

2,732,307

METHOD OF CONTINUOUSLY BLENDING STREAMS OF POTATO GRANULES

Filed Feb. 26, 1953

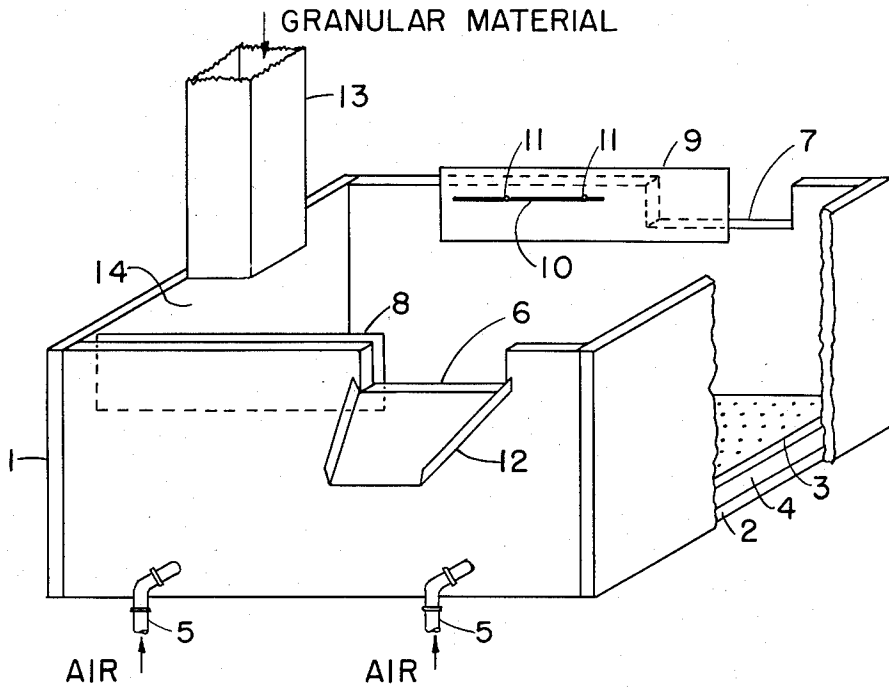


FIG. 1

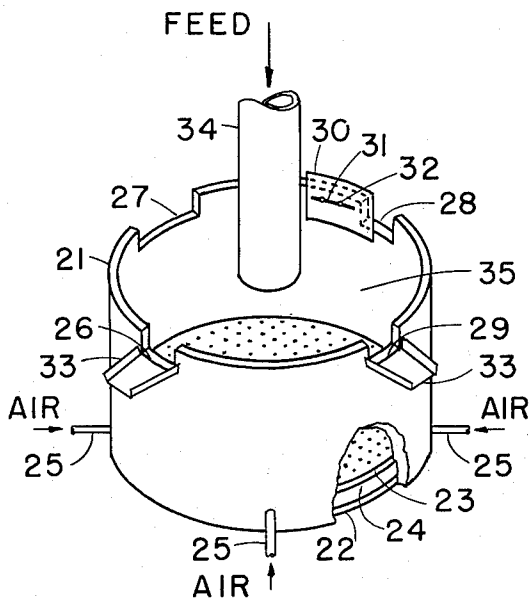


FIG. 2

G. H. NEEL
M. W. COLE
INVENTORS

by *T. A. Seegrist*
ATTORNEY

1

2,732,307

**METHOD OF CONTINUOUSLY BLENDING
STREAMS OF POTATO GRANULES**

George H. Neel, Albany, and Manley W. Cole, San Pablo,
Calif., assignors to the United States of America as represented by the Secretary of Agriculture

Application February 26, 1953, Serial No. 339,192

6 Claims. (Cl. 99—207)

(Granted under Title 35, U. S. Code (1952), sec. 266)

A non-exclusive, irrevocable, royalty-free license in the invention herein described, for all governmental purposes, throughout the world, with the power to grant sublicenses for such purposes is granted to the Government of the United States of America.

This invention relates to the continuous blending and proportionating of streams of divided solid materials, particularly granular substances. The invention has as its prime object the provision of apparatus and methods whereby a stream of divided solid material is continuously subjected to fluidization and while in the fluidized state the material is automatically and continuously separated into a plurality of separate streams of pre-determined proportions. The fluidization also accomplishes a blending or homogenizing of the material so that the several streams are all of uniform composition.

In chemical manufacture, food processing, ore refining and other industries it is often necessary to divide a single stream of divided solid material into several separate streams. This may be for the purpose of conveying to different locations or for applying a different mode of processing, etc. In general known devices for effectuating such stream separation or proportionation have many shortcomings. In the first place, many of the known devices are expensive requiring intricate mechanical devices such as variable-stroke oscillating rakes, pistons, or paddles. The known devices often give unsatisfactory operation due to packing, caking or bridging of the material being handled. Further, the known devices tend to exert damaging forces such as impact, compression, and abrasion whereby they cannot be used with fragile materials.

In the present invention the above disadvantages are essentially eliminated. Thus the device of this invention is very simple and inexpensive—it has no moving parts to wear out or require replacement. Further, during operation of the device, the material being handled cannot become packed, caked, or bridged. The device does not exert damaging forces whether by compression, impact or abrasion on the material being handled. Thus the device is eminently suited for handling potato granules and other foods or materials which are fragile or easily damaged by excessive forces. Inaccuracies due to different degrees of packing as with oscillating pistons or other mechanical feeders does not occur as the material is at all times maintained at the same density level and no compressive forces are applied at any time. The device of this invention is flexible in that it is capable of handling a wide variety of divided materials and adjustments in the proportions of the several streams can be made easily even while the device is in operation. A further advantage of our device is that the stream being proportionated can also be subjected to a variety of operations while the separation into streams is taking place.

Further objects and advantages of this invention will be apparent from the instant description considered together with the accompanying drawing.

2

In the drawing:

Fig. 1 depicts one embodiment of the device of this invention, parts being broken away for clarity of illustration.

Fig. 2 depicts another embodiment of the device of this invention, parts being broken away and parts being omitted for clarity of illustration.

Referring with more particularity to the drawing in which like numerals represent like parts, the embodiment of Fig. 1 includes bin 1 provided with a solid bottom 2 and a foraminous false bottom 3, the space between these defining a plenum chamber 4. Pipes 5 are provided for introducing air or other gaseous medium into the plenum chamber 4 under superatmospheric pressure. Corresponding pipes on other sides of the bin 1 may be provided to ensure equal distribution of the gaseous medium into plenum chamber 4.

Weirs 6 and 7, essentially equi-distant from feed conduit 13 are provided for discharging separate streams of the material from bin 1. The weirs are provided with slidable gates 8 and 9, respectively, for controlling the width of the weirs. The method of weir-width adjustments is depicted with reference to gate 9 and is the same with gate 8. Thus gate 9 is provided with slot 10 and screws 11. By loosening the screws 11, the gate 9 can be shifted to left or right to define a desired weir width and then the screws 11 are tightened again to prevent dislodgment of the gate during operation. Chutes 12 are provided for directing the separate streams into suitable receivers.

In operation, the material to be divided into separate streams is fed by gravity, for example, into the system by conduit 13 from where it flows into chamber 14, that is the part of bin 1 above false bottom 3. At the same time air is forced into plenum chamber 4 via pipes 5. This air then moves upwardly through false bottom 3 which is made of a porous ceramic material or finely woven cloth backed with wire screen to give it the necessary strength. The air in passing through the foraminous false bottom is divided into minute streams of very small cross-section which rise up through the material in chamber 14 and keep the material in a fluidized state. The passage of the minute streams of gas through the material also causes an intimate homogenizing of the material so that it is completely uniform in composition in all parts of the chamber 14. By reason of the fluidization, the material in chamber 14 instead of having the physical characteristics of a solid has the characteristics of a fluid and keeps a level surface and pours just like a liquid. As the level of fluidized material in chamber 14 rises, the fluidized material flows over weirs 6 and 7. Since the bottom edges of both weirs are at the same level the amount of material flowing over each is controlled solely by their width which as before mentioned can be adjusted by slidable gates 8 and 9. It is obvious that by this means the single flow entering through conduit 13 is divided into two streams of pre-determined proportions. It is of course evident that for satisfactory operation the size of the weirs and the influx of material through conduit 13 must be correlated so that the level of fluidized material in chamber 14 is over the bottom edges of weirs 6 and 7 and below the top of bin 1.

As depicted in Fig. 1, weir 6 has twice the width of weir 7 so that the stream from weir 6 will contain $\frac{2}{3}$ of the material entering the system while the stream from weir 7 will contain $\frac{1}{3}$ of the material entering the system. These proportions will be retained regardless of the rate of flow as long as the level of fluidized material is above the bottom edges of the weirs and below the top of bin 1.

While the material is in chamber 14 and is undergoing

fluidization and separation into several streams, it can be subjected to a variety of treatments. For example if it is desired to dry or partly dry the material, hot air, dry air or other dehydrating medium may be introduced through pipes 5 as the fluidizing medium. If it is desired to cool the material then cold air or other cold gas can be introduced through pipes 5. To heat, cook, or blanch the material in process, steam or other hot gas may be introduced through pipes 5. Various chemical agents can also be introduced in a similar way. For example in the treatment of foods it may be desirable to introduce sulphur dioxide gas to prevent or minimize browning of the foodstuff. To this extent, sulphur dioxide gas mixed with air, steam, or inert gases may be introduced through pipes 5. To effect a stabilization of the fat content of the foodstuff in question, it may be advisable to introduce vapors of a volatile fat-stabilizing anti-oxidant such as butylated hydroxy anisole into the streams of gas or vapor used as the fluidizing agent. To effect a change in flavor of a foodstuff, wood smoke or other volatile flavoring agents as vinegar, spices, essential oils, volatile fruit essences, and so forth may be added to the stream of gas or vapor used as the fluidizing agent.

Because of the intimate mixing which occurs in chamber 14 during fluidization, separate streams of similar materials may be fed into chamber 14 for blending, fluidizing and separation into several streams. In such case, single conduit 13 may be replaced by two side-by-side conduits or the streams may both be fed into conduit 13. As an example of such application, a stream of potato granules at 8% moisture content and a stream of potato granules at 6% in equal proportions are fed into conduit 13. The streams of granules flowing over weirs 6 and 7 will then each have a uniform moisture content of 7% because of the intimate mixing taking place in chamber 14. It is evident that this idea may be extended to obtain uniform products from two different lots of differing taste, odor, color, chemical composition and so forth. Further, if only the blending operation is desired rather than blending combined with proportionating then it is a simple matter to close one weir and discharge all the uniform, homogenized product through the remaining weir.

Referring particularly to Fig. 2, this embodiment of the invention includes cylinder 21 provided with solid bottom 22 and a foraminous false bottom 23, the space between these defining plenum chamber 24. Pipes 25 are provided for introducing air or other gaseous medium into plenum chamber 24 under superatmospheric pressure.

Weirs 26, 27, 28, and 29 are provided for discharging the separate proportionated streams of fluidized material from cylinder 21. All four weirs may be provided with slidable gates for controlling their width. In Fig. 2, only gate 30 is shown for clarity of illustration. Gate 30 is provided with slot 31 and screws 32 which function as explained above in connection with the modification of Fig. 1. Chutes 33 are provided for directing the separate streams from the weirs.

The operation of the embodiment of Fig. 2 is like that of Fig. 1. Thus the granular material is fed into the system via conduit 34, the axis of which is coincident with the axis of cylinder 1. The entering material drops into cylindrical chamber 35—that is, the space in cylinder 21 above false bottom 23. The homogenized and fluidized material flows out of weirs 26, 27, 28, and 29, the flow through each being dependent on the width thereof.

The primary advantage of the embodiment of Fig. 2 is that the feed conduit 34 is located at the axis of cylinder 21 whereby the distance between each weir and the feed conduit is the same regardless of position of the weirs on the periphery of the cylinder. This means that each weir is fed the same amount of material hence the level of fluidized material at each weir is the same and

accurate proportionating is effected. Such action is to be contrasted with a system wherein a first weir is close to the feed conduit and a second weir is remote from the feed conduit. In such case the supply to the second weir might be inadequate with a result that the surface of the fluidized bed would tend to be lower in the vicinity of the second weir so that flow rate through the second weir would be somewhat less than the flow rate to be expected from the weir as calculated from its width.

It is evident that the embodiment of Fig. 2 can be utilized to accomplish any of the auxiliary treatments regarding drying, cooling, heating, cooking, blanching, chemical treatment, etc. as described above in connection with the embodiment of Fig. 1.

A particular application of the present invention lies in the production of dried potato granules. The production of this product involves the following technique.

Potatoes are peeled, sliced, cooked with steam, then mashed. The mashed potatoes are then thoroughly mixed with "seed" (dried potato granules from a previous batch) to give a moisture content of about 40% for the mix. This moist, friable powder is then subjected to dehydration in an air-lift drier or similar device and the dried granules resulting are subjected to sieving to separate it into fractions. The coarse material (retained on 16 to 24 mesh screen) is sold for stock feed. The intermediate fraction (passed through 16 mesh, retained on 60 mesh screen) is re-cycled to the system as part of the "seed." The fine fraction (passed through 60 mesh screen) comprises about 40 to 70% of the total and this fraction must be divided into two portions—one comprising about 16 to 20% of total dried material for packaging as product and the remainder for re-cycling together with the intermediate fraction as the "seed."

The separation of the fine fraction into (1) product for packing and (2) "seed" is advantageously performed in accordance with this invention and affords many benefits such as low cost of apparatus and maintenance, absence of packing, caking or bridging, continuous operation, ease of adjusting for changes in product specifications of raw material, accurate proportionation, and thorough blending of the material by reason of the fluidizing so that a uniform product is obtained. It is also to be emphasized that the device does not exert any deleterious impact or compression forces on the potato granules. This is a very important consideration because devices which exert impact, compression, etc. forces tend to rupture the cells in the potato tissue with consequent release of starch from the cells. In such case when the final product is reconstituted (re-hydrated) for use it forms a sticky, unpalatable product. However, when proceeding in accordance with this invention no impact, compression or other deleterious forces are exerted on the potato granules so that when the dried product is re-constituted for use it forms a highly palatable, fluffy dish of mashed potatoes. A further advantage of the invention is that during the proportionation of the potato granules they may be subjected to cooling or further dehydration as necessary by adjustment of the temperature or type of fluidizing medium so that the separated streams will be in the best possible condition for packaging or recycling. A further advantage of the device of this invention is that it is open and easily accessible for cleaning so that it is a simple matter to keep it in a sanitary condition. Another advantage is that impurities of a dense nature such as tramp iron and stones remain on the foraminous surface and are not discharged through the weirs; these impurities can be removed when the apparatus is shut down for cleaning.

Another example of the application of this invention lies in the field of sampling. In many industrial operations it is necessary to obtain samples of materials as they are being processed for analytical or other testing purposes. By applying this invention, a stream of solid granular material can be separated into two streams—

5

one comprising the majority of the flow (for example 99%) which is returned to the proper stage of the operation and a second minor stream (for example, 1%) being retained in suitable receivers for testing purposes. The advantage of the invention in such an application is that the minor stream is truly representative of the main stream because of the thorough blending which takes place during the fluidization. Further, the device does not interfere with the orderly progress of material through the plant nor exert any damaging forces on the material.

Although this invention is adapted to the treatment of potato granules it is obvious that the invention is not necessarily so restricted but may be applied to any fluidizable granular material such as sugar, cereals, dried milk, dried egg and other granular foodstuffs, alfalfa meal, granular soap and detergents, granular plastics, cellulose derivatives, ores, chemicals, and so forth.

Having thus described our invention, we claim:

1. A method for continuously blending a plurality of streams of potato granules of different characteristics to form a uniform material and continuously separating the uniform material into a plurality of streams of predetermined proportions which comprises continuously introducing into a zone a first stream of potato granules having a particular moisture content, simultaneously and continuously introducing into said zone at least one other stream of potato granules having a moisture content different from the granules in the first stream, continuously maintaining the potato granules in said zone in the form of a bed in a fluidized state by continuously forcing minute streams of a gaseous medium upwardly through the bed of potato granules in said zone, the bed of potato granules thereby assuming the characteristics of a liquid in that it keeps a level surface and is capable of pouring, the granules of the separate streams being thereby intimately mixed to form a uniform blended product, and

6

continuously removing said product in the form of at least two separate streams each of different volume by continuously exposing the bed of fluidized, blended granules while at constant level to apertures of predetermined cross-sectional area whereby to divide the blended granules into a plurality of streams, each stream having the same uniform moisture content but the volume of each stream being a function of the cross-section of the aperture through which it passes.

2. The process of claim 1 wherein the gaseous medium is cooled thus to obtain simultaneous cooling of the potato granules.

3. The process of claim 1 wherein the gaseous medium is a gaseous dehydrating medium whereby to obtain simultaneous dehydration of the potato granules.

4. The process of claim 1 wherein the gaseous medium is heated thus to obtain simultaneous heating of the potato granules.

5. The process of claim 1 wherein the gaseous medium contains a volatile preservative whereby to obtain simultaneous improvement in the keeping quality of the potato granules.

6. The process of claim 1 wherein the gaseous medium contains a flavoring material whereby to obtain simultaneous alteration of the flavor of the potato granules.

References Cited in the file of this patent

UNITED STATES PATENTS

204,454	Russell	June 4, 1878
2,005,238	Peebles	June 18, 1935
2,378,542	Edmister	June 19, 1945
2,384,932	Lechthaler	Sept. 18, 1945
2,433,726	Angell	Dec. 30, 1947
2,513,369	Shaw	July 4, 1950
2,526,081	Meincke	Oct. 17, 1950
2,586,818	Harms	Feb. 26, 1952