

Nov. 29, 1938.

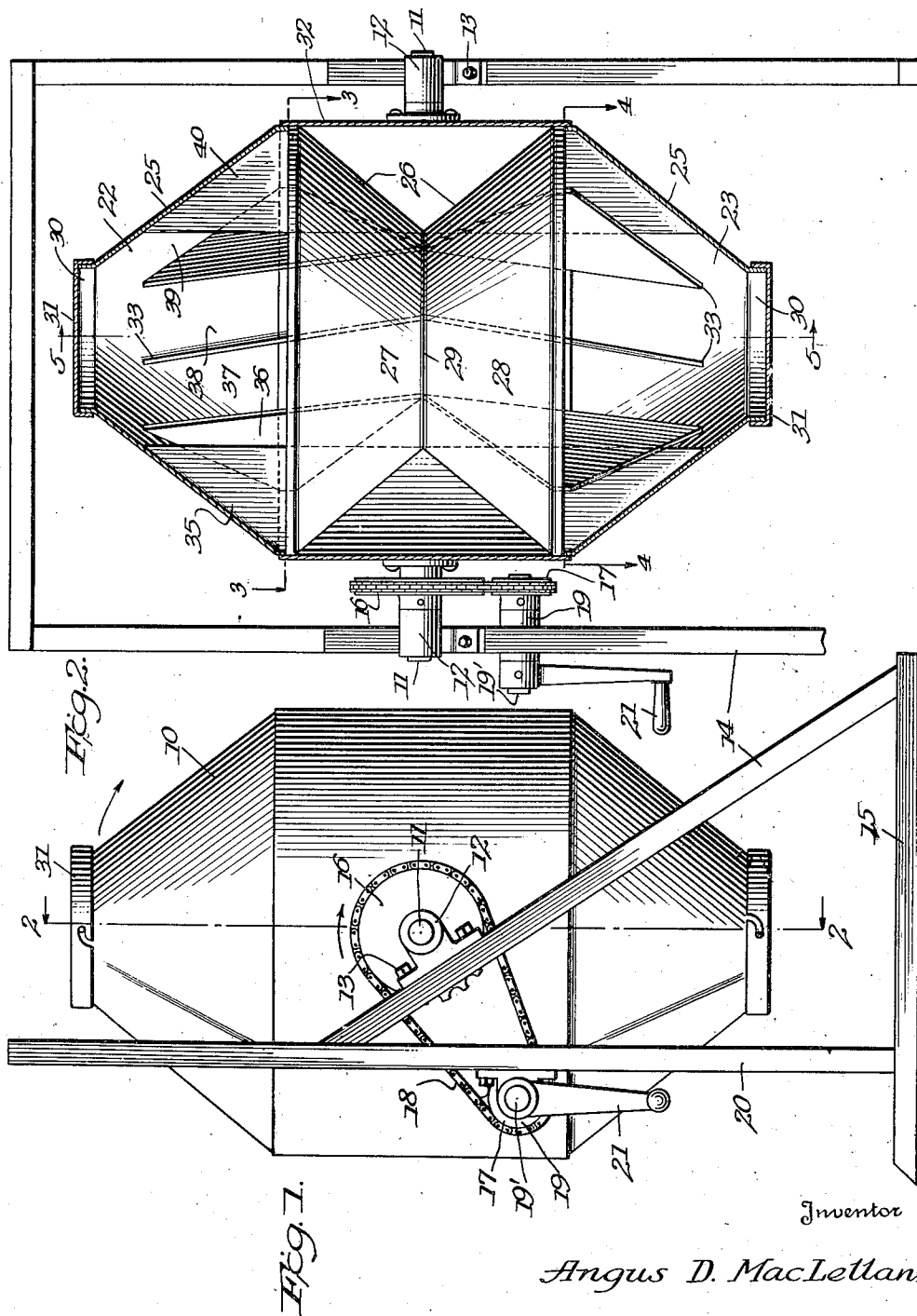
A. D. MacLELLAN

2,138,550

MIXING APPARATUS

Filed Jan. 15, 1938

3 Sheets-Sheet 1



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Fig. 3.

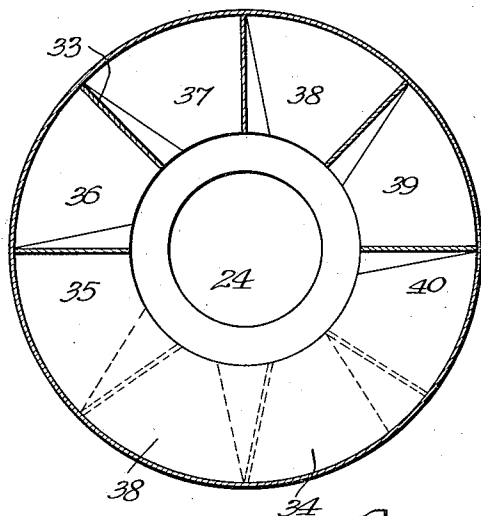


Fig. 4.

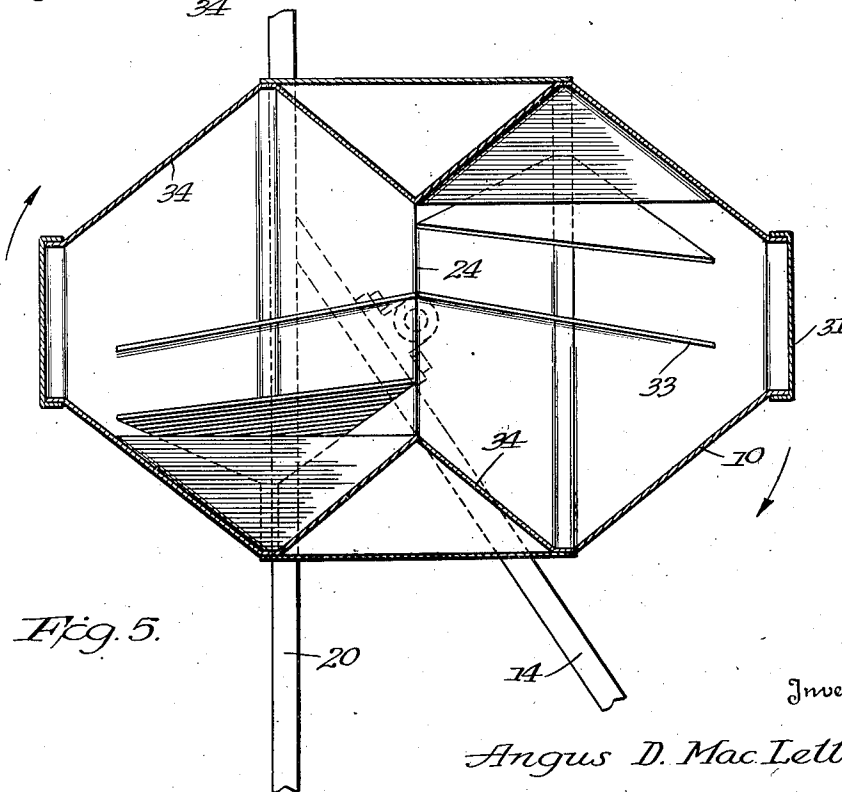
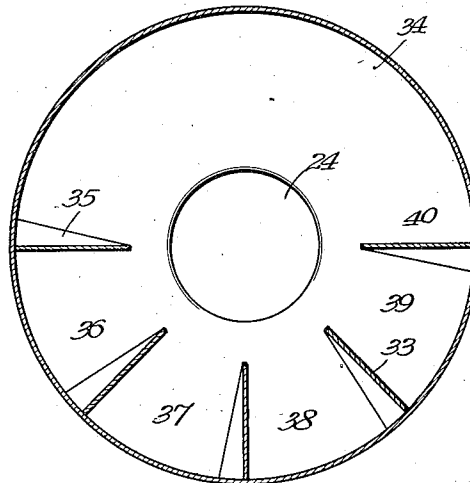


Fig. 5.

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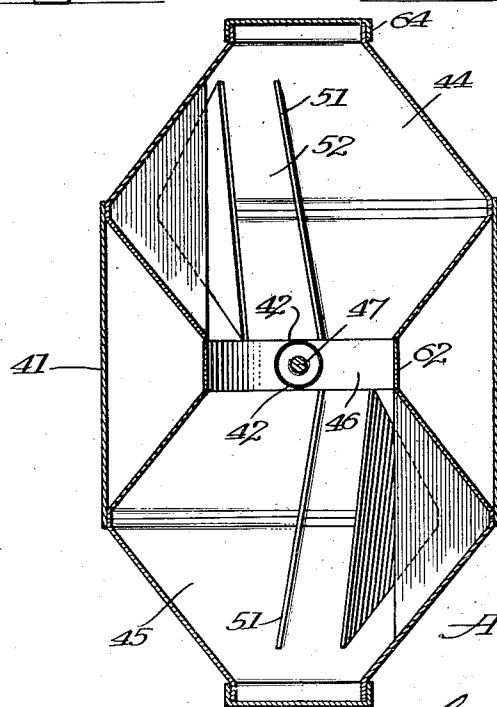
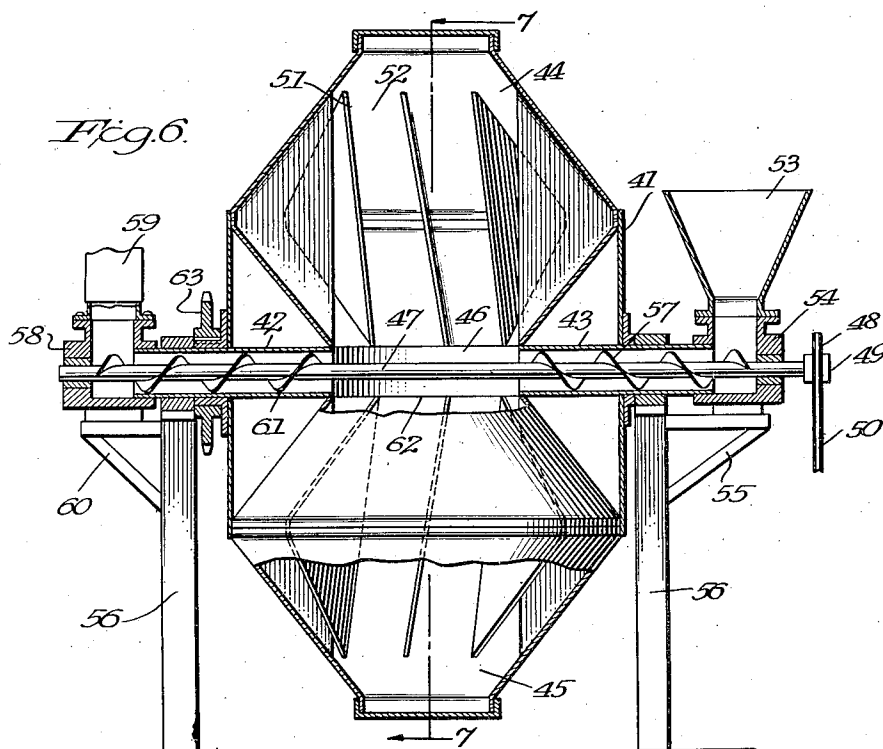
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,138,550

MIXING APPARATUS

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Application January 15, 1938, Serial No. 185,233

4 Claims. (Cl. 259—14)

The present invention relates to an improved batch mixer in which means are provided for mixing any kind of dry, free-flowing materials or liquids with scientific accuracy by dividing and pyramiding the materials during the mixing operation in order to obtain a uniform, thorough and perfect blending of the materials, and is an improvement over the apparatus covered in my Patent No. 1,496,992, dated June 10, 1924.

An important feature consists in providing a rotary container or drum with two communicating compartments, and associating with at least one of the compartments, spaced partition plates which are disposed at an acute angle relative to the horizontal transverse axis of the container; the spaces between the plates constituting inwardly inclined pockets for receiving separate batches of the material and for sequentially discharging the same into the other compartment during the operation of the mixer, thus providing a definite plan of mixing the materials during the rotation of the container. The inclination of the plates acts to progressively advance the material across the container so that during the rotation of the latter, the material works its way around to the other side of the container, to insure a thorough mixing of the materials across the container as well as in other parts thereof during the operation of the mixer.

A further object is to provide a mixing apparatus with side charging and retaining means for permitting the release or escape of the air replaced by the stock introduced into the container and for replacing the material in the container with air when the charge is drawn off.

Another object consists in associating with a side charging container, pockets for conducting the material from one end of the container to the other, said pockets being separated by a band or sleeve for facilitating the discharge of the material from one end of the container to the other.

Other objects and advantages of the invention will become apparent from the following description when taken in conjunction with the accompanying claims.

Referring to the drawings in which are shown several preferred embodiments, the invention may assume,

Figure 1 is a side elevation of an apparatus embodying the invention.

Figure 2 is a sectional view taken substantially along the line 2—2 of Figure 1.

Figure 3 is a sectional view taken substantially along the line 3—3 of Figure 2.

Figure 4 is a sectional view taken substantially along the line 4—4 of Figure 2.

Figure 5 is a sectional view taken substantially along the line 5—5 of Figure 2 with the container moved to its horizontal position relative to its support.

Figure 6 is a vertical sectional view of a modified form of the invention.

Figure 7 is a sectional view taken substantially along the line 7—7 of Figure 6.

Referring to the drawings in which like numerals designate like parts in the several views, 10 indicates a rotary container or drum which has extending medially and outwardly from its opposite sides, trunnions 11 mounted in the bearings 12. Bolts 13 secure the bearings to the inclined side bars 14 of the supporting frame 15. The container may be rotated by any suitable means and as shown, is actuated by a sprocket wheel 16 keyed to one of the trunnions 11 and operatively connected to a sprocket 17 by an endless chain 18. The sprocket 17 is keyed to a shaft 19' journaled in a bearing 19 carried by one of the uprights 20 of the frame 15. A handle 21 secured to the shaft 19' is arranged when actuated to rotate the container 10 in a clockwise direction as indicated by the arrow in Figure 1. Manifestly, any other form of driving means, such as a motor or the like, may be connected to the container for rotating the same about its horizontal transverse axis.

The interior of the container 10 has two separate compartments 22 and 23 respectively, which communicate at their inner ends through a restricted opening 24. Each compartment preferably is formed with an outer funnel or truncated shaped side 25 and a similarly shaped inner side 26. The inner sides 26 meet and are secured together as at 29 (Figure 2). The diverging sides 25 and 26 are inclined preferably at an angle of 50° to the horizontal axis of the container to facilitate the discharge of the materials into and through the opening 24 irrespective of the varying sizes, weights and shapes of the materials to be mixed.

The outer reduced ends of the compartments 22 and 23 each communicate with a reduced filling and discharging opening 30 which may be closed by any suitable means such as a removable cap or plug 31. A sleeve 32 encloses the inner sides 26 and may overlap the inner ends of the outer sides 25 so as to be welded or otherwise secured thereto in order to provide a rigid structure.

Extending inwardly from each of the compartments 22 and 23 and shaped to conform with

the inner walls thereof, are spaced separators in the form of partition plates or wings 33 which preferably extend half way around one side of each compartment (Figure 4). The spaces between the plates constitute inclined pockets for receiving and conducting the materials from one compartment to the other through the restricted opening 24. The plates 33 in the compartment 22 are positioned on the opposite side of a plane extending longitudinally through the container from the plates in the compartment 23 so that the sides of the compartment opposite the plates are provided with curved smooth portions 34 which receive the material and transfer the same to the pockets in their respective compartments upon the rotation of the container. As shown, each of the compartments 22 and 23 is divided by the separators 33 into six pockets 35, 36, 37, 38, 39 and 40 respectively, which have their bottoms disposed at an angle of substantially 50° in order to facilitate the discharge of material deposited thereon irrespective of the size or weight of the same. The separators 33 are preferably inclined at an angle of substantially 80° relative to the horizontal transverse axis of the container for a purpose which will subsequently be described. Manifestly, the number of pockets may be varied as working conditions may require.

In my Patent No. 1,496,992, the separators are perpendicular to a horizontal plane passing through the container. I have found that by positioning these separators at an angle of substantially 80° to this horizontal plane, that the inclination of the separators constitutes means which act to laterally deflect the material across and around the container so that the material as it is being agitated, by the rotary movement of the container, is at the same time being worked around to the other side of the container, thus insuring a uniform and perfect blending of the various materials being mixed. Additionally, the inclination of the separators 33 presents surfaces in the path of the material falling into the pockets which imparts a rolling movement to the particles of material as they empty into the pockets to further obtain a more intimate mixture.

In operation, one of the end closures 31 is removed and the container is charged in an upright position such as shown in Figure 2. As the different materials in the desired proportions are introduced into the container, they fall to the bottom or lower compartment and upon the rotation of the container by the driving means, such as the handle 19, the container is revolved in a clockwise direction as indicated by the arrow in Figure 1. As the container continues to rotate, the material slides into the pockets of the compartment 23, so that when the container reaches its horizontal position (Figure 5) the material will be divided into six lots or batches in the compartment 23. As the compartment 23 moves upwardly and reaches an angle of substantially 45°, the inclination of the bottom of the end pockets 35 and 40 causes the material to be discharged from these pockets through the restricted opening 24 and into the smooth portion 34 of the compartment 22. When the compartment 23 reaches an angle of substantially 60°, the pockets 36 and 39 discharge their contents through the opening 24 into smooth portion 34 of the adjacent compartment, and at 80°, the pockets 37 and 38 discharge the material therein through the opening 24 to the compartment 22. When the container reaches its vertical position, all the material is transferred to

the now lower compartment 22 and the mixing and discharging operation is repeated. Thus, it will be seen that twelve complete separations and mixtures take place during each complete revolution of the container. As the rotation of the container carries the material above the transverse axis of the mixer, the material falls by gravity and is aided by the inclination of the bottom of the pockets so as to discharge sequentially or successively from two pockets at a time, thus pyramiding and forming layers in the smooth portion of the lower compartment prior to being introduced into the pockets therein. As this operation is repeated every half revolution, it will give sixty complete operations and mixes in five revolutions. Further, as the container rotates, the material is alternately conducted from a smooth portion of one compartment to the pockets therein from where it is delivered in separate lots or batches through the opening 24 into the smooth portion of the adjacent compartment.

By positioning the separators 33 at an acute angle of preferably 80° to the transverse axis of the container, the material is fed across the container from one end to the other, so as to provide means which coact with the other parts of the device for insuring a thorough and perfect mixing of the various ingredients during the rotation of the container. Thus, if four pounds of flour and one tablespoonful of pulverized charcoal are desired to be intimately mixed and if the charcoal is initially deposited in one of the end pockets, such as 40 (Figure 4), and the apparatus started, the charcoal will be moved transversely across or around the container to the opposite pocket 35 in twenty revolutions or one quarter of this distance in five revolutions. Thus, the inclination of the plates or blades not only constitutes walls for the pockets but also provides means for gradually advancing and turning the particles of material from one side of the container to the other during the mixing operation. Further, as portions of the plates 33 are positioned in the path of the material as it falls into the pockets, the particles dropping on the plates will roll down the sides of the plates into their respective pockets thus forming an intimate mixture with adjacent particles prior to the emptying of the separate batches of the materials into the smooth portion of the lower compartment, as contrasted to directly falling into the pockets as is the case when the separators are positioned substantially perpendicular to the transverse axis of the container. By virtue of this construction simple, efficient and positive means are provided for obtaining a rapid and thorough mixing of the materials with scientific accuracy, and irrespective of their sizes, shapes or proportions. Moreover, the materials initially mixed as well as the last charge will be as thoroughly blended as the other batches, thus obviating the necessity and expense of taking off the first and last batch for remixing on account of imperfect mixing. The total time required for mixing a good batch will depend upon the facilities for charging the mixture. However, a complete and uniform mix may be obtained in five revolutions of the container. Due to the inclination of the separators 33, it will be seen that the material is turned around or advanced across the container as it is being mixed, thus providing a definite plan or method of intimately mixing the materials.

In the modified form of the invention disclosed in Figures 6 and 7, the operation of the mixer is

substantially similar to that previously described. However, instead of introducing the material into the container 41 through end openings, means are provided for charging the mixture through one side thereof. As shown, the container 41 has extending medially and outwardly from its sides, tubular members 42 and 43 interposed between the conical compartments 44 and 45 and which communicate with the central opening 46 between the compartments. A rotary driving shaft 47 extends transversely through the tubular members and the opening 46 and has fastened to one end thereof, a pulley 48 as at 49. The pulley 48 may be connected to any suitable driving means, such as a motor or the like, by the belt 50. Each of the compartments 44 and 45 has positioned therein the separators 51 which preferably extend half way around the interior of the same and which are disposed at an angle of substantially 80° to the horizontal transverse plane of the container. The inclined sides of the compartments 44 and 45 opposite the separators 51 are preferably smooth so as to receive and conduct the material to the pockets 52 formed by the separators 51. The materials in the pockets 52 are sequentially discharged therefrom at predetermined intervals during the rotation of the container in substantially the same manner as in the form previously described.

The materials to be mixed are introduced into the container 41 through a hopper 53 mounted on a tubular intake member 54 supported on a bracket 55 carried by the frame 56. The drive shaft 47 extends through the intake 54 and has a screw conveyor 57 for conducting the material to the opening 46 from where the same falls into the lower compartment 45. The opposite end of the shaft 47 extends through a tubular outlet member 58 on which is mounted an air discharge stocking 59. The outlet member 58 may be supported by a bracket 60 connected to the frame 56. A screw conveyor 61 is mounted on the shaft 47 between the opening 46 and the outlet member 58 and has its winding opposite to that of the conveyor 57 so that both conveyors act to conduct the material inwardly toward the opening 46. The inner opposed ends of the compartments 44 and 45 adjacent the opening 46 may be separated by a transverse annular band 62 of substantially the same width as the tubular members 42 and 43 and through which the shaft 47 extends. The container 41 may be rotated in any suitable manner such as by a sprocket wheel 63 fastened or otherwise non-rotatably secured to one of the tubular members such as 42, and which is operatively connected to a motor or the like, not shown.

The screw conveyor 61, during the rotation of the shaft 47, acts to preclude material from being withdrawn from the container and also constitutes means for permitting the escape of air from the compartments 44 and 45 during the mixing operation. Heretofore, in devices of this character, no means have been provided for releasing the air replaced by stock introduced into the container with the result that the air is forced back into the container creating dust which interferes with the efficient mixing of the materials. By providing the right and left hand conveyors 57 and 61 respectively, and associating with the conveyor 61 the air outlet 58, air is permitted to escape through the stocking 59 without blowing dust through the container. The outer ends of the compartments 44 and 45 may be each closed by a removable plug 64 which, when removed,

allows the mixed materials to be withdrawn from the container.

In operation, assuming that the shaft 47 is rotating, the materials to be mixed are introduced into the container in the desired proportions through the hopper 53 and are conducted by the conveyor 57 to the opening 46 from where they discharge into the bottom container 45. The container is then operatively connected by the sprocket wheel 63 to any suitable driving means so as to rotate the same.

As the lower compartment 45 is moved upwardly, the materials in the pockets 52 are sequentially discharged through the opening 46 into the smooth portion of the compartment 44 in the manner as previously described, and as the compartment 44 is moved to its lower position, this operation is repeated.

In the mixing of certain materials it is essential, in order to obtain proper blending of the ingredients, to have perfect control over the air in the container when charging the device so as to allow the air replaced by the material to escape. On the other hand, on drawing off the charge, it is essential to have means for replacing the material in the drum with air as soon as the material is drawn off. It will be seen that by reason of the association of the conveyor 61 and the air outlet 58 with the mixer, that positive means are provided for controlling the supply of air to and from the container. Thus, if the apparatus is used to mix a product containing a very light ingredient of a potent medicinal nature, such as strychnine, the rotation of the conveyor 61 acts to return the dust into the container but allows the air to escape through the tubular member 42 and the air outlet 58.

By associating the inclined separators with the rotary container, means are provided for not only separating the batch into six different lots to mix them two at a time by pyramiding and forming layers in the lower end of the container but also due to the angularity of the plates, the material as it is agitated by the rotation of the container is also progressively carried across the container from one side to the other so as to insure a proper and intimate mixture of the various materials irrespectively of their sizes, shapes or proportions. Further, means are also provided for allowing the air to escape when the container is charged with a new batch of material and to replace the air when the material is discharged from the container.

It is to be understood that the forms of the invention herewith shown and described are merely illustrative of preferred embodiments and that such changes may be made as fall within the purview of one skilled in the art without departing from the spirit of the invention and the scope of the appended claims.

I claim:

1. A side charging mixing apparatus of the class described including a rotary container interiorly divided into two compartments, the inner ends of said compartments being spaced from each other and communicating through a band between the compartments, tubular members extending outwardly from opposite sides of said band, a shaft extending transversely through the tubular members and said band, means for conducting material to be mixed into one of the tubular members, an air outlet on the other tubular member, a shaft extending transversely through the tubular members and said band, means for rotating said shaft, means for conducting mate-

rial to be mixed into one of the tubular members, an air outlet on the other tubular member, the portions of said shaft within the tubular members having oppositely wound screw conveyors thereon, one of said conveyors constituting means for feeding the material into the container and the other of said conveyors providing means for preventing the withdrawal of the material therethrough but allowing the air in the container to escape.

2. A side charging mixing apparatus of the class described including a rotary container interiorly divided into two compartments, the inner ends of said compartments being spaced from each other and communicating through an annular band between the compartments, tubular members extending outwardly from opposite sides of said band, a shaft extending transversely through the tubular members and said band, means for conducting material to be mixed into one of the tubular members, an air outlet on the other tubular member, a shaft extending transversely through the tubular members and said band, means for rotating said shaft, means for conducting material to be mixed into one of the tubular members, an air outlet on the other tubular member, the portions of said shaft within the tubular members having oppositely wound screw conveyors thereon, one of said conveyors constituting means for feeding the material into the container and the other of said conveyors providing means for preventing the withdrawal of the material therethrough but allowing the air in the container to escape whereby upon the introduction of material into the container to permit the air replaced by the material to be withdrawn from the container and to replace the air in the container when the material is discharged therefrom.

3. A side charging mixing apparatus of the class described including a rotary container interiorly divided into two compartments, the inner ends of said compartments being spaced from each other and communicating through a band

between the compartments, means for rotating the container, spaced partitioned plates extending inwardly from at least one of the compartments and disposed at an acute angle relative to the horizontal transverse axis of the container, the spaces between the plates constituting pockets for receiving batches of the material and for sequentially discharging the separate batches into the other compartment during the rotation of the container, the inclination of the plates acting progressively to advance the material from one side to the other of the container during the rotation of the latter, tubular members extending outwardly from opposite sides of said band, a shaft extending transversely through the tubular members and said band, means for conducting material to be mixed into one of the tubular members, an air outlet on the other tubular member, means for rotating said shaft, the portions of said shaft within the tubular members having oppositely wound screw conveyors thereon, one of said conveyors constituting means for feeding the material into the container and the other of said conveyors providing means for preventing the withdrawal of the material therethrough but allowing the air in the container to escape.

4. A side charging mixing apparatus of the class described including a rotary container interiorly divided into two compartments communicating at their inner ends through a central opening, a band enclosing said opening, tubular members extending outwardly from opposite sides of said band, a rotary shaft extending transversely through the tubular members and said band, means on the portion of said shaft extending through one of the tubular members for feeding material into the container, and means on the portion of said shaft extending through the other tubular member for preventing the withdrawal of the material therethrough and for controlling the supply of air to and from the container.

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