Jan. 20, 1959 J. H. PICKIN 2,869,837

APPARATUS FOR HOMOGENEOUS BLENDING

Filed July 13, 1956

Fig. 1.

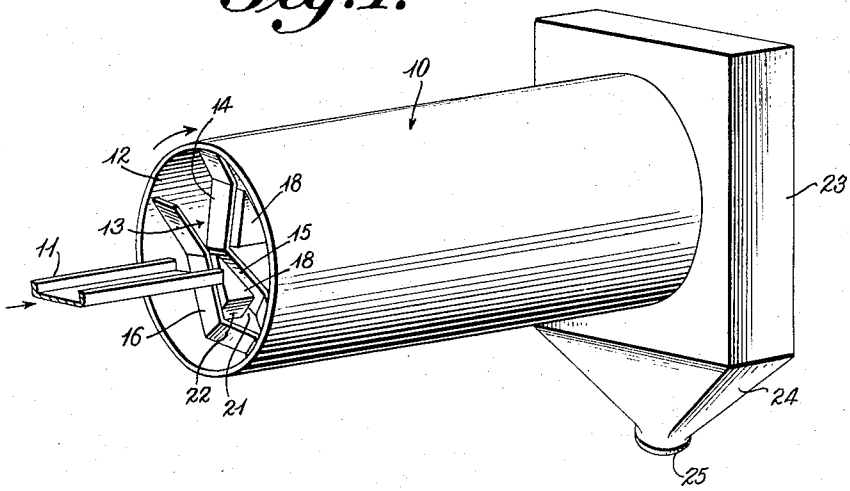


Fig. 3.

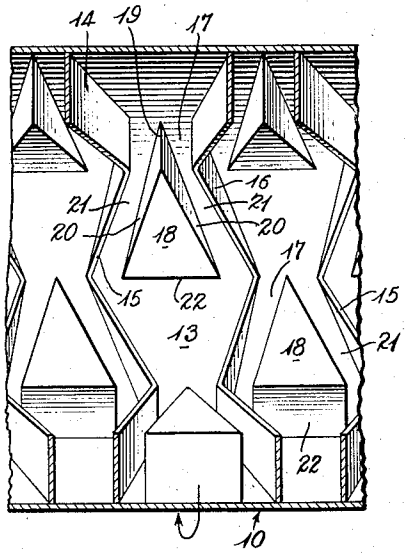
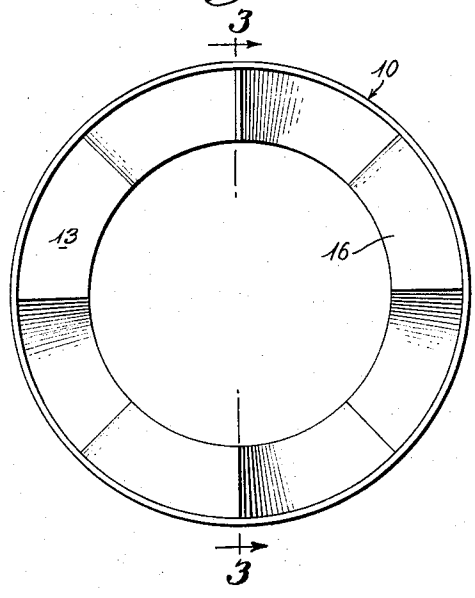


Fig. 2.



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APPARATUS FOR HOMOGENEOUS BLENDING

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3 Claims. (Cl. 259—3)

This invention relates to an apparatus for blending powdered or granular material. More particularly, it relates to an apparatus for continuous blending by passing powdered or granular material along a spiral channel located around the inner surface of a rotating drum having a series of alternating convergent and divergent sections with a flow splitting baffle at the exit end of each convergent section to effect continuous splitting and recombining of the material as it flows along the spiral path.

In conventional blenders and mixers, powdered and granular materials are blended by stirring, beating, agitating or rolling. It has been found, where materials to be blended vary in particle size and density, that in using these conventional mixers or blenders, considerable care in the blending must be taken to avoid stratification of the like particles which results in a mixture lacking homogeneity.

This invention contemplates an improved apparatus for producing homogeneous blending of powdered and granular materials varying in particle size and apparent density by passing a continuous stream of material to be blended along a spiral path around the inner surface of a rotating drum and effecting alternate splitting and recombining of the material passing through the rotating drum. The spiral path is formed in such a manner around the inner surface of the drum that the material fed into one end of the drum is picked up by the entrance section of the spiral path and forced to travel through a series of alternate convergent and divergent sections throughout the length of the drum. In the spiral path formed from a series of alternately diverging and converging walls are wedge-shaped flow splitting baffles with the point of each wedge-shaped baffle being centered at the exit end of each convergent section. The material is forced to pass along the spiral path by the rotation of the rotary drum which inches the material forward by lifting and falling actions as the material is carried upwards against gravity by the rotation of the drum. The continuous splitting and recombining of the material, which varies in particle size and apparent density, as it passes through the drum produces with ease and in an efficient manner a homogeneous blend heretofore found difficult to obtain.

An object of the invention is to provide an apparatus for the continuous blending of material having different specific surfaces and apparent densities by continuous splitting and recombining of a stream of material as it travels along a spiral path in a rotary drum.

A still further object of the invention is to provide a blending apparatus having a spiral path around the inner surface of a rotary drum with alternate convergent and divergent sections forming the spiral path and having a splitting wedge located at the exit of each of the convergent sections so that a stream of material passing along the spiral path is continuously split and recombined throughout its travel.

Additional objects will become apparent from an examination of the drawings, description and claims.

The invention will be described further in connection with the accompanying drawings which are to be considered as an exemplification of the invention and do not constitute limitations thereof.

In the drawings:

Figure 1 is a view in perspective showing a rotary drum arrangement with a spiral path formed on the inner surface of the drum, a feeding chute for feeding the material into the drum, and a discharge chute for removing the material after blending;

Figure 2 is an end view of Figure 1 showing the convergent and divergent walls which form the spiral path around the inner surface of the drum; and

Figure 3 is a fragmentary sectional elevational view, along the line 3—3 of Figure 2, showing the convergent and divergent sections forming the spiral path with wedge-shaped baffles located at the exit of the convergent sections for splitting the flow of material.

The invention will be described in detail in connection with the accompanying drawings, in which Figure 1 shows a horizontal rotary drum **10** provided with a material feed chute **11** which supplies a continuous stream of material to be blended to the entrance section **12** of the drum. On the inner surface of the rotary drum **10** is a spiral path **13** which travels around the inner surface of the drum for its entire length. The spiral path is defined by a series of convergent sections **14** and divergent sections **15**, which alternate throughout the path along the inner surface of the drum. The spiral path is formed from a series of angularly positioned walls **16** which extend towards the center line of the drum for a distance equal to a portion of the radius of the drum and are welded at their base to the surface of the drum. Wall **16** is in portions which are positioned in reversed angularity with respect to each other. The convergent and divergent sections of the spiral path are formed by the angular walls **16**, being so arranged that the side of one convergent section forms the side of the divergent section of the next turn of the spiral. This arrangement of alternate divergent and convergent sections provides a series of convergent throats **17** for funneling the material from the convergent section into the divergent section.

Located in each divergent section **15** is a wedge-shaped baffle **18** having its point **19** centered with respect to throat **17**. The wedge-shaped baffle has faces **20** substantially parallel to the wall **16** of the divergent section **15** and thus defines two channels **21** through which the material leaving throat **17** must pass. The wedge baffle **18** has a flat side **22** which is parallel to the axis of the rotary drum at the end of the divergent section **15**. This arrangement of alternate convergent and divergent sections with a wedge-shaped baffle positioned in the center of path **13** of each divergent section **15** provides for the funneling of the material so that it can be split into two streams by the baffle as it passes through the divergent section from the convergent section and recombines in the next convergent section.

At the exit end of the rotary drum is located a receiving hood **23** into which the blended material falls after passing along the spiral path of the rotary drum. The receiving hood terminates in a funnel **24** having an outlet opening **25** for conveying the blended material from the blending system.

In operation, granular material to be blended is fed through chute **11** into the front end of a slowly rotating drum **10**. As the drum rotates, the entrance section **12** picks up the unblended material as the drum revolves around its longitudinal axis. The material forced to enter the spiral path **13** is first converged in convergent section **14** and, when leaving the section passing through

throat **17**, it is split into two streams by the splitting baffle **18**. The split streams pass through channels **21** and are recombined as they enter the next convergent section. Continuous splitting and recombining of the material as it is inched along the spiral path of the rotating drum produces intimate mixing of the particles in the material so that stratification of like particles is prevented and a homogeneous blending of material initially varying in particle size and apparent density is produced.

After the material has passed along the length of the spiral in the rotary drum, it exits into a hood arrangement where the blended material is funneled to a convenient discharging device for removal from the blending system.

The movement of granular materials through the rotary drum is accomplished by presenting a continuous flight in the form of a spiral path around the inner surface of the rotating drum. As the drum rotates, the material is forced to travel in a longitudinal direction as it flows along the spiral path. The particles of the material are lifted by the rotating action of the drum until gravity causes them to slide and fall downward, thereby advancing the material along the spiral path. As each wedge-shaped baffle is presented, the flow of material is split into two streams and the streams are recombined as they enter the convergent section after passing the face of the baffle. The alternate splitting and recombining as the material is gravitated along the continuous spiral path brings about the intimate blending of the particles.

It is to be understood that various modifications may be made of splitting baffles in the divergent portions of the spiral path. For example, provision may be made for lifting and splitting as well as just splitting the stream of material in order to facilitate blending of material differing widely in apparent density. Also within the scope of this invention is a splitting baffle which will split the flow into a plurality of streams.

Spiral path wall heights of from about one-fourth to one-half the radius of the drum are effective in handling a steady flow of material to produce good blending without spilling the material from one side to the other. Walls having an inclined angle of about 60 to 90 degrees defining the convergent and divergent portions and channel widths between the wedge-shaped baffle and the divergent section walls of about one-fourth to one-third the width of the exit throat provide split flow paths which produce homogeneous blending with a minimum of attrition. Also, drum rotation speeds from 5 to 25 revolutions per minute produce a well-blended material. A plurality of dry powdery ingredients, in and of themselves conventional, of dentifrice compositions may be suitably blended in accordance with the present invention.

It will be apparent from the foregoing description that the present invention provides an easy, convenient

and simplified method and apparatus for effecting a continuous blending of materials which, because of the physical characteristics, are difficult to blend homogeneously in conventional types of blenders and mixers. Consequently, this invention permits blending such materials in a continuous and efficient manner with a substantial reduction in the rate of attrition normally occurring in conventional types of blending equipment.

The apparatus of this invention can readily be incorporated into a continuous process system, whereas conventional types of blenders operate as batch units. The apparatus of this invention has the advantage of blending powdered or granular material with a minimum of breakage and produces a blend homogeneous throughout without stratification of like particles.

While the novel features of the invention have been shown and described and are pointed out in the annexed claims, it is to be understood that various omissions, substitutions and changes in construction and arrangement of the parts shown and described may be made by those skilled in the art without departing from the spirit of the invention. Therefore, it is understood that all matters shown or described are to be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. An apparatus for continuously blending powdered or granular material varying in particle size and apparent density comprising a rotary drum, means defining a continuous spiral path located around the inner surface of said drum for conveying said material through said drum along a path that is spiral with respect to said drum, and means located in said spiral path for splitting said material into a plurality of streams and for then recombining them at a plurality of points along said spiral path.

2. An apparatus for continuously blending powdered or granular material varying in particle size and apparent density comprising a rotating drum; an inwardly extending wall around the inner surface of said drum, said wall having alternate portions positioned at reversed angularity with respect to each other to define a spiral path having a plurality of alternately convergent and divergent sections; and means located in said divergent sections for dividing each said divergent section into a plurality of channels.

3. An apparatus as claimed in claim 2 in which the dividing means is a wedge-shaped baffle located in the divergent portion of said spiral path for dividing the divergent section into two channels.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,869,837 January 20, 1959

John Harlan Pickin

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 43, for "inclined" read -- included --.

Signed and sealed this 11th day of August 1959.

(SEAL)

Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON

Commissioner of Patents