July 5, 1966 C. E. PHILLIPS 3,259,372

BLENDING AND MIXING APPARATUS

Filed Jan. 27, 1964 3 Sheets-Sheet 1

FIG. 1

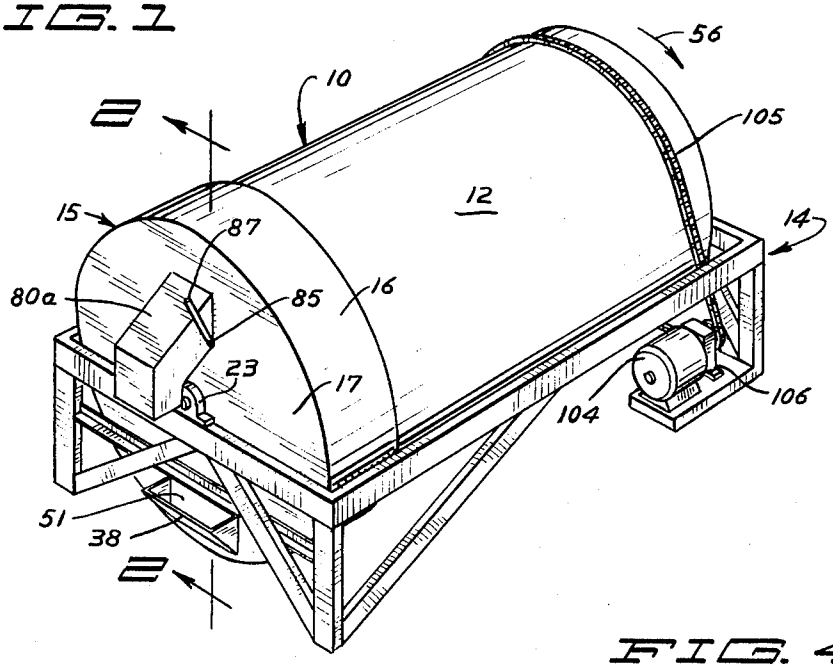
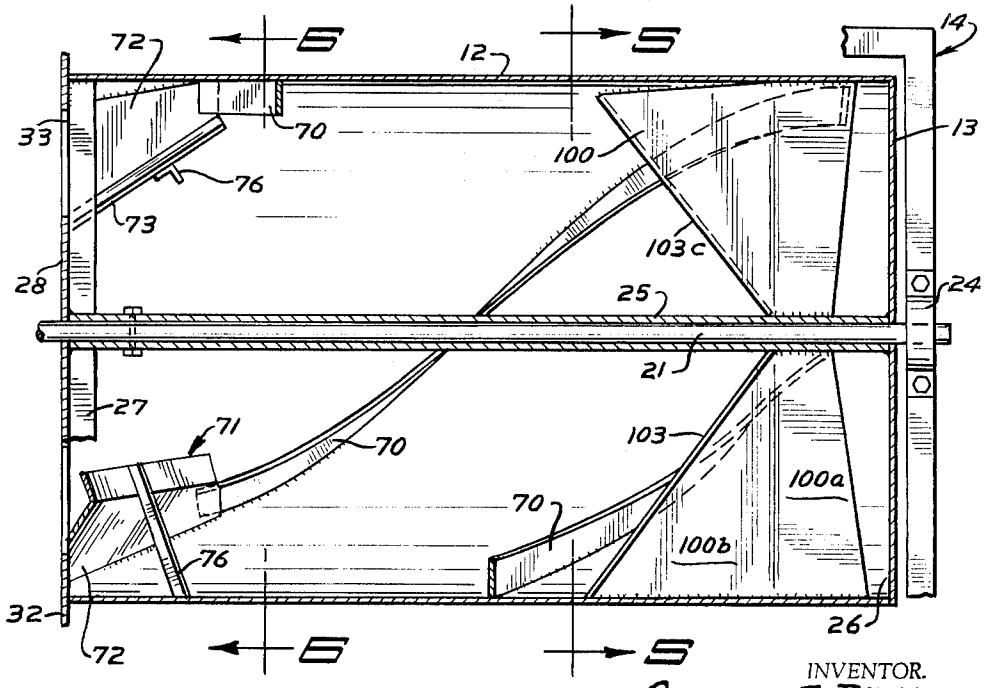


FIG. 4



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Filed Jan. 27, 1964 3 Sheets-Sheet 2

FIG. 1

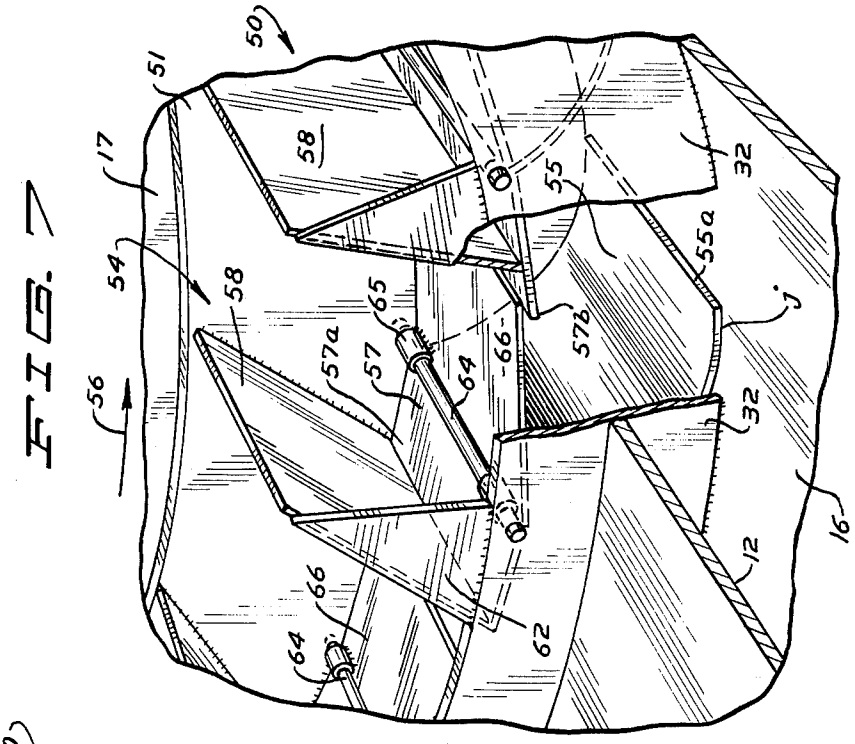
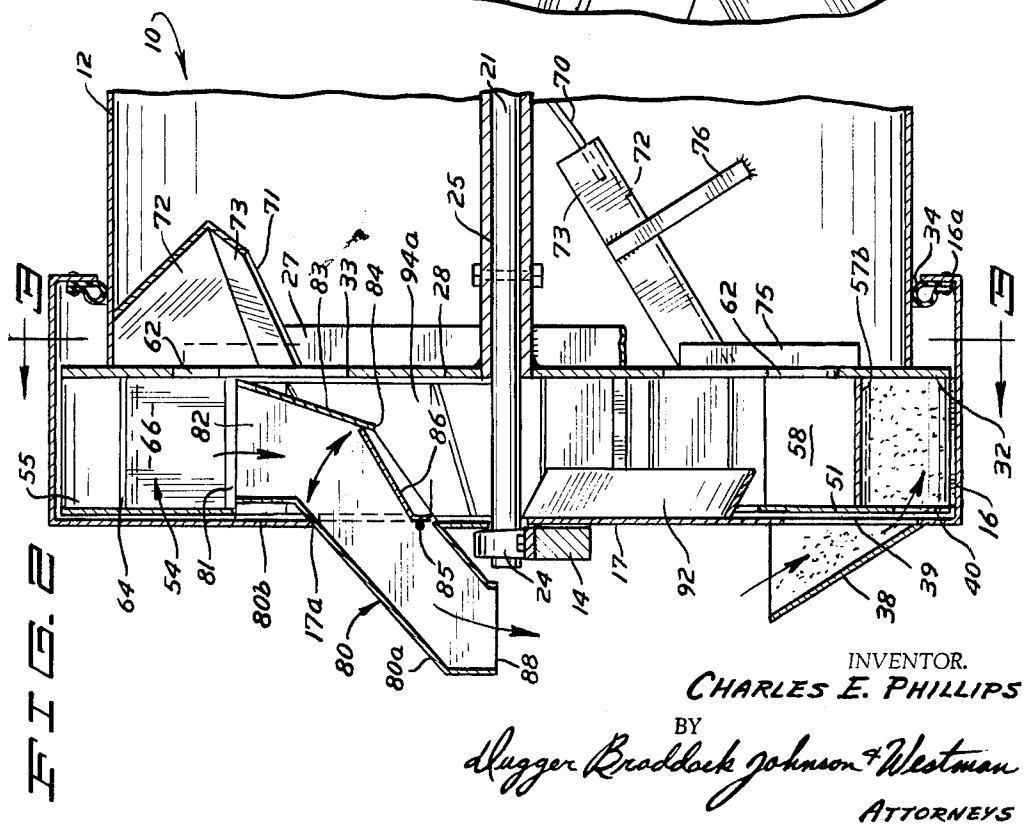


FIG. 2



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BLENDING AND MIXING APPARATUS

Filed Jan. 27, 1964 3 Sheets-Sheet 3

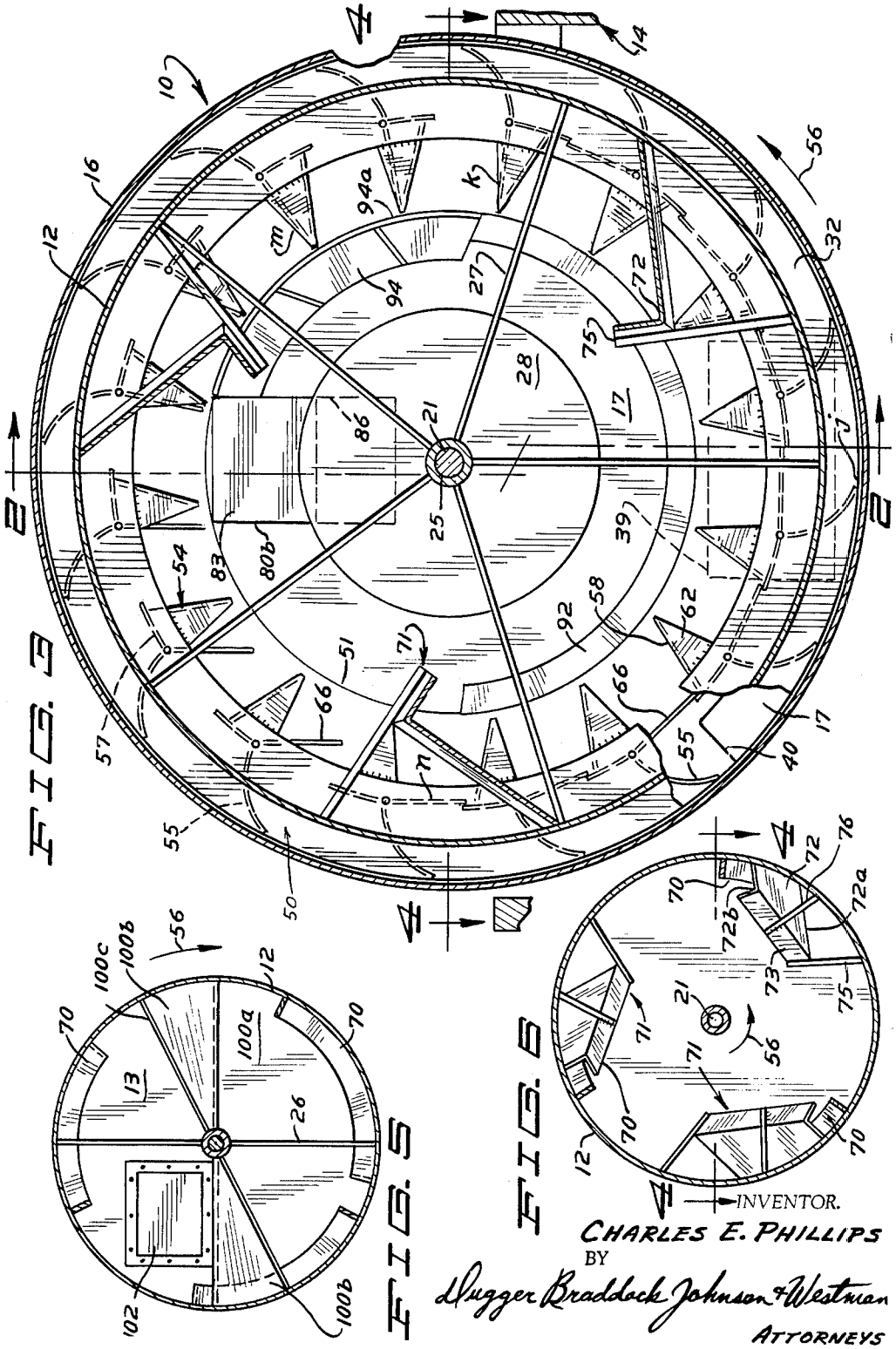


FIG. 3

FIG. 5

FIG. 6

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BLENDING AND MIXING APPARATUS

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Filed Jan. 27, 1964, Ser. No. 340,354
17 Claims. (Cl. 259—3)

This invention relates to the improvements in rotary drum type apparatus for mixing or blending particulate materials, for example, livestock feeds of differing particle sizes, density, and other physical characteristics, fertilizer, and other miscellaneous material in either a dry or moist condtion.

The present invention is an improvement over the invention described in my patent, Patent No. 3,088,711, granted May 7, 1963, and my co-pending application Serial No. 100,623 filed April 4, 1961.

One of the objects of this invention is to provide new and novel mechanism in a rotary drum type mixer of large capacity for facilitating the loading of particulate material into the mixer. A further object of this invention is to provide new and novel mechanism in a rotary drum type mixer having a stationary end wall for transferring particulate material through an aperture in said end wall into the interior of the rotary drum while it is rotating and at the same time selectively precluding the discharge of material that has been transferred into the rotary drum.

An additional object of this invention is to provide new and novel transfer means in a rotary drum type mixer and blender apparatus that will charge a rotary drum while rotating and at the same time continuously positively convey material in the drum through an arcuate path of an angle of at least 45° relative to the horizontal even though only a small quantity of material is in the drum. Another object of this invention is to provide in a rotary type mixer new and novel mechanism at either axial end of said mixer for positively moving particulate material through a substantial portion of the rotary cycle of the mixer to more thoroughly mix or blend said material. Still another object of this invention is to provide in a rotary type mixer new and novel transfer means having single movable elements for permitting loading of the mixer while it is rotating and at the same time operable for continuously moving the material within the drum to an elevation that facilitates and controls the flow of the mixture into sacks or other suitable receptacles.

A still further object of this invention is to provide in a rotary drum type mixer, a plurality of transfer means located around the circumference of one end of the drum, each of which has only a single part movable relative to the motion of the drum for facilitating the transfer of materials from outside of the drum into the interior of the drum.

Other and further objects are those inherent in the invention herein illustrated, described and claimed and will become apparent as the description proceeds.

To the accomplishment of the foregoing and related ends, this invention then comprises the feature hereinafter fully described and particularly pointed out in the claims, the following description setting forth in detail certain illustrated embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

The invention is illustrated with reference to the drawings in which corresponding numerals refer to the same part and in which:

FIGURE 1 is a perspective, somewhat schematic, view of the mixing and blending machine of this invention;

FIGURE 2 is an enlarged, fragmentary, vertical longitudinal cross-sectional view generally taken along the line and in the direction of arrows 2—2 of FIGURE 1 to illustrate the transfer mechanism and associated elements for loading material into the rotary drum and structure for discharging material from said drum;

FIGURE 3 is a vertical transverse sectional view generally taken along the line and in the direction of the arrows 3—3 of FIGURE 2 to more clearly illustrate the mechanism for transferring material from the stationary casing into the rotary drum and for positively conveying material to a substantial elevation where it is selectively discharged or permitted to descend in the drum to the general level of the material in the drum;

FIGURE 4 is a fragmentary horizontal cross-sectional view of the apparatus of FIGURE 1 other than that at the front end portion, said view being generally taken along the line and in the direction of the arrows 4—4 of FIGURES 3 and 6 to show the mixing baffles at the rear end of the rotary drum, portions of the spiral flanges in schematic and some of the structure in cross section;

FIGURE 5 is a transverse cross-sectional view generally taken along the line and in the direction of the arrows 5—5 of FIGURE 4 to illustrate the mixing baffles at the rear end of the drum and portions of the spiral flanges in the drum;

FIGURE 6 is a transverse cross-sectional view generally taken along the line and in the direction of the arrows 6—6 of FIGURE 4 to show only the relative positions of the troughs and the forward ends of the spiral flanges in the drum; and

FIGURE 7 is an enlarged fragmentary perspective view more particularly illustrating the construction of the transfer means, said view showing one of the transfer mechanisms in the lower portion of the rotary cycle of the drum.

Referring in particular to FIGURES 1, 2 and 4 there is illustrated a perspective view, a fragmentary vertical cross-sectional view, and a fragmentary horizontal cross-sectional view of the mixing and blending apparatus, generally designated 10, of this invention. The apparatus 10 includes a large cylindrical drum having a tubular outer wall 12 and a rear end wall 13 mounted to revolve on its axis and supported on a frame generally designated 14. There is provided, a stationary hood, generally designated 15, having tubular outer wall 16 and a stationary end wall 17, the tubular wall 16 being of a larger diameter than tubular wall 12 and concentrically located relative to the end portion of the drum opposite the end wall 13. As may be noted from FIGURE 2, a portion of the hood tubular wall overlaps a portion of the tubular drum wall. Extending axially through the drum and at one end projecting through end wall 13 and at the opposite end through the end wall 17 is a shaft 21 that is supported on end braces of the frame 14 by bearings 24 (see FIGURES 2 and 4). Mounted on the shaft to rotate therewith and add rigidity thereto is the tubular support member 25 that extends the axial length of the drum wall 12.

The support member 25 at one end is rigidly connected to the end wall 13 by suitable spider members 26, while at the opposite end a plurality of spider members 27 are each at one end welded to the tubular support member 25 and at the opposite end to the inner peripheral surface of drum wall 12. As may be noted from FIGURE 2, the spiders 27 are located a substantial axial distance from the hood end wall 17. A circular baffle 28 having an aperture for the shaft 21 to extend through is welded to the spider members 27 and support member 25. As may be noted from FIGURES 2 and 3, the baffle is of a substantially smaller diameter than the inner diameter

of the tubular drum wall and is located axially at the front end of the drum.

An annular mounting flange **32** is located concentric to the baffle plate **28** and has adjacent surfaces welded to the spider members **27** and to the edge of the drum tubular wall. The outer diameter of flange **32** is slightly less than the inner diameter of the hood tubular wall **16**, and the inner diameter is substantially larger than the maximum diameter of baffle **28** but substantially less than the inner diameter of the drum tubular wall **12**. Thus baffle **28** and flange **32** provide an angular opening **33**, other than for spider members **27**; and through mechanism to be described hereinafter, to permit transfer of material into and out of the confines of the drum outer wall.

Referring to FIGURE 2 it is to be noted that the hood has an inwardly extending annular flange **16***a* located axially opposite mounting flange **32** from the hood end wall, a resilient annular seal member **34** being mounted on said annular flange **16***a* to bear against the tubular outer wall **12** of the drum to form a seal therewith.

In order to permit loading of the drum while it is rotating, a chute **38** is welded to the hood end wall for directing material downwardly through the rectangular opening **39** provided in said end wall toward the lowermost portion of the hood tubular wall. That is, the lowermost horizontal edge of the opening **39** is located at a lower elevation than the lowermost portion of the tubular drum wall. In order to permit particulate material being moved through the chute **38** and aperture **39** and thence into the tubular drum housing while said housing is rotating, and at the same time to selectively retain material within the housing there is provided the transfer mechanism generally designated **50** (see FIGURES 2, 3, and 7).

The transfer mechanism includes the aforementioned annular mounting flange **32** and a second annular mounting flange **51** that has substantially the same outside diameter as that of flange **32** but a substantially smaller inside diameter. Mounting flange **51** is fixedly attached to flange **32** and retained in axial spaced relationship by structure to be described hereinafter. However, at this time it is to be noted that the mounting flange **51** is retained axially adjacent the hood end wall **17** as shown in FIG. 2 and that it is of a greater radial dimension than the vertical height of the inlet port **39**. Further the inner peripheral edge of flange **51** is located radially more adjacent the shaft **21** than any portion of the peripheral edge of port **39**. In order to permit the flow of material from port **39** to space axially between the flanges **32**, **51**, flange **51** has a plurality of circumferentially spaced cut outs **40**.

The annular mounting flanges **32**, **51** in conjunction with structure described hereinafter provide a plurality of scoops, generally designated **54** joined one to another to extend completely around the circumference of the hood within the confines of said hood. As may be noted from FIGURES 3 and 7, each scoop **54** includes an arcuate wall **55** that has opposite axial edges welded to the adjacent portions of mounting flanges **32** and **51**. The arcuate wall is curved to extend radially outwardly of the shaft **21** and forwardly in the direction of rotation of the drum, the direction of rotation being designated by arrow **56**. The wall **55** has a leading edge **55***a* closely adjacent the hood wall **16** and a trailing edge located a small radial distance outwardly of the inner peripheral edge of the flange **32**. A partition **57** has opposite axial edges welded to the mounting flanges **32** and **51** and a rear portion **57***a* with a leading edge joined to the trailing edge of the arcuate wall **55**. The general plane of the partition portion **57***a* extends at nearly a right angle to a radial line passed through a juncture of said portion with the arcuate wall. A rectangular plate **59** has its radially outermost edge joined to the trailing edge of partition portion **57***a* to form an angle opening in the direction of rotation that is substantially less than 90°. One radial edge of plate **58** is welded to the mounting flange **51** while the opposite radial edge is welded to a somewhat triangular plate **62**. A second edge of the triangular plate extends along a radial line which nearly passes through the juncture of partition portion **57***a* and wall **55** while the third edge is arcuately curved to abut against the adjacent inner arcuate edge of the mounting flange **32** and is welded thereto.

Extended through appropriate apertures in mounting flanges **32**, **51** and secured to said flanges at a position slightly radially inwardly of the leading edge of partition portion **57***a* is a rod **64**. Positioned on each opposite end portion of the rod to pivot thereabout and located closely adjacent to the respective mounting flange is a short tubular pivot member **65**. The trailing edge of a door **66** is welded to the pivot members such that in a door closed position it is closely adjacent to the juncture of the arcuate wall **55** and partition **57***a*. The door extends axially between mounting flanges **32**, **51** and forwardly in the direction of rotation of the drum to have the leading edge portion thereof overlay the trailing edge portion of partition portion **57***b* that has its leading edge integrally joined to the trailing edge of the partition portion **57***a* of the next scoop forward in the direction of rotation. Each scoop is of the same construction as that above described.

For purposes of thus facilitating the description of the invention it will be considered that one scoop includes the arcuate portions of the mounting flanges **32**, **51** intermediate two arcuately adjacent rectangular plates **58** and corresponding pair of arcuate walls **55**; partition portions **57***a*, **57***b* and door **66** intermediate said plates **58**; the wall **55** and plate **58** of the respective pair which are angularly rearwardly in the direction of rotation of the drum; and the hinge mounting **64**, **65**, **65**. Between each adjacent pair of arcuate walls **55** there is provided a notch **40**.

Further it will be considered that each scoop is divided into an inner scoop portion and an outer scoop portion, the separation being provided by partition portion **57***a*, door **66** and partition portion **57***b* which are located between two arcuately adjacent rectangular plates **58**.

The outer scoop portion functions to move the particles that have passed through the chute **38**, inlet **39** and the notch **40** in the angular direction of arrow **56**; and when the respective scoop has angularly moved a sufficient amount, the door **66** under the action of gravity and the movement of material over the wall **55**, or solely due to the action of gravity, pivots to an open position to permit the material in the outer scoop moving through the door opening and into or through the confines of the inner scoop. At the same time when one inner scoop is at the lowermost portion of the rotary cycle drum, any material within the confines of the drum at a higher elevation than lowermost portions of the mounting flange **32** is free to fall over said mounting flange into the inner scoop portion, the material being elevated through the rotation of the drum in a manner that will become more apparent hereinafter.

In order to facilitate thorough mixing of the material and movement of the material from within the confines of the drum to the inner scoops, especially when the drum is in a nearer empty state, there is provided a plurality of troughs generally designated **71** and spiral mixing blades or spiral flanges **70**. For the particular machine illustrated there are provided three circumferentially spaced troughs (see FIGS. 2–4 and 6, each of these views illustrating the troughs at the same point of the rotary cycle). Also for the particular machine illustrated, there are provided three spiral mixing blades **70** that are fixed on and project radially inwardly from the interior surface of the drum wall **12**. These blades are preferably made of

spiral form as indicated, and angularly pitched so that each blade preferably extends circumferentially in the drum in the general neighborhood of 180° at an angle of approximately 45° to a plane perpendicular to the axis of rotation of the drum. Each blade has one end closely adjacent a drum end wall **13** and an opposite end in part overlaying a respective trough **71**. As the drum rotates, these blades feed material toward the troughs, and at the same time the material spilling over the inner radial edge of the blade becomes more thoroughly mixed than if the blades were not provided.

Each of the troughs **71** is generally of the same construction and is fixedly attached to the drum to rotate therewith. Accordingly the angular position of the troughs continuously varies as the drum rotates and therefore for purposes of facilitating description of the trough, the only trough described in this paragraph will be the one appearing at the lower right corner of FIGURE 3 and FIGURE 6. When the lower right hand trough is in the FIGURE 3 position, the generally planar oblique plate **72** is inclined downwardly in an axial direction toward the hood end wall **17**; and in a direction at a right angle to the first mentioned direction, is inclined downwardly and outwardly at an acute angle with reference to a radial line passed through point of juncture of the plate **72** with the tubular wall **12**. Further the transverse dimension of the edge **72***b* of the oblique plate opposite the edge **72***a* that is closely adjacent the hood end wall is slightly greater than the corresponding dimension of a mixing blade and is substantially smaller than the corresponding dimension of the edge **72***a*. Thus a portion of the edge **72***a* is located more closely adjacent the axis of rotation of the drum than the corresponding angular portion of the mounting flange **32**. A third edge of the oblique plate is welded to the drum wall **12** while the fourth edge is integrally joined to a right angle flange **73**. Accordingly as the drum rotates the trough from the lowermost elevated position of the rotary cycle to the position illustrated at the lower right hand corner of FIGURE 3 and thence angularly past said FIGURE 3 position, the trough directs the particulate material in an axial direction into the confines of the inner scoops to be moved thereby. The excess material that cannot be handled by the inner scoops falls over the edge of the right angle flange **72** and descends to the general level of the material in the drum to facilitate a more thorough mixing of the material in the drum. In order to support a trough in the above-described position there is provided a brace **75** which at one end is welded to the mounting flange **32** and at the opposite end to the right flange **73**, and a second brace **76** that at one end is welded to the intermediate portion of the right angle flange and at the opposite end to the tubular wall **12**.

Mounted on the interior of hood end wall **17** to extend axially inwardly and upwardly from the discharge port **17***a* in the hood end wall at **80***b* and on the exterior thereof to extend outwardly and downwardly therefrom at **80***a* is the discharge chute, generally designated **80**, having a generally rectangular inlet opening **81** located directly beneath the scoops that are at a maximum elevation. The portion **80***b* of the chute located within the confines of the hood includes side walls **82**, an inclined rear wall **83** and an outlet opening **84** that may be selectively closed by a slide door **86** welded to the rod **85** that is extended through the sidewalls of portion **80***a* at an elevation slightly above the bottom edge of the end wall outlet port **17***a*. A hand lever **87** (see FIGURE 1) is welded to the rod **85** to pivot the rod so that the door **86** may be moved from the solid line position of FIGURE 2 closing the opening **84** to a generally vertical dotted line position of said figure to open the opening **84** and to block the flow of material through the inner chute portion **80***b* to the outer chute portion **80***a*, the outer chute portion having a discharge opening **88** that is located at approximately the same elevation as the shaft **21**. Thus when the material is carried by the inner scoops to be above the opening **81** and the door **86** is in the solid line position of FIGURE 2, that material passes through the chute portion **80***a* to be discharged through opening **88**. However when the door **86** is in the dotted line position of FIGURE 2, the material elevated by the inner scoops falls through the opening **81** and opening **84** of chute portion **80***b* to descend to the lower angular portion of the transfer mechanism.

In order to direct the descending material away from the end wall **17** and toward the center portion of the lower inner scoops, there is provided an arcuate flange **92** that extends through an arc of approximately 180°. The arcuate flange **92** is welded to the inner surface of the hood end wall **17** and is inclined to extend axially toward the drum in a downward direction. The other arcuate edge of the flange **92** is located closely adjacent the inner axial edges of the rectangular plates **58** that are angularly adjacent thereto. Thus the flange **92** serves to minimize a buildup of material in the drum adjacent the end wall **17** and minimize the tendency of material to flow between the mounting flange **51** and the adjacent lower portion of the hood end wall.

In order to facilitate the conveyance of material from about the 90° position of the drum rotating cycle (at about *k* of FIGURE 3) to the inlet opening **81** of the discharge chute, there is provided a baffle **94** attached to the end wall **17**. The baffle **94** includes an arcuate plate **94***a* that is of an axial length to extend from the hood end wall to substantially the plane of the triangular plates **62** of the scoops and curved to be closely adjacent the free edges of the rectangular plates **58** as they are angularly moved from approximately the 90° position to a position just directly over the opening **81**. Accordingly even though a given scoop in moving angularly in advance of the approximately 90° position of the rotary cycle has its rectangular plate increasingly inclined more nearly to the horizontal and subsequently to be substantially vertical, baffle **94** prevents the material being carried by said inner scoop from descending to the general level of the material in the drum until the respective inner scoop has moved angularly past the arcuate baffle and over the rectangular opening **81**.

Mounted in the rearward end of the drum are a pair of baffles **100**, one being on either side of the tubular support member **25** and having one edge connected thereto. Each of the baffles **100** includes a generally planar portion **100***a* substantially located in the common plane of the axis of rotation of the drum, the rearward edge of the portion **100***a* being secured to edge of the adjacent spider member **26** or else overlaying the respective spider member. Each of the baffles also has an inclined triangular portion **100***b* that has its rearward edge integral with the forward edge of the respective portion **100***a*. Portion **100***b* forms an obtuse angle with the portion **100***a* opening in a direction opposite the direction of rotation of the drum. The portions **100***a* are diametrically opposite one another and the triangular portions **100***b* are oppositely inclined in an axial direction toward the stationary hood. Thus the rotation of the drum and baffle portions **100***a* impart a generally circulating motion to the feed about an axis parallel to the axis of the rotation of the drum. In addition to the aforementioned circulating action the axially inwardly and rearwardly inclined sloping surfaces **100***b* of the baffles **100** impart a generally circulating action to the feed in circles having axes extending generally perpendicular to the axis of rotation of the drum. Thus due to the baffles inclined surfaces **100***b* a more thorough mixing action is provided than if surface portions **100***b* were not provided. As an example of the slope of surface portions **100***b* but not as a limitation thereon, the edge **100***c* may extend at about a 45° angle relative to the axis of rotation of the drum while the upper general planar surface **100***b* of the left hand baffle of FIGURE 5 forms approximately a 30° angle with the horizontal.

Referring to FIGURES 4 and 5, it is to be noted that one portion of the mixing blade on the left hand side of FIGURE 5 is beneath baffle portion 100*a* while the end portion of said blade is located above the baffle portion. Also in referring to FIGURE 5 it is to be noted that there is provided an access door 102 that is bolted to end wall 13 to removeably close an access opening therein.

Suitable power actuating mechanism for the drum 10 is shown schematically in FIGURE 1 and may comprise an electric motor 104 operatively connected through suitable speed reduction mechanism 106 to a sprocket chain and ring gear 105 affixed on the outer periphery of the tubular wall of the drum. Thus the drum may thereby be rotated at a suitable speed, usually in the order of 2 to 5 r.p.m. in the direction of the arrow 56.

The structure of the invention having been described, the operation thereof will now be briefly set forth. Assuming that the drum is in an emptied condition, the particulate material to be mixed is merely dumped into the chute 38 where under the action of gravity it flows through the hood inlet port 39 and thence through the cutouts 40 of the mounting flange 51 that are located axially adjacent inlet port 39. The material going through the cutouts moves under the action of gravity toward the bottom of the hood tubular wall 16 to be located about at position *j* axially between flanges 32, 51 and circumferentially between arcuate walls 55, whereupon, with the drum rotating, it is moved by an outer scoop in a direction of the arrow 56 to a more elevated condition (see FIGURE 3). Upon an outer scoop moving to about position *k* from position *j*, the weight of the material acting against the respective closure 66 forces it to an open condition whereupon the material is free to flow over the closure into the area of the inner scoop portion. However at this time the material is not free to descend since the rectangular plate 58, triangular plate 62 and corresponding arcuate portions of the mounting-flange 51 are closely adjacent the baffle 94. Thus as the drum rotates the scoop to position *m*, the material moves radially inwardly toward the surface of baffle 94 and is moved thereover until it is above the opening 81 of the discharge chute. Since at this time material has not been mixed, the slide closure 86 is in the dotted line position of FIGURE 2 whereupon material falling off the edges of the baffle passes through chute inlet opening 81, opening 84 and thence into the inner scoops which are then at the bottom or *j* position. When an inner scoop having material therein has moved up to the *k* position, there may be a sufficient amount of material carried by the inner scoop to prevent the closure 66 opening at the *k* position, however, as the inner scoop is angularly moved past the *k* position toward the *m* position, the material in the inner scoop flows toward the baffle 94. Accordingly the material being carried by the outer scoop flows to force the door open and the material carried by the outer scoop portion flows through the opening into the area of the inner scoop portion. As the material is continually transferred from the outer scoops through the opening presented by the opening of closure 66 into the annular confines of the transfer mechanism, it builds up sufficiently so that under the action of gravity it axially flows over the mounting flange 32 and onto the angularly bottom portion of the drum wall 12. At this time, the material within the drum is lifted by the troughs and due to the inclination of the troughs is moved from the 0° or *j* position toward a 90° position of the drum rotary cycle and thence is directed back into the area of the inner scoop. As additional material is fed through the chute 38 and transferred into the drum in the above mentioned manner, the level builds up at the end of the drum adjacent the transfer mechanism sufficiently to be a greater depth than the height of the mixing blades in the lowermost angular position and accordingly spills over the top of the mixing blades and gradually works back to the end 13 of the drum. This process continues until the drum is loaded. All the time the material is being continually mixed.

It is to be mentioned that when a given scoop has moved to the *n* position of FIGURE 3, the closure 66 is hanging generally vertically in position to abut against the adjacent partition portion 57*b*. As the drum is further rotated, partition portion 57*b* prevents further pivoting movement of the closure that was at the *n* position and accordingly when said closure is beneath the discharge chute it prevents the passage of material from the inner scoop back into the corresponding outer scoop.

Also to be indicated is that as the material builds up in the drum sufficiently to be adjacent the end wall 13, the previously described mixing action at the rear of the drum takes place due to the provision of baffles 100.

After the desired amount of material has passed through the chute 38, the outer scoops continue to transfer material into the annular confines of the transfer mechanism until there is no more material present on the hood tubular wall to be transferred by the outer scoops. Now, after the drum has been loaded to the desired capacity, and the material has been thoroughly mixed, the mixed material may be discharged by operating the hand lever to move the slide closure 86 to the solid line position of FIGURE 2 to block the opening 84. At this time as the material is elevated by the inner scoops to be above chute portion 80*b*, it descends through opening 81 and falls under the action of gravity to flow across the then top surface of slide closure 86 and through chute portion 80*a* to be discharged into a bag or an appropriate receptacle located beneath the discharge opening 88. As the material within the confines of the transfer means continuously discharges, the mixing blades 70 continuously direct the material to move in an axial directon toward the end wall 17 where the material during the rotary action of the drum is directed by the troughs 71 into the area within the confines of the transfer mechanism. Due to the construction of the troughs and the provision of the spiral mixing blades, the drum may be substantially emptied.

As an example of the invention but not a limitation thereof, using an appropriate speed reducer for a motor revolving at 175 r.p.m. and the drum turning at 5 r.p.m., four tons of fertilizer or two tons of feed can be mixed in the apparatus of this invention in about three minutes. Further the apparatus of this invention has a very low initial load factor, and accordingly, the drum when filled to capacity may be easily started from a dead stop. That is, the motor may build up to operating speed within a couple of revolutions of the drum.

An important feature of this invention is the construction of the transfer mechanism. Particularly it is to be noted that the transfer mechanism includes only one series of elements moveable independent of the rotation of the drum, i.e. a closure 66 for each scoop provided. Due to the provision of only having doors moveable independent of rotation of the drum (other than for the angular movement of flanges 32, 51), the scoops may be located completely around the circumference of the drum and more closely adjacent one another to provide a more continuous transfer of material from the stationary hood into the confines of the drum or discharge of material through the discharge chute. Likewise each scoop does not have to be of nearly as large a capacity as the scoops of my Patent 3,088,711 to provide the same transfer rate and accordingly an even more smooth type of a mixing operation is obtained.

As many widely apparent different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that I do not limit myself to this specific embodiment herein.

What I claim is:

1. A machine for mixing particulate materials comprising a drum mounted to revolve about a substantially horizontal axis and having a tubular wall and a rear end wall at one axial end of the drum, a fixed hood enclosing the opposite end of the drum, said hood having a tubular wall that is of a substantially larger diameter than the drum tubular wall, an end wall with an inlet port and a discharge port at a higher elevation than said inlet port, a chute attached to the end wall for directing material into the inlet port, discharge means attached to the hood end wall for selectively discharging material through the discharge port, said discharge means including means moveable between two positions for selectively permitting discharge of material from the drum and blocking discharge from the drum, transfer means in part joined to said opposite end of the drum to rotate therewith and extending axially within the confines of the hood tubular wall for transferring material passed through the hood inlet port into the hood into the confines of the drum and retaining the material in the drum as long as the said moveable means is in a blocking position, said transfer means including a plurality of circumferentially spaced scoops each having a moveable closure and means cooperating with said closure for dividing the respective scoop into an inner scoop portion and an outer scoop portion and permitting passage of material only from the outer scoop portion to the inner scoop portion, the inner scoop portion being radially more adjacent the axis of rotation than the outer scoop portion, and means for rotating the drum in a given direction.

2. The machine of claim 1 further characterized in that said scoop dividing means includes a partition and means for hingedly mounting said closure to fall open under the action of gravity as the drum rotates a scoop including said closure from the lowermost elevation to the uppermost elevation of the normal drum rotating cycle to permit flow of material from the outer scoop through the inner scoop and to move to a closed position as the drum rotates from the uppermost elevation to the lowermost elevation.

3. The machine of claim 1 further characterized in that there is provided baffle means adjacent the drum end wall for more thoroughly mixing the material, said baffle means including a baffle extending radially outwardly of the axis of revolution and having a first baffle portion generally extending perpendicular to the drum end wall, and a second baffle portion joined to said first baffle portion to extend more closely adjacent said hood than said first baffle portion and inclined relative to said first baffle portion.

4. The apparatus of claim 1 further characterized in that said transfer means includes an arcuate baffle attached to the hood, extending angularly from at least about the 90° rotating position of the drum to the discharge chute and axially closely adjacent the radially inward edge of the adjacent scoop portions to prevent materials descending from the scoops prior to being angularly elevated angularly adjacent the discharge chute.

5. The machine of claim 1 further characterized in that said discharge means includes a chute extending axially beneath a scoop when the scoop is adjacent its uppermost rotary position, said chute having an upper inlet opening, a discharge chute opening axially beneath said upper inlet opening and within the confines of said hood to permit material to descend to the lower portion of the transfer means, and a lower discharge outlet exteriorly of the hood, and that said discharge moveable means is mounted for movement between a position blocking said discharge chute opening for directing descending material from the upper inlet opening to said discharge outlet, and alternately blocking material flow from the upper inlet opening to said discharge outlet and permitting material flow from the upper inlet opening through the discharge chute opening.

6. The apparatus of claim 5 further characterized in that said transfer means includes a pair of axially spaced annular mounting flanges, one of said flanges being adjacent the hood end wall and the other attached to the drum, said scoops having axially extending portions, each of the last mentioned portions having one edge joined to one of the mounting flanges and an opposite edge joined to the other mounting flange.

7. The apparatus of claim 5 further characterized in that each of said outer scoop portions includes an arcuate wall portion opening in the direction of rotation of the drum and having a leading edge closely adjacent the hood tubular wall, and that each inner scoop portion is somewhat cup-shaped and is open in the direction of rotation of the drum.

8. The structure of claim 6 further characterized in that there is provided a shaft, a plurality of spider members connecting the shaft to the front axial end of the drum and a baffle plate attached to the spider members is substantially the same plane as the flange attached to the drum, the last mentioned flange and baffle plate providing an annular opening.

9. A machine for mixing particulate materials comprising a drum mounted to revolve about a substantially horizontal axis and having a tubular wall and a rear end wall at one axial end of the drum, a fixed hood enclosing the opposite axial end of the drum, said hood having a tubular wall that is of a substantially larger diameter than the drum tubular wall and an end wall having an inlet port and a discharge port at a higher elevation than the inlet port, means including a shaft extended through said end walls for mounting said drum for rotation, a chute attached to the hood end wall for directing material into the inlet port, a discharge chute attached to the hood end wall for discharging material through the discharge port, first and second annular flanges having outer diameters slightly less than the inner diameter of the hood tubular wall and inner diameters substantially smaller than the inner diameter of said drum tubular wall, the first flange being joined to said opposite axial end of the drum tubular wall and the second flange being axially adjacent the hood end wall and having a plurality of circumferentially spaced cut outs, the cut outs angularly adjacent said inlet port opening to said inlet port, circumferentially spaced means joined to said flanges to in conjunction therewith form a plurality of circumferentially spaced scoops, each scoop having an outer scoop portion that opens through a cut out to the hood end wall and a leading edge adjacent the hood tubular wall, an inner scoop portion extending radially more adjacent the axis of revolution than the inner peripheral edge of the first flange, and means for separating the inner scoop portion from the outer scoop portion and to permit material to flow only from the outer scoop portion through the inner scoop portion after the respective scoop has been moved a substantial angular distance in advance of the lowermost angular position of the drum rotary cycle, the last mentioned means including a closure openable by gravity after the respective scoop has moved a substantial distance angularly past said lowermost angular position, said scoop portions being open generally in the direction of rotation of the drum, said discharge chute having an inlet opening beneath scoops and at an elevation above said axis, a discharge outlet exteriorly of said hood end wall and an outlet opening at a lower elevation than said discharge chute inlet opening and within the confines of said hood, means for selectively controlling the flow of material passing through said discharge chute inlet opening to flow through said discharge chute outlet opening, means mounted on the hood to extend axially beneath the scoops angularly adjacent the trailing edge of the discharge chute inlet opening and angularly opposite the direction of rotation of the drum a substantial distance for retaining material being elevated by the scoops adjacent the scoops as they are angularly moved from adjacent the hood inlet port to adjacent the

discharge chute and then permitting material to descend to the discharge chute inlet opening, and means for rotating the drum in a given angular direction.

10. The apparatus of claim 9 further characterized in that there is provided means in the drum for directing material towards said scoops as the drum is rotating and that said inner and outer scoop portions are fixedly attached to said flanges.

11. The apparatus of claim 9 further characterized in that said separating means includes a partition portion and means for pivotally mounting said closure to coact with said partition portion to block flow of material from the inner scoop portion to the outer scoop portion when said scoop portions are in the vertical lower portion of the drum rotary cycle, to pivotally swing into said inner scoop portion under gravitational force after the respective scoop has moved angularly adjacent the trailing edge of said means for retaining material carried by the scoops adjacent said scoops and to again move to coact with said partition portion as above indicated as the respective scoop moves angularly between the discharge chute and the hood inlet opening.

12. The apparatus of claim 9 further characterized in that there is provided baffle means in the drum adjacent the drum end wall to impart circular motion to material about axes that are respectively generally parallel to the axis of rotation and generally perpendicular thereto.

13. A machine for mixing particulate materials comprising a drum having a tubular wall and a rear end wall mounted to revolve about a substantially horizontal axis, means for drivingly rotating the drum in a given direction, a fixed hood enclosing the front end of the drum and having a lower axially extending portion, a discharge chute on the hood having an outlet opening, extending into the hood and having an inlet at an elevation above said axis, said discharge chute having means for selectively blocking said outlet opening and permitting flow of material through said outlet opening, chute means for feeding material into the hood lower axial portion at an elevation below said axis and scoops cooperating means in part on the hood and in part on the drum to rotate therewith for transferring material fed into the hood by the chute means into said drum and retaining it in the drum as the drum rotates and elevating material from the drum to a position above the discharge chute inlet to selectively be discharged through said discharge chute as the drum rotates the scoop cooperating means on the drum to an elevated condition extending above the discharge chute inlet.

14. The structure of claim 13 further characterized in that said hood has a hood end wall and that the last mentioned scoop cooperating means include a plurality of circumferentially spaced scoops mounted in fixed relation to one another on the front axial end of the drum tubular wall and extending axially to adjacent the hood end wall.

15. The structure of claim 13 further characterized in that the last mentioned scoop cooperating means is generally annular and that the discharge chute includes a closure movable between a first position for blocking material flow between the discharge chute inlet and outlet and a second position directing material flow from the discharge chute inlet to the discharge chute outlet, said discharge chute having an opening blocked by said closure in the second position and opened in the first position at a lower elevation than said discharge chute inlet.

16. A machine for mixing particulate material comprising a drum having a tubular wall and a rear end wall mounted to revolve about a substantially horizontal axis, means for drivingly rotating said drum in a given direction, a fixed hood enclosing the front end portion of the drum and having a hood end wall forwardly of the front axial end of the drum and lower axially extending portion, a discharge chute extending into the hood and having an inlet opening at an elevation between the elevation of said axis and the uppermost portion of the hood, a lower discharge opening exteriorly of the hood and a second opening within the hood at a lower elevation than said inlet opening, chute means on the hood for feeding material into the hood at an elevation below said axis, means in part on the hood and in part joined to the front axial end of the drum to rotate therewith for angularly elevating material fed into the hood by the chute means and discharging said elevated material into the discharge chute inlet opening as the drum rotates, the cooperating means joined to the drum including means for receiving material from the drum and elevating it above the discharge chute inlet opening and discharging the elevated material into the discharge chute inlet while blocking flow of material from contact with said lower axial portion of the hood and movable control means extending in said discharge chute for in a first position blocking material flow between the discharge chute inlet opening and said outlet and permitting material flow through said discharge chute second opening, and a second position to direct material flow from said discharge chute inlet opening to the discharge opening and blocking said second opening, and means for directing material axially forwardly in the drum into said drum cooperating means.

17. A machine for mixing particulate material comprising a frame, a generally horizontal shaft mounted on said frame, a drum mounted on the shaft to revolve about the axis of the shaft, said drum having a tubular wall having a front opening and a rear wall, a stationary hood enclosing the front axial end of the drum and having an end wall axially spaced from said front axial end of the drum, means on the hood for feeding material into the hood, a discharge chute on the hood and, cooperating means on the hood and drum for transferring material from said feed means into the drum elevating said material and selectively discharging said elevated material through the discharge chute, baffle means adjacent the drum end wall for more thoroughly mixing the material, said baffle means including a baffle extending radially outwardly of the shaft and having a first baffle portion generally perpendicular to said end wall and a plane containing the axis of rotation of the drum and a second baffle portion extending axially from said first baffle portion toward said hood and inclined relative to said first baffle portion to extend toward said hood and in the direction opposite to the rotation of the drum, said baffle portions having an axially extending edge secured to the drum tubular wall, and means for rotating the drum in a given direction.

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