July 13, 1965 N. MURRAY 3,194,538

ROTARY CYLINDER MIXING MACHINE

Filed June 5, 1962

Fig. 1.

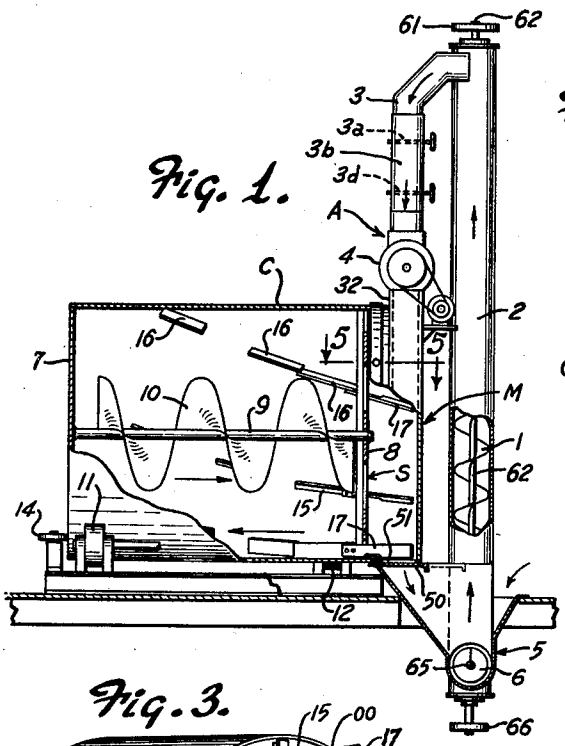


Fig. 2.

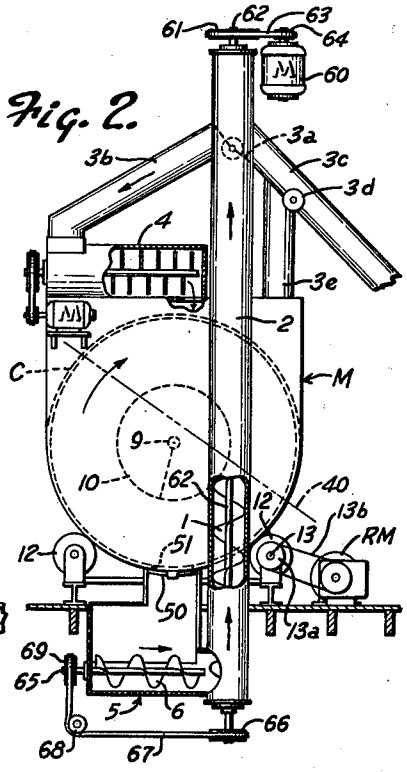


Fig. 3.

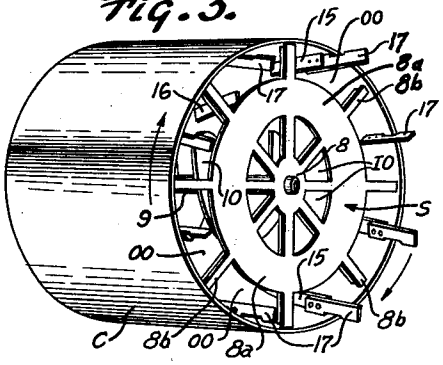


Fig. 4.

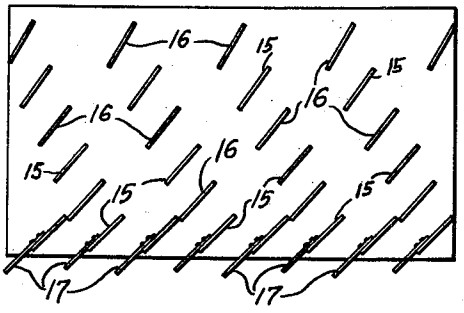
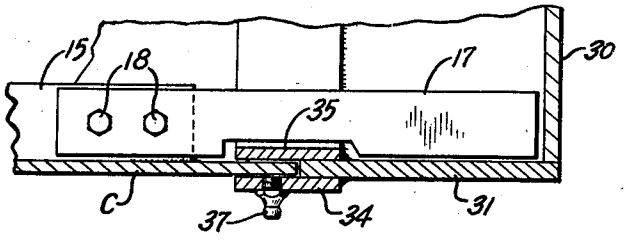


Fig. 5.



INVENTOR.
Ned Murray
BY
Lieber, Lieber & Nilles
Attorneys

United States Patent Office 3,194,538 Patented July 13, 1965

3,194,538

ROTARY CYLINDER MIXING MACHINE

Ned Murray, P.O. Box 192, Waupaca, Wis.

Filed June 5, 1962, Ser. No. 200,114
8 Claims. (Cl. 259—3)

This invention relates to mixing apparatus and finds particular but not exclusive utility as a mixing device for animal feed or the like.

It is conventional to provide a rotary cylinder type mixer having a stationary manifold in communication with one end of the cylinder, through which manifold the material passes in entering and leaving the cylinder. It is also known in this art to provide such mixing machines with various helical screws, paddles, or baffle plates, or combinations of them to set up various currents of flow of material for thorough mixing.

An important aspect of the present invention is to provide a mixer of the above type having an improved cylinder construction which cooperates with its stationary manifold to provide particularly efficient and thorough mixing of the product. The arrangement is such that a combination of three different mixing actions for the material is provided and which results in complete and rapid transfer of material between the manifold and cylinder.

A more specific aspect of the invention provides an improved rotary cylinder construction of the above type and including a novel spider for support of a central auger, and also including inclined sweeper baffles which positively move the material in the manifold as well as in the cylinder in the desired directions. The resulting function is particularly efficient in continuously moving material in two different flow paths and also in providing additional turbulence by a general and continuous tumbling action.

Another aspect of the invention relates to an improved stationary manifold and recirculating apparatus for a horizontal, rotary cylinder type mixer.

These and other objects and advantages of the present invention will appear hereinafter as this disclosure progresses, reference being had to the accompanying drawings, in which:

FIGURE 1 is a side elevational view, in section, and with parts broken away or removed for clarity, of a mixer made in accordance with the present invention;

FIGURE 2 is a front elevational view of the mixer shown in FIGURE 1, certain parts being shown in section or removed for clarity;

FIGURE 3 is a perspective view, on a slightly enlarged scale, of the cylinder shown in FIGURES 1 and 2;

FIGURE 4 is a view, on a reduced scale, of the interior of the cylinder which has been opened up or laid out flat to show both the interior baffles and the intake baffles, and

FIGURE 5 is an enlarged sectional view taken along line 5—5 in FIGURE 1 and showing the joint between the rotary cylinder and the stationary manifold.

General arrangement

The mixing apparatus generally consists of a large rotatable cylinder C which is mounted for rotation about a horizontal axis. A stationary manifold M is provided at the front end of the cylinder and is in communication with the interior of the cylinder for introducing material into the cylinder and also for withdrawing it from the cylinder.

Means are provided for introducing material into the manifold and also for withdrawing material from the manifold and causing it to either be recirculated through the cylinder or drawn off from the mixing apparatus entirely. This means comprises a vertically disposed auger 1 located at the front end of the cylinder and which is enclosed in its tubular casing 2 and extends to a considerable height above the cylinder where it discharges material into the tubular chute 3. The chute 3 contains a Y-valve 3*a* for selectively directing the material into a conduit 3*b* or to a conduit 3*c*. Conduit 3*b* in turn conducts the material back into the manifold via a blender 4.

The blender 4 is in itself of conventional design and can blend such products as molasses into the feed and needs no detailed explanation here. Conduit 3*c* in turn also has a Y-valve 3*d* for selectively directing its material to its lower discharge end (not shown) where it can be bagged off or deposited in a waiting truck, or the material can be diverted to conduit 3*e* for direct re-entry into the manifold.

At the lower end of the vertical conveyor is a horizontal feed trough or hopper 5 which is located beneath the cylinder and contains a horizontal auger 6 journaled therein for conveying material into the lower end of the casing 2 for upward conveyance by the auger 1.

Rotatable cylinder unit

The rotatable cylinder C is closed at its rear end by the rear wall 7 and has a generally open spider S rigidly secured adjacent its front end.

The spider S may be formed from a plate of steel which has a central disk portion 8 and an intermediate ring portion 8*a* which are secured together and to the interior of the cylinder by means of the spoke members 8*b*. Thus, a series of outer arcuate shaped openings OO are formed around the cylinder wall and also a series of inner arcuate shaped openings IO are formed through the more central portion of the spider.

Conveying means are provided in the central portion of the cylinder for moving material that has reached a certain height in the cylinder axially towards the front end of the cylinder. This means has been shown as comprising a large central shaft 9 having an auger 10 welded thereto and which is rigidly secured at its rear end to the rear wall 7 and rigidly supported at its front end by the spider S. It will be noted that the auger is somewhat shorter than the length of the cylinder; that is to say, it terminates short of the wall 7 and at its other end terminates short of the spider. The pitch of this auger is such that as the cylinder rotates, it feeds material forwardly in the cylinder. It should also be noted that the auger is of considerably less diameter than the internal diameter of the cylinder, and a considerable space exists between the auger and the cylinder wall.

Other conveying means may be utilized in place of the specific auger shown for moving the material towards the front of the cylinder when the material reaches a certain height therein. For example, paddles (not shown) which are pitched or inclined to feed the material axially forward could be secured to the shaft 9 at axially spaced locations and would extend generally radially from the shaft.

The cylinder is supported for rotation about its horizontal axis in the known manner, for example, on four rubber-covered wheels, one pair of wheels 11 being located adjacent the rear end of the cylinder, and another pair of wheels 12 being located adjacent the front end of the cylinder. These wheels are suitably journaled on anti-friction bearings, and any number of them may be driven by a reversible motor RM to thereby cause rotation of the cylinder. In the embodiment shown, one of the wheels of each pair of wheels is mounted on a common drive shaft 13, and this drive shaft has a sprocket 13*a* fixed thereto. The sprocket may be connected by a flexible chain 13*b* to the motor RM causing rotation of the cylinder in one direction for mixing, and in the other direction for quick unloading, as will appear. The cylinder is prevented from displacement to the left (as viewed in FIGURE 1) by means of the wheel 14 which bears against the rear wall 7 as the cylinder rotates.

Other means may be provided for rotating the cylinder about a generally horizontal axis and still come within the scope of the present invention. For example, the cylinder may be supported on a central shaft extending axially through the cylinder, and the shaft then supported at either end on suitable bearings, in a conventional manner.

A series of generally radially extending baffles are secured to the interior of the cylinder, and it will be noted that certain of the baffles **15** generally form non-continuous spirals along the length of the inner surface of the cylinder, while other of the baffles **16** form other spirals along the length of the cylinder. Baffles **15** and **16** are furthermore staggered along the axial length of the cylinder in respect to one another to further enhance the turbulence and tumbling action of the material as the cylinder rotates. The baffles **15** and **16** are referred to as the interior baffles.

A series of intake baffles **17** are secured to and form a continuation of some of the interior baffles and extend through the spider. These intake baffles sweepingly extend into the manifold M and are removably secured to the interior baffles by bolts **18** to facilitate assembly of the mixer, as will appear later. These intake baffles closely follow the arcuate bottom or curved contour of the interior of the manifold as they move relative to the housing and act to sweep the material from right to left (as viewed in FIGURE 2) and also rearwardly into the cylinder.

The cylinder, spider, interior baffles, intake baffles, and the auger are all rigidly secured together for rotation as a single unit.

Manifold

The manifold M consists of a front wall **30**, a U-shaped side wall **31**, and a rear, arc-shaped wall **32**. Walls **30**, **31**, and **32** are welded together as a unit and act to enclose the front end of the cylinder with which the unit is in communication.

The manifold M is stationary and the cylinder C rotates, and a rugged joint which forms a lubricated mechanical seal (FIGURE 5) is provided between the relatively moving parts, as follows. An outer guide ring **34** and an inner guide ring **35** are welded to the rear edge of the side wall **31** and extend rearwardly therefrom to form an annular groove at the rear side of the manifold. The forward edge of the cylinder rotates within this groove and thus prevents dusting and leakage of any material from the mixer. Grease fittings **37** are set in the outer ring **34** whereby lubricating grease may be periodically and only infrequently introduced into the joint and lubricate the relatively moving parts and provide a life-long, trouble-free seal.

Generally, the spider is located immediately behind the manifold, and the front end of the central shaft **9** also terminates short of the manifold. Thus, the manifold has a substantially open and unobstructed inside. The entire cylinder assembly is self-contained and externally supported by rollers **11** and **12** for rotation.

Conveying and recirculating apparatus

The apparatus A at the front of the machine feeds the material into the manifold through the top side of the manifold for delivery into the cylinder. After the material is mixed, it may rapidly be unloaded by the reverse feeding action of the baffles when the direction of rotation of the cylinder is reversed from its normal mixing direction. Unloading occurs by gravity through the discharge door **50** slidably mounted at the lowermost side of the manifold. When this door is slid forwardly as indicated by the dotted line in FIGURE 1, the material from the manifold falls through the manifold opening **51** and into the hopper **5** where it is conveyed by the horizontal auger **6** and then upwardly by the vertical auger **1**, for sacking off or re-entry into the cylinder.

The drive for the vertical conveyor is furnished by a motor **60** located at the top of the conveyor and connected to the pulley **61** secured to the conveyor shaft **62** by means of the endless belt **63** and motor pulley **64**. The horizontal auger conveyor shaft **65** is driven from the lower end of shaft **62** through pulley **66** fixed to shaft **62**, belt **67**, idler pulleys **68** (only one shown), and pulley **69** fixed to shaft **65**.

Operation

As the cylinder rotates, the auger **10** acts to feed that material which has reached a certain height in the cylinder forwardly from the rear end of the cylinder and generally along the path indicated by the upper horizontal arrow in FIGURE 1, and thus one path of mix travel is established, namely, rearwardly along the lower side of the cylinder to the rear of the cylinder where the direction is reversed and then, under the influence of the central auger, the material is caused to flow forwardly toward the front of the cylinder.

In addition to the above-mentioned flow path, another general flow path or mixing action is established due to the rotation of the cylinder, the baffles, and the particularly shaped spider, as follows. The general level of the mix within the cylinder, depending somewhat on the type of product being mixed, assumes a position as shown by the broken line **40**. Material is moved forwardly in the cylinder by the auger **10** and enters the manifold from the cylinder generally through the openings IO located in the lower right quadrant. The intake baffles are also inclined in respect to the axis of the cylinder and consequently as the cylinder rotates, the intake baffles also axially feed the material rearwardly, from the manifold and into the cylinder. Stated otherwise, the intake baffles act to feed the material through the spider openings CO which are located generally in the lefthand lower quadrant of the spider. At the same time, the intake baffles also act to move the material with a sweeping action generally from right to left along the lower side of the manifold. In this manner, a second flow path of material is provided which is generally in the direction from right to left as viewed from the front of the machine and also generally from a central location within the cylinder and downwardly. As the material enters the cylinder from the manifold, the interior baffles then continue to feed the material as it begins its travel through its first mentioned flow path, as indicated by the arrows in FIGURE 1.

A third type of mixing action is provided, namely, that of the general turbulence or tumbling action created by the rotation of the drum, further enhanced by the spiral position of the baffles and also the alternate spacing and staggering of the baffles within the cylinder.

Résumé

The present mixing apparatus provides a particularly efficient device for thoroughly and rapidly mixing large quantities of different materials due to the three different types of mixing actions.

The structure itself is relatively simple, and the spider, the cylinder and its auger and baffles are all mounted for rotation together as a unit.

The material is swept positively from the manifold into the cylinder by the baffles and when the rotation of the cylinder is reversed, the material is positively moved into the manifold by the baffles for quickly unloading the cylinder.

The stationary manifold and the conveying and recirculating apparatus result in an efficient and versatile unloading and/or recirculating mechanism.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. In a mixing machine, a stationary manifold for receiving and discharging material and having an arcuate

bottom, a rotary cylinder having a closed rear end and also having an open front end in communication with said manifold, and a series of baffles secured to the interior of said cylinder and at an angle to the direction of rotation thereof for feeding material toward said rear end, at least some of said baffles extending into said manifold to sweep material across said arcuate bottom and rearwardly into said cylinder.

2. In a mixing machine, a stationary manifold for receiving and discharging material and having an arcuate bottom, a rotary cylinder having a rear end wall and also having an open front end in communication with said manifold, a generally open spider secured in said cylinder adjacent said front end and through which material can pass, a shaft secured between said rear end wall and said spider, conveying means mounted on said shaft and having a pitch to feed material towards said front end, and a series of baffles secured to the interior of said cylinder and at an angle to the direction of rotation thereof for feeding material toward said rear wall, at least some of said baffles extending into said manifold to sweep material across said arcuate bottom and rearwardly into said cylinder.

3. In a mixing machine, a stationary manifold for receiving and discharging material and having an arcuate bottom, a rotary cylinder having a closed rear end and also having an open front end in communication with said manifold, a series of baffles secured to the interior of said cylinder and at an angle to the direction of rotation thereof for feeding material toward said rear end, at least some of said baffles extending into said manifold to sweep material across said arcuate bottom and rearwardly into said cylinder, a hopper located beneath said manifold for receiving material by gravity therefrom, a generally vertical conveyor having a lower end in communication with said hopper and having an upper end located above said manifold, and conduit means in communication with said upper end for selectively directing material to said manifold and to a location separate from said machine.

4. In a mixing machine, a stationary manifold for receiving and discharging material and having an arcuate bottom, a rotary cylinder having a rear end wall and also having an open front end in communication with said manifold, a generally open spider secured in said cylinder adjacent said front end and through which material can pass, a shaft secured between said rear end wall and said spider, conveying means mounted on said shaft, and having a pitch to feed material towards said front end, a series of baffles secured to the interior of said cylinder and at an angle to the direction of rotation thereof for feeding material toward said rear wall, at least some of said baffles extending into said manifold to sweep material across said arcuate bottom and rearwardly into said cylinder, a hopper located beneath said manifold for receiving material by gravity therefrom, a generally vertical conveyor having a lower end in communication with said hopper and having an upper end located above said manifold, and conduit means in communication with said upper end for selectively directing material to said manifold and to a location separate from said machine.

5. A rotary cylinder unit for a mixing machine comprising, a rotatable and generally horizontally disposed cylinder having a rear end wall and an open front end, a generally open spider rigidly secured in said cylinder adjacent said front end and through which material can pass, a shaft secured between said rear end wall and said spider for rotation therewith, and conveying means rigidly mounted on and along said shaft and having a pitch to feed material from the rear end of said cylinder, along its length and to said front end and through said spider.

6. A rotary cylinder unit for a mixing machine comprising, a rotatable and generally horizontally disposed cylinder having a rear end wall and an open front end, a generally open spider secured in said cylinder adjacent said front end and through which material is adapted to pass in either direction, a shaft secured between said rear end wall and said spider, conveying means mounted on said shaft and having a pitch to feed material from the rear end of said cylinder, along its length and to said front end, and a series of baffles secured to the inner surface of said cylinder and arranged at an angle to the axis thereof for feeding material rearwardly in said cylinder.

7. A rotary cylinder unit for a mixing machine comprising, a rotatable and generally horizontally disposed cylinder having a rear end wall and an open front end, a generally open spider secured in said cylinder adjacent said front end and through which material can pass, a shaft secured between said rear end wall and said spider, conveying means mounted on said shaft and having a pitch to feed material towards said front end, and a series of baffles secured to the inner surface of said cylinder and arranged at an angle to the axis thereof, said baffles extending through said spider and outwardly of said cylinder whereby material can be fed by the baffles rearwardly through said spider and in said cylinder.

8. In a mixing machine having a rotatable cylinder and a stationary manifold in material passing communication with one end thereof, a hopper located beneath said manifold for receiving material by gravity therefrom, a generally vertical conveyor having a lower end in communication with said hopper and having an upper end located above said manifold, and conduit means in communication with said upper end for selectively directing material to said manifold and to a location separate from said machine.

References Cited by the Examiner

UNITED STATES PATENTS

1,997,301	4/35	Kniffen et al.	
2,924,513	2/60	Altimier et al.	259—3 X
3,064,948	11/62	Hallberg	259—3

WALTER A. SCHEEL, *Primary Examiner.*