United States Patent

Crose

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[45] **June 27, 1972**

[54] MIXER

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[52] **U.S. Cl.** **259/6**, 259/41, 259/104

[51] **Int. Cl.** **B01f 7/08**

[58] **Field of Search** 259/5, 6, 41, 9, 10, 45, 46, 259/109, 110, 25, 26, 68, 69, 104

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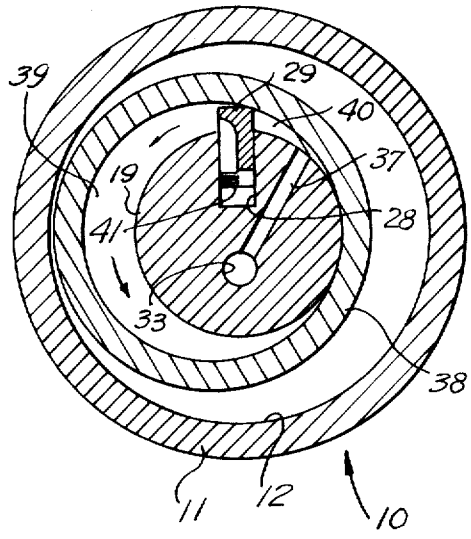
[57] **ABSTRACT**

A mixer particularly suited for use in mixing fluid materials, such as feed for livestock, characterized by a portable, elongated shell having an open top, for therein receiving materials to be mixed, a side discharge port, for discharging mixed materials, and a plurality of parallel augers adapted simultaneously to advance the materials in opposite directions for transporting and incidentally mixing the materials. A particular feature of the mixer resides in an agitator conforming to a rotatable paddle wheel operatively affixed to one of the augers, for mixing the materials received within the shell, adapted to avoid the effects of substantially immovable obstructions encountered by the agitator as it is driven in operative rotation.

18 Claims, 13 Drawing Figures



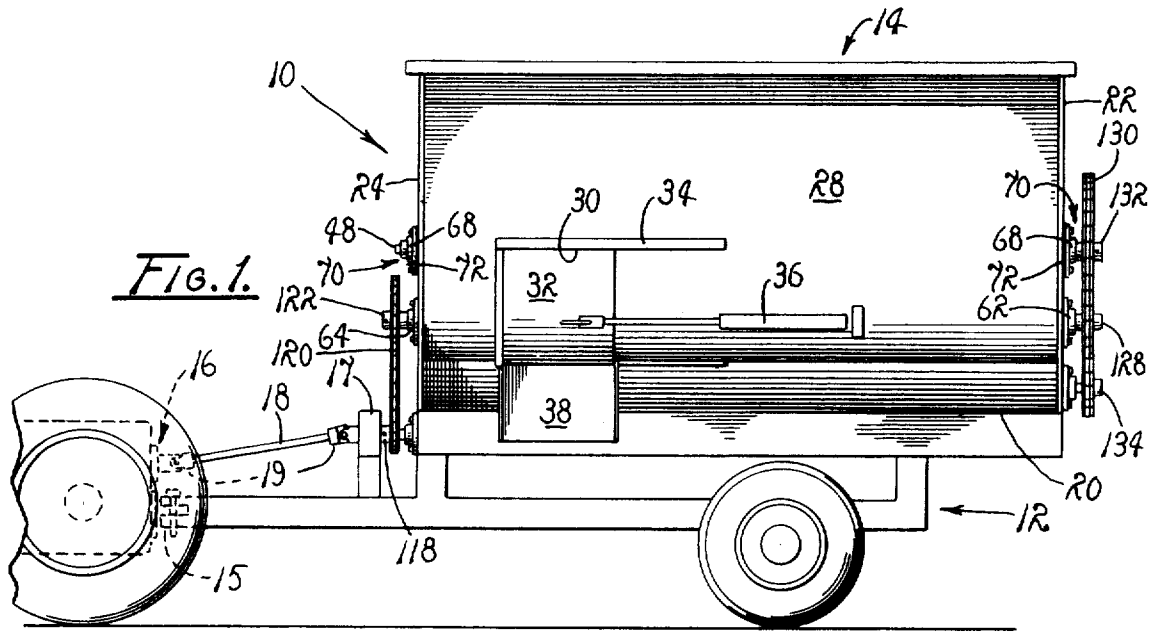


FIG. 1.

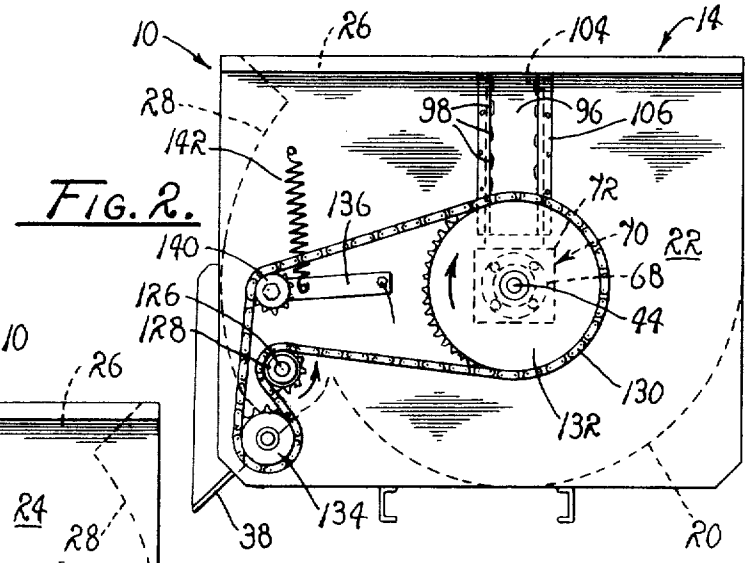


FIG. 2.

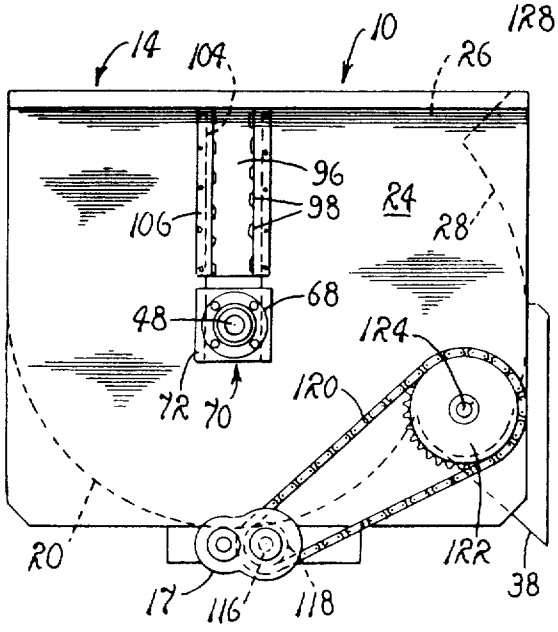


FIG. 3.

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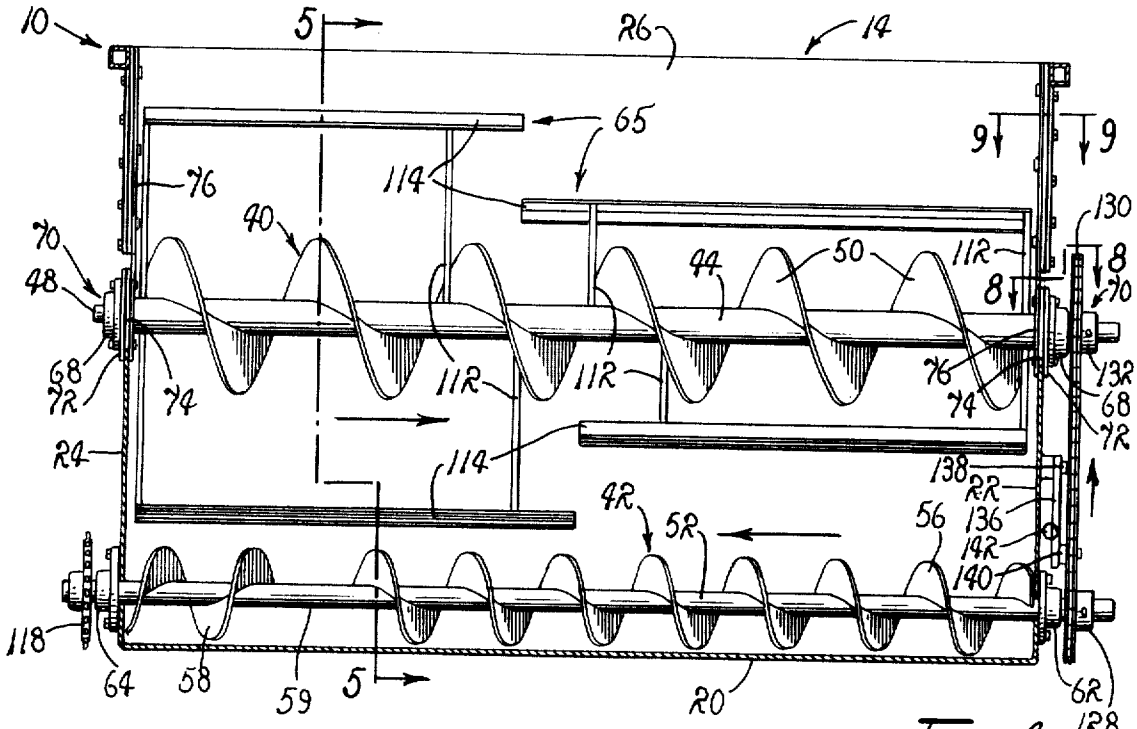

FIG. 4.

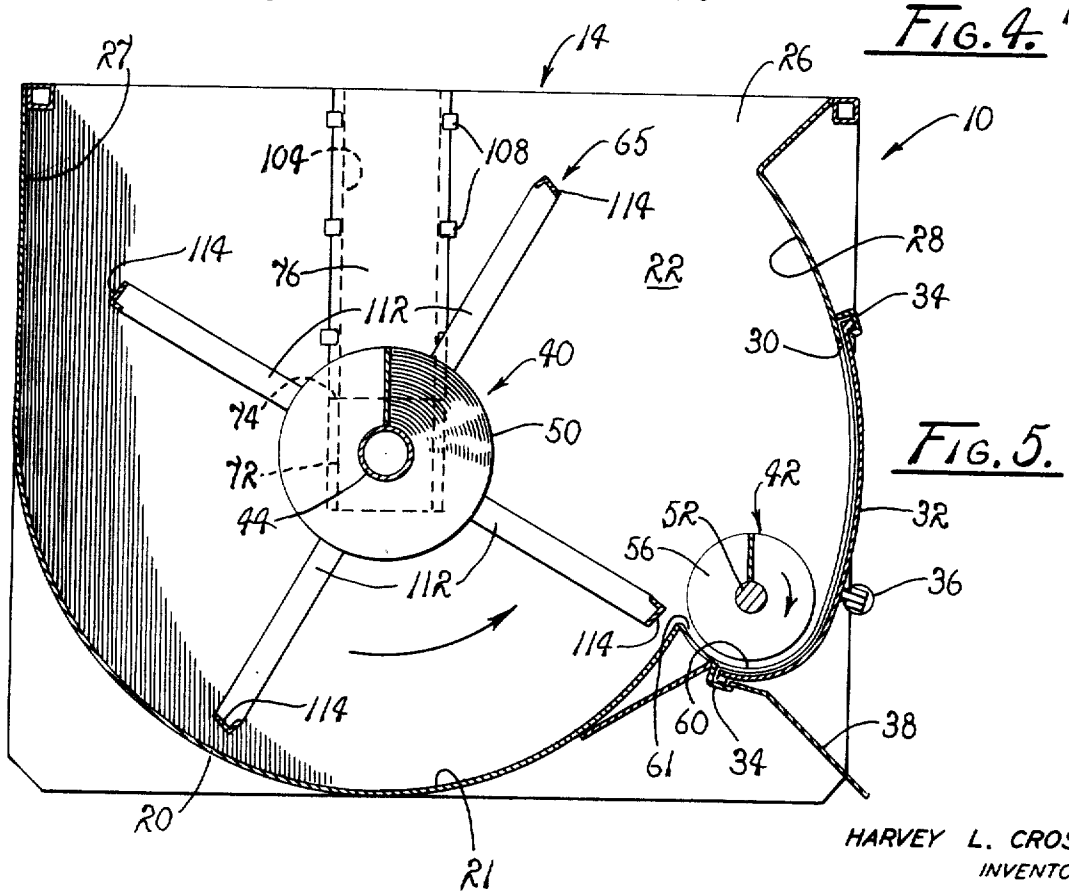

FIG. 5.

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FIG. 6.

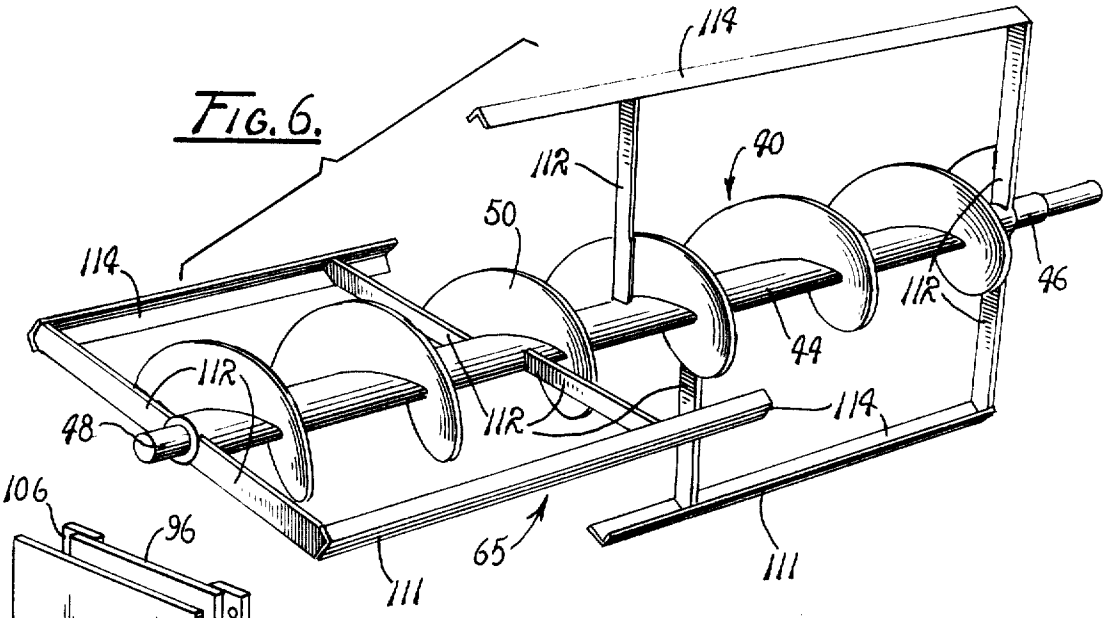
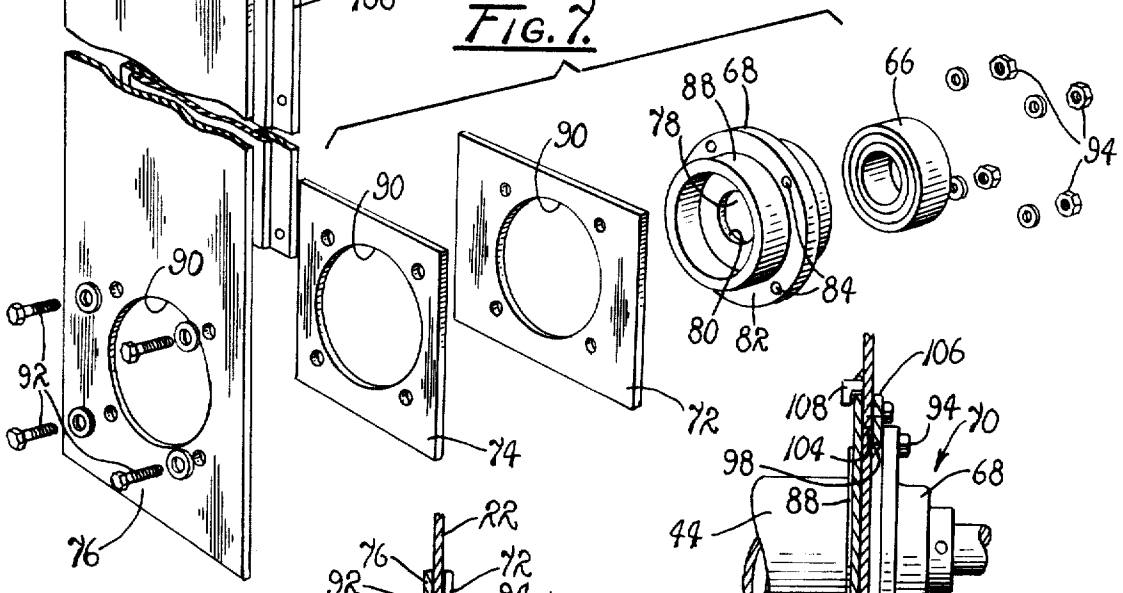


FIG. 7.



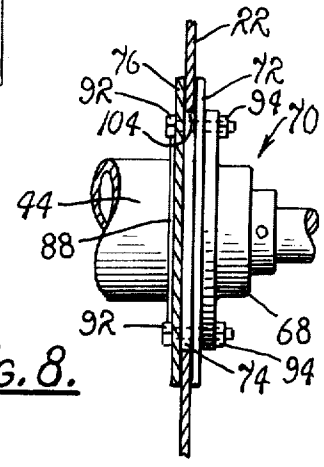


FIG. 8.

FIG. 9.

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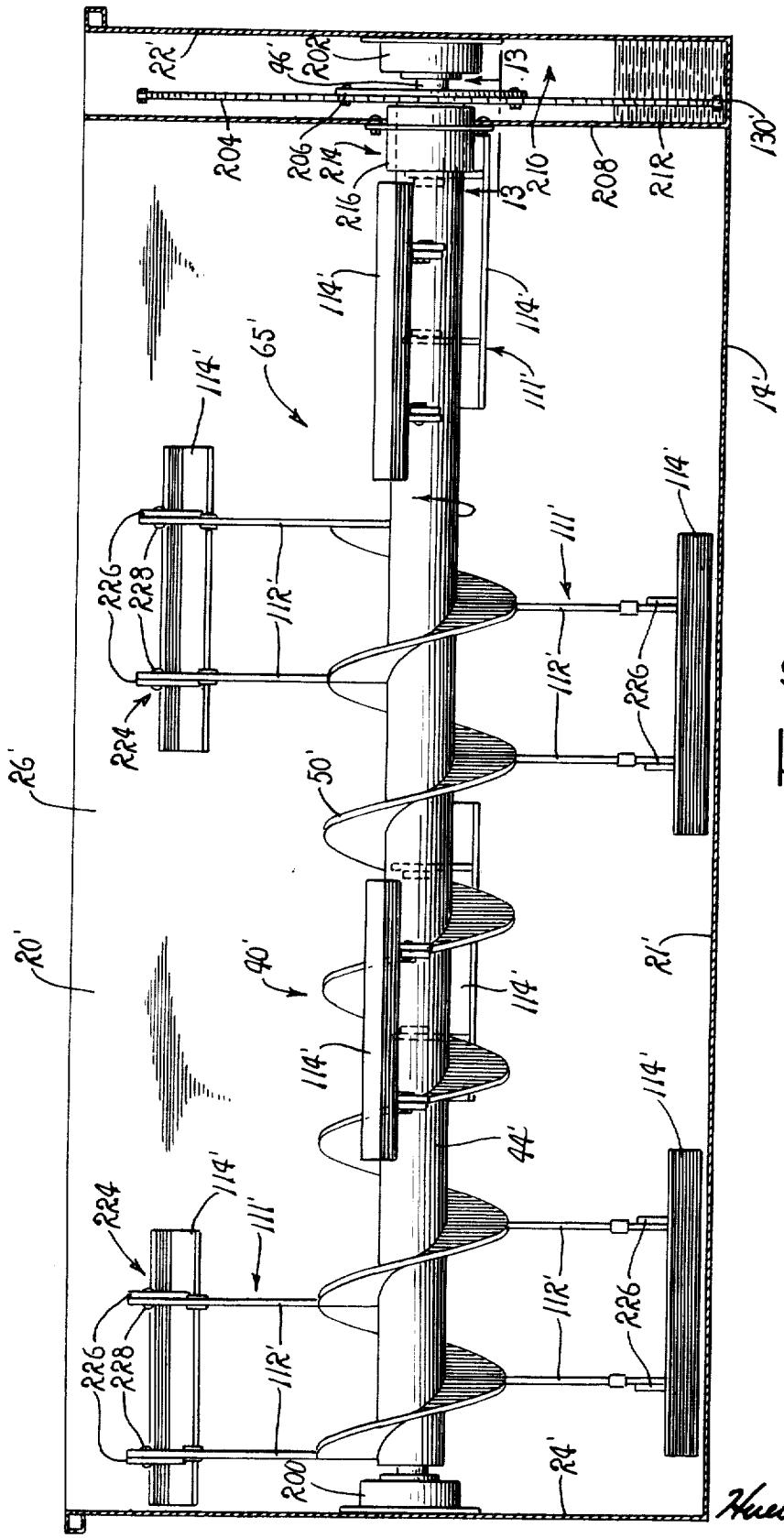

FIG. 10.

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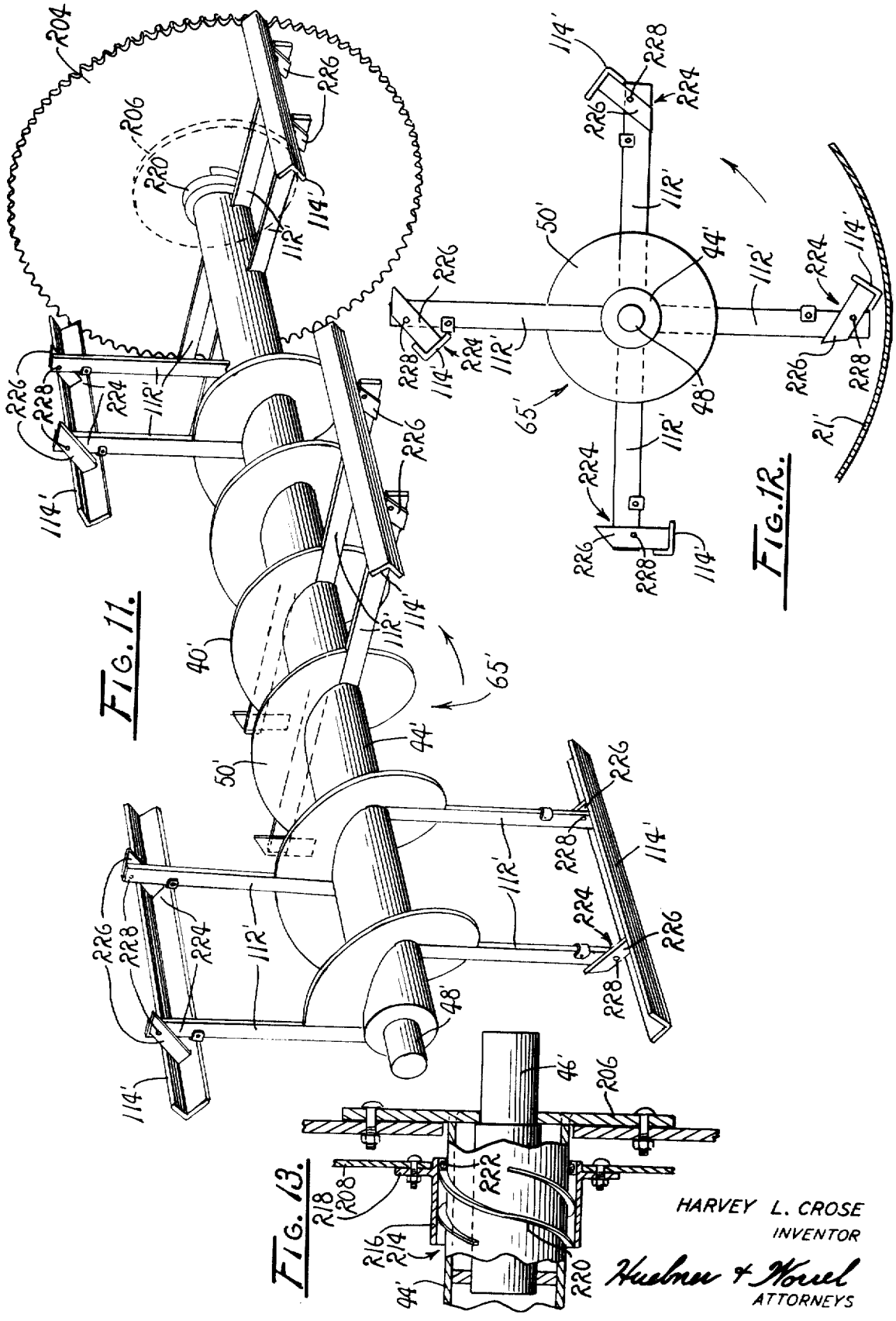

FIG. 11.

FIG. 12.

FIG. 13.

MIXER

BACKGROUND OF THE INVENTION

The invention generally relates to mixers, and more particularly to a portable mixer employed in delivering mixed feed to feeder pens.

In preparing feeder cattle for market, the cattle often are maintained in feeder pens. In order to provide an adequate quantity and quality of feed for the cattle, the feed is deposited in long troughs circumscribing the pens. Where the livestock are confined within the pens for extensive periods of time, such as normally occurs in instances where livestock are being prepared for market, feed of a wide variety must be provided. For example, where cattle are being prepared for market, the types of feed supplied to the cattle will vary for various reasons, including climate conditions, the age of the cattle, the length of time the cattle have been confined, and the markets for which the livestock are being prepared. Therefore, it is necessary that various types of feed be delivered to the troughs. These types include concentrates in powder and meal form, silage in chopped form, and roughage in the form of chopped as well as unchopped hay.

Frequently, it is desirable to mix various types of feed such as powdered concentrates and grains, grains and hay, or other combinations which the cattle apparently find particularly palletable. Heretofore, such mixing has been performed in large, centrally located plants and subsequently delivered in "feed wagons" which include therein conveyor structure for delivering the mixed feed through side delivery chutes. As is readily apparent, such techniques, in many respects, are deemed to be quite inefficient.

Attempts have been made to overcome such inefficiency by mixing feed as the feed is being transported to the feeder pens. However, currently available mixers normally cannot readily handle certain feed materials such as unchopped hay, since the strands of hay tend to "ball" and thus establish obstructions within the mixer. These obstructions normally render the mixer inoperative and require that an operator "clear" the mixing structure. Consequently, currently available mixers simply do not fill existing needs since their use tends to be limited by their inherent inability to handle the normally wide range of feed materials which must, as a practical matter, be supplied in given feeding operations.

OBJECTS AND SUMMARY OF THE INVENTION

It therefore is an object of the instant invention to provide an improved mixer.

Another object is to provide an improved mixer for simultaneously mixing and delivering fluid materials having a wide range of textures.

Another object of the invention is to provide an improved mixer for use in mixing feed for livestock while concurrently therewith transporting the feed.

Another object is to provide an improved, mobilized mixer having a capability of simultaneously mixing and transporting livestock feed of textures ranging between a powdered substance and dry and unchopped hay.

Another object is to provide a unique mixer having a rotatable agitator adapted to overcome effects of encountered obstructions.

Another object is to provide a wheel-supported mixer, of a type having a shell for receiving therewithin fluid materials to be mixed, with a rotatable agitator including a relief mechanism adapted to avoid the retarding effects of encountered obstructions for thus accommodating a continuous mixing operation of the agitator.

Another object is to provide the mixer having a unique arrangement of unique structure, including a mixer shell, a rotatable agitator supported for displacement in radial directions relative to said shell to accommodate a mixing of fluid materials of a wide range of textures.

These and other objects and advantages are achieved through the use of a mobilized, wheel-supported mixer including an elongated shell having a driven auger supporting a rotatable agitator adapted to be operated to effect a continuous mixing and a "scraping" of the internal surfaces of the shell, while being further adapted to accommodate a passage of encountered obstructions between the agitator and the internal surfaces of the shell.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of a mixing tank and a supporting trailer included within a mixer embodying the principles of the present invention.

FIG. 2 is a partial rear elevation of the mixing tank of FIG. 1.

FIG. 3 is a partial front elevation of the mixing tank of FIG. 1.

FIG. 4 is a partially sectioned, side elevation of the mixer of FIG. 1, depicting a mounting for one form of an agitator employed by the mixer of the instant invention.

FIG. 5 is a sectioned, end elevation taken generally along line 5—5 of FIG. 4.

FIG. 6 is a perspective view, of the agitator shown in FIG. 4, but on somewhat of an enlarged scale.

FIG. 7 is an exploded perspective view of a journal bearing and its associated mounting structure, as employed in mounting the agitator illustrated in FIG. 6.

FIG. 8 is a partially sectioned fragmentary plan view of a bearing employed in mounting the agitator shown in FIGS. 4 through 6, taken generally along line 8—8 of FIG. 4.

FIG. 9 is a partially sectioned fragmentary plan view of the bearing depicted in FIG. 8, but taken generally along line 9—9 of FIG. 4.

FIG. 10 is a partially sectioned, side elevation illustrating another form of the agitator embodied within the mixer of the instant invention.

FIG. 11 is a perspective view illustrating the agitator depicted in FIG. 10.

FIG. 12 is a sectioned end view of the agitator illustrated in FIGS. 10 and 11.

FIG. 13 is a sectioned view on an enlarged scale of sealing structure employed in sealing the mixing shell, taken generally along line 13—13 in FIG. 10.

GENERAL DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, and particularly to FIGS. 1 through 5, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown a mixer 10.

The mixer 10 preferably is employed in mixing and transporting feed supplied at storage bins to be delivered to livestock feeder pens. Therefore, the mixer is, in practice, provided with a wheel-supported trailer 12, for operatively supporting a mixing tank 14, adapted to be coupled with a suitable tractor, not designated, through a trailer hitch 15.

The mixer 10 is powered through a drive train extending from a P.T.O. (Power Take-Off Unit) 16, of a suitable type normally provided for wheeled tractors, delivered to a gear box 17 through a drive shaft 18. As a practical matter, and for obvious reasons, it is preferred that the drive shaft 18 terminate at its opposite ends in a pair of universal couplings 19.

As currently employed, the mixing tank 14 includes therewithin a shell 20 which functions to establish the tank's internal wall surfaces. The shell 20 generally conforms to a horizontally disposed, truncated cylinder, whereby the lowermost internal surfaces of the shell 20 provide the mixing tank 14 with a curved bottom wall 21 of a substantially arcuate cross sectional configuration. As a practical matter, the tank 14 is closed at its rear and front ends by a pair of walls, or transverse bulkheads, including a vertical rear wall 22 and a vertical front wall 24. These walls are of a substantially planar configuration and normally are related to the longitudinal axis of the shell 20.

The tank 14, in effect, is an open-top tank having an elongated opening 26, of a dimension substantially greater in its length than the diameter of the shell 20, for thus affording ready access to the interior of the mixing tank. It is to be understood that, in practice, the mixing tank 14 is filled employing various types of loading structure including conveyors, blowers, front loading tractors, and the like. Of course, where it becomes practical to do so, the top of the mixing tank is covered employing any convenient closure, not shown.

While the shell 20 of the tank 14, particularly along the bottom wall 21, is of a substantially cylindrical configuration, it is important to note that the shell 20 also includes an upstanding substantially vertical side wall 27 and a curved side wall 28, FIG. 5. The curvature of the wall 28 is such as to have a radius of curvature greater than that of the bottom wall 21, each wall being concentric to the longitudinal axis of the shell 20. The wall 28 has formed therein a discharge opening 30 which is closed by a sliding door 32 suspended from a pair of suitable parallel tracks 34. The door 32 is adapted to be driven in reciprocating displacement by any suitable means including an hydraulic actuator 36. Consequently, materials to be mixed are introduced into the tank 14 through the opening 26 and, once mixed, the materials are delivered through the discharge opening 30, as the door 32 is displaced therefrom. As a practical matter, an external chute 38 is suspended from the side of the tank 14, in a substantially coaxial relationship with the discharge opening 30, for purposes of guiding flowable material as it is delivered from the opening. Of course, a conveying structure can be employed with the chute 38 for positively transporting material from the opening 30.

Within the mixing tank 14 there is provided a primary auger, generally designated 40, and a secondary auger, generally designated 42. The auger 40 is of a convenient design and includes an elongated shaft 44 terminating in a rear journal 46 and a front journal 48. The auger 40 further includes a helical rib 50 having a suitable diameter and pitch, as dictated by the operative dimensions of the mixing tank. It is to be understood that the primary auger 40 is employed for advancing fluid materials axially through the mixing tank 14 and serves to enhance mixing of the materials as an advance thereof is effected. Therefore, the specific configuration of the helical rib 50 is dictated by its use and can empirically be determined.

The secondary auger 42 is of a design quite similar to that of the primary auger 40. However, the diameter of the secondary auger is somewhat less than that of the primary auger 40. The auger 42 is disposed in parallelism with the auger 40, FIG. 4, and includes an elongated shaft 52 which includes a front and a rear journal, not designated, and is circumscribed by a first helical rib 56, having a first pitch, and a second helical rib 58, having a reversed pitch. The ribs 56 and 58 circumscribe mutually spaced portions of the shaft 52 with the adjacent ends thereof being disposed in a mutually spaced relationship, for providing therebetween a clear portion 59.

The portion 59 of the shaft 52 is provided for accommodating a lateral discharge of materials delivered thereto from opposite directions, as the auger 42 is driven in rotation. Like the primary auger 40, the pitch and diameter of the ribs of the secondary auger 42 can empirically be determined. However, it is to be understood that the pitch of the rib 56 is such as to deliver fluid materials from portions of the tank 14, near the rear wall 22, toward portions of the tank 14 located near the front wall 24. This delivery occurs simultaneously with a delivery of the fluid material from portions of the tank near the front wall 24 toward portions located near the rear wall 22, through the action of the rib 50 of the primary auger 40. It is to be understood that the fluid material is caused simultaneously to progress in reversed directions between the front wall 24 and the rear wall 22 of the mixing tank 14.

In order to assist in the delivery of the fluid material, by the action of the secondary auger 42, the auger is seated within a trough 60, FIG. 5, formed in the internal surface of the shell 20 and arranged adjacent to the surface of the side wall 28. The trough 60 extends the length of the tank 14 and is provided with a bottom wall 61, also of an arcuate configuration.

In practice, the opposite ends of the shaft 52 of the secondary auger 42 is provided with journals, not designated, which extend through the walls 22 and 24. As a practical matter, the rear journal of the secondary auger 42 supportingly is received within a journal bearing 62 fixed to the wall 22, while the front journal is received within a front journal bearing 64 fixed to the front wall 24. The journal 64 are of any suitable design and 62 and 24, are mounted on the walls 22 and 24, respectively, through any suitable structure including studs, bolts, welds and the like.

As a reversed progression of the material is achieved within the mixing tank, a uniform mixing thereof is accomplished, primarily through the stirring effects of a rotary agitator, a first form thereof being designated 65 in FIGS. 4, 5 and 6, and a second form thereof being designated 65' in FIGS. 10, 11 and 12. As will hereinafter become more readily apparent, each of the agitators 65 and 65' is provided with a relief mechanism which acts to overcome "clogging" effects imposed on the mixer 10 through an agitator retardation or, otherwise stated, the encountered obstructions such as "balled" hay and the like.

FIRST FORM OF AGITATOR

Each of the journals 46 and 48, of the primary auger 40, is supported by a bearing race 66 operatively seated in a suitable bearing housing 68, FIGS. 8 and 9. Each of the bearing housings 68 is of similar construction and is coupled to one of the end walls 22 and 24 through a bearing mount generally designated 70. As best illustrated in FIG. 7, each of the bearing mounts 70 includes a front plate 72 which receives thereon the bearing housings 68, a spacer or shuttle plate 74, disposed in a contiguous face-to-face relationship with the front plate 72, and a rear plate 76. Each of the bearing housings 68 is provided with an internal bearing cup 78 and receives therewithin one of the bearing races 66 in a manner such that each mount 70 is provided with an axial bore 80 for receiving one of the journals 46 and 48.

As a practical matter, each of the housings 68 further includes an annular mounting flange 82 having a plurality of openings 84 extended therethrough. These openings are adapted to be brought into coaxial alignment with coaxially related openings 86 provided in plates 72, 74 and 76. These openings serve to accommodate a coupling of the bearing housings 68 with the plates of the bearing mounting 70. Additionally, in order to assist in coupling the bearing housings 68 with the mounts 70, an annular sleeve 88 is provided for each of the bearing housings 68. This sleeve is received by each of the plates 72, 74 and 76, in openings 90 appropriately formed therein. Where desired, each bearing housing 68 is coupled with its associated mount 70 through a plurality of screws 92 and nuts 94, however, the specific manner in which the housings 68 are coupled with the mounts 70 is deemed a matter of convenience. Additionally, the sleeve 88 also serves to supportingly receive an end portion of the shaft 44.

It is important to note that the mounts 70 are coupled with the end walls 22 and 24 of the shell 20 in a similar manner. Therefore, a detailed description of the manner in which one of the mounts 70 is associated with the end wall 22 is deemed adequate to provide a complete understanding of the herein disclosed embodiment of the present invention.

As illustrated in FIG. 7, the rear plate 76 slidingly is engaged by a closure plate 96 secured to the wall 22 by means including skip welds 98, FIG. 2, and is disposed within an upper portion of an elongated, vertically extended slot 104 formed within the wall. While the skip welds 98 can directly attach the plate 96 to the end walls 22 and 24 it has been found practical, for purposes of assembly, to weld the plate to parallel strips 106 which then are bolted to the associated end wall of the shell 20 in a manner such that the strips 106 act as mounting brackets for the plate 96.

As illustrated, the tank **14** of the mixer **10** is mounted on a trailer **12** and is connected with the P.T.O. **16** of an associated tractor, coupled therewith, through a trailer hitch **15**. Of course, other types of vehicles can be employed in supporting the tank.

Fluid materials, including feed constituents to be mixed within the mixer **10**, are delivered through the opening **26** by any suitable means, including blowers, discharge chutes, or front loaders. Once the materials are deposited in appropriate proportions, within the mixing tank **14**, the P.T.O. **16** is activated for driving the drive shaft **18**. As the drive shaft **18** is driven, the gear box **17** serves to impart a driving rotation, through the sprocket **118** and the drive chain **120** to the sprocket **122** coupled to the shaft **52** of the secondary auger **42**.

At the rear wall **22** of the mixing tank **14**, the shaft **52** serves to impart a simultaneous, but opposed, rotation to the shaft **44** of the primary auger **40**, through the sprocket **128**, the drive chain **130** and sprocket **132**. As the primary auger **40** and the secondary auger **42**, respectively, are driven in rotation, the helical rib **50** of the primary auger, and the helical rib **56** of the secondary auger serve to impart a counter flow to the fluid material confined within the mixing tank **14**. Hence, the material is advanced in a first direction extending from the front wall **24** toward the rear wall **22**, by the primary auger **40**, and from the rear wall **22** toward the front wall **24** by the secondary auger **42**. While a significant mixing of the materials results as a consequence of the effects of the augers **40** and **42**, the major portion of the mixing of the materials results from a tumbling action imparted to the material by the agitator **65**.

Concurrently, with the thus established counter flow, the slats **114** of the agitator **110** are advanced along a path describing a cylinder about the longitudinal axis of the shaft **44**. In practice, the slats **114** are advanced upwardly as they approach the trough **60** housing the secondary auger **42**. This direction of advancement enhances delivery to the secondary auger, as well as achieving a thorough and complete mixing of the materials. In view of the fact that the rotating segments **111** are angularly related a complete mixing is achieved through a phased tumbling action imparted to the material by the segmented agitator **65**.

As the fluid material is advanced toward the wall **24**, by the rib **56**, the helical rib **58** serves to advance the fluid material from points adjacent to the front wall **24** toward the wall **22**. Should the discharge opening **30** remain closed, by the positioning of the door **32**, the material contained within the tank **14** continuously is recirculated for assuring a complete mixing thereof. However, as the tank **14** is caused to approach selected troughs of feed pens, the door **32** slidingly is advanced along its tracks **34** in a direction such as to uncover and thus open the opening **30**. While, as illustrated, this sliding advancement of the door **32** is achievable through an energization of the actuator **36**, it should readily be apparent that such advancement can be achieved through any suitable structure, including a hand-operated rack and pinion, not shown.

As the door **32** is displaced in a direction such that the discharge opening **30** is opened, the material contained within the mixing tank **14** is discharged from the opening, as a consequence of the effect of the ribs **56** and **58** of the secondary auger **42** acting in mutual opposition. This material then is directed by the discharge chute **38** into the adjacent troughs.

In the event an obstruction is encountered as the slats **114** are advanced, an elevation of the auger **40** is accommodated as the bearing mounts **70** are elevated along the slots **104**. Due to the capability of the primary auger **40** to undergo elevation, or vertical displacement, the retarding effects of obstructions encountered as a result of "balling" or compacting of the fluid materials being mixed, readily are avoided. Consequently, the mixer **10** is adapted to be operated continuously until all of the flowable or fluid contents thereof are discharged, without necessitating a clearing of "balled" or compacted materials from the mixer.

Referring now to the operation of the form of the agitator designated **65'** and illustrated in FIGS. **10** through **13**, it will be appreciated that as the mixing tank **14'** is filled with materials to be mixed and transported to feeder pens, in the manner aforedescribed with respect to the operation of the mixing tank **14**, the agitator **65'** is advanced in rotation as the auger **40'** is driven by the sprocket **204**. The sprocket **204**, in turn, is advanced as the drive chain **130'** is driven through its drive train. A bath of lubricating oil **212** is provided for purposes of lubricating the chain and sprocket as they are drivingly advanced therethrough.

Due to the material-advancing effect of the rib **220**, material contained within the shell **20'** is retained therewithin, against the material-advancing effects of the auger **40'** since the rib **220** acts in opposition to the rib **50'**.

Due to the fact that the bearings **200** and **202** act to support the journals **46'** and **48'**, against radial displacement, the agitator **65'** also is secured against radial displacement. However, in the event an obstruction to rotation is developed at a point adjacent the internal surfaces of the shell **20'**, each of the slats **114'**, as it encounters the obstruction, is moved inwardly as the pivot arms **226** pivot about the associated pivot pins **228**. Thus an avoidance of any obstructions encountered by the slats **114'** readily is achievable as a consequence of the pivotal displacement.

In view of the foregoing, it should readily be apparent that the mixer **10** which embodies the principles of the present invention is provided with an agitator including a relief mechanism which permits the agitator **65** and **65'** to overcome encountered obstructions for avoiding clogging and the like, whereby the mixer **10** is caused to serve as a practical and economic mixer for facilitating a rapid, economic and practical mixing of livestock feed of a wide range of textures, whereby the efficiency of livestock feeding operations is enhanced. Of course, it can readily be appreciated that while the instant invention has particular utility in simultaneously mixing and distributing livestock feed, it also can be employed in mixing other materials which have a tendency to develop compacted obstructions within a mixing tank.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the illustrative details disclosed.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A mixer for fluent materials comprising:

A. an elongated shell of a substantially cylindrical configuration having a first and a second end wall defining within said shell an elongated mixing tank;

B. means defining within said shell an access opening through which materials are delivered to said tank;

C. support means supporting said tank in a substantially horizontal disposition;

D. selectively operable mixing means disposed within said tank for conveying material in mutually opposed, axial directions including,

1. a first auger comprising a shaft having a helical rib circumscribing a selected portion thereof and supported to be driven in rotation about its longitudinal axis of symmetry for advancing the materials toward a first end wall of said tank,

2. a second elongated auger, including a shaft having a helical rib circumscribing a selected portion thereof disposed in parallelism with said first auger and supported to be driven in rotation about its longitudinal axis of symmetry for advancing said materials toward the second end wall of said tank, and

3. drive means operatively coupled with the shaft of each of said augers for driving the shafts in simultaneous rotation;

E. an agitator operatively associated with said augers for continuously agitating the materials as they are advanced

within said tank, including a plurality of elongated arms radially extended from the shaft of the first auger and terminating in a plurality of mutually parallel slats defining a paddle wheel concentric with said first auger, whereby the paddle wheel is caused to describe a cylinder concentric to the first auger as rotation is imparted thereto; and

F. material discharge means for discharging from said tank materials delivered thereto and mixed therewithin.

2. The mixer of claim 1 further comprising support means supporting one of said augers for radial displacement relative to the horizontal axis of symmetry of said shell.

3. The mixer of claim 1 wherein said first elongated auger is supported by support means comprising:

A. means defining a journal at each of the opposite ends of said shaft;

B. a pair of journal bearings, each bearing of said pair operatively receiving therewithin one of said journals in a manner such as to accommodate radial displacement of said shaft; and

C. mounting means coupling said bearings to said end walls.

4. The mixer of claim 3 wherein said mounting means includes:

A. means defining within one of said end walls a vertically extended slot;

B. a shuttle plate seated within said slot and operatively supported for vertical reciprocation therewithin; and

C. means operatively coupling one journal bearing of said pair of journal bearings to said shuttle plate.

5. The mixer of claim 1 wherein said discharge means includes:

A. means defining an opening disposed adjacent to said second end wall of said tank;

B. a displaceable cover plate operatively associated with said opening;

C. a discharge chute disposed externally of said shell in coaxial relationship with said opening for receiving fluid material discharged through said opening;

D. an elongated auger trough receiving therewithin said second auger and communicating with said opening; and

E. a terminal helical rib circumscribing a portion of the shaft of said second auger, axially spaced from said selected portion, extending between said second end wall of said tank and said opening adapted to advance fluid material toward said opening as the auger is driven by said drive means.

6. The mixer of claim 5 wherein said means defining an access opening is extended in a horizontally disposed plane intersecting said shell near its uppermost portion, the internal bottom surface of said shell is of a cylindrical configuration concentrically related to said first auger, said support means supporting said tank in a substantially horizontal disposition includes a wheel-supported trailer, and said drive means includes a gear box adapted to be coupled with a power take-off unit, whereby fluid materials can be delivered to said tank, a mixing thereof achieved, and a discharge thereof accommodated as said mixer is transported by the wheeled vehicle.

7. A mixer for flowable materials comprising:

A. an elongated shell of a substantially cylindrical configuration having a pair of transverse end walls and an arcuate bottom wall defining therewithin an open-top mixing tank;

B. a mobile structure supporting said tank;

C. selectively operable mixing means including a pair of parallel augers operatively disposed within said tank and adapted to be driven in predetermined directions of rotation for simultaneously advancing said flowable materials toward opposite ends of the tank for achieving a mixing thereof;

D. an agitator, including a plurality of arms, radially extended from one of said augers, terminating in a plurality of mutually spaced, parallel slats extended in parallelism with said augers and adapted to be advanced in rotation about the axis of symmetry of one of said pair of augers as rotation is imparted thereto; and

E. means mounting said one of said augers for radial displacement relative to the arcuate wall whereby said agitator is adapted to be displaced in radial directions.

8. The mixer of claim 7 wherein the means mounting one of said augers includes:

A. means defining within said end walls a pair of vertically extended slots radially projected from said one of said augers;

B. a pair of shuttle plates each seated for reciprocation within each of said slots;

C. journal bearings supportingly coupled with said one of said augers near the opposite ends thereof; and

D. bearing mounting means coupling said journal bearings with said shuttle plates whereby said one of said augers is afforded displacement in radial directions.

9. In a mixer for mixing fluent materials, the combination comprising:

A. container means for containing materials to be mixed;

B. an agitator within said container means including an elongated shaft,

C. bearing means supporting said shaft at its opposite ends for rotation about its longitudinal axis of symmetry; and

D. bearing support means supporting said bearings for reciprocating displacement in substantially radial directions relative to said shaft.

10. The combination of claim 9 wherein said axis is extended in a substantially horizontal plane.

11. The combination of claim 10 further comprising:

a plurality of arms radially extended from said shaft, and a plurality of slats affixed to the distal ends of said arms disposed in substantial parallelism with said axis of symmetry.

12. In a mixer for mixing fluent materials, the combination comprising:

A. a container for materials to be mixed;

B. an agitator within said container including an elongated shaft;

C. bearing means supporting said shaft at its opposite ends for rotation about its longitudinal axis of symmetry; and

D. a plurality of longitudinally spaced, angularly related arms radially extended from said shaft, and a plurality of slats pivotally coupled with the distal ends of said arms and disposed in substantial parallelism with said axis of symmetry, whereby the slats are afforded displacement in substantially radial directions relative to said shaft.

13. The mixer of claim 12 further comprising a separator bulkhead defining a sprocket housing adjacent to one end of said container means.

14. The mixer of claim 13 further comprising a chain-driven sprocket affixed to one end of said shaft and seated in an oil bath confined within said sprocket housing, whereby the sprocket continuously is lubricated by said bath.

15. The mixer of claim 14 wherein said separator bulkhead further comprises means defining therewithin a sealed opening through which the elongated shaft is extended to isolate the fluid materials contained within said container means and the oil of said oil bath.

16. The mixer of claim 15 wherein said opening is sealed by a special purpose seal including a tubular sleeve fixed to said separator bulkhead and a helical rib circumscribing said shaft and seated for rotation within said sleeve adapted to function as an auger for continuously displacing from said sleeve fluid material contained within said container means.

17. The mixer of claim 16 further comprises a helical rib extending along said shaft toward said bulkhead and from the opposite end of the container.

18. A mixer for fluid materials comprising:

A. an elongated shell of a substantially cylindrical configuration having a first and a second end wall defining within said shell an elongated mixing tank;

B. means defining within said shell an access opening through which fluid materials are delivered to said tank;

C. support means supporting said tank in a substantially horizontal disposition;

D. operable mixing means disposed within said tank adapted to convey fluid materials in mutually opposed, axial directions, including an agitator comprising,

i. an elongated shaft having a journal disposed at each of its opposite ends,

ii. a journal bearing rigidly fixed to each end wall of said shell and receiving therein one of said journals,

iii. a helical rib extending along said shaft defining an auger disposed within said shell,

iv. a plurality of arms radially extended from said shaft,

v. a plurality of slats, each slat being pivotally supported by a pair of said arms and adapted to be advanced along a prescribed path circumscribing the shaft as it is driven in rotation about its longitudinal axis, and further adapted to be displaced from said path in response to obstructions encountered thereby, and

vi. a driven sprocket affixed to said shaft adjacent to one of said journals adapted to be driven in rotation for thus imparting rotation to said shaft; and

E. material discharge means adapted to discharge fluid materials from said tank.

* * * * *

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CERTIFICATE OF CORRECTION

Patent No. 3,672,640 Dated June 27, 1972

Inventor(s) Harvey L. Crose

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Columns 5, 6, 7 and 8 have been omited from the Patent. Insert the following in the grant (only):

---The lowermost end surface of the plate 96 normally is spaced from the uppermost end surface of the shuttle plate 74. Consequently, the shuttle plate 74 serves operatively to guide the mount 70 in repositioning of the shaft 44, relative to the axis of symmetry of the tank 14 as an elevating and lowering displacement of the mount 70, relative to the slot 104, is achieved.

A pair of sets of right angle brackets 108, Fig. 5, are provided within the shell 20 and are mounted along opposite edges of the slots 104. The brackets 108, in conjunction with the internal surface of end walls, with which they are associated, serve to guide the plate 76 as axial reciprocation is imparted thereto. Therefore, it is to be understood that the mounts 70 are supported for reciprocation, by the plate 72, within the slots 104, and that a slot 104 is formed in both the rear wall 22 and the front wall 24. Consequently, reciprocation of the auger 40, in radial directions, is accommodated at both ends thereof. The purpose of the structure employed in mounting the bearing mounts 70 is to afford the mixer with a relief mechanism which accommodates an avoidance of obstructions operatively encountered by the supported agitator 65, by permitting the auger 40 to rise and fall within the shell 20.

The agitator 65, in effect, is configured to conform to a segmented paddle wheel fixedly mounted on the auger 40. As illustrated, the agitator is defined by a pair of coaxially

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aligned, angularly related planar segments 111. The segments 111 preferably are angularly related at 90°. Each of the segments 111 includes pairs of coplanar arms 112 radially extended from and rigidly fixed to the shaft 44. Each pair of the arms 112 terminates in a slat 114 fixed thereto. As a practical matter, the arms 112 are of a length such that the slats 114 are in parallelism and are, in operation, caused to be displaced along an arcuate path adjacent to the surfaces of the shell 20, particularly the surface of the bottom wall 21, as the agitator 40 is driven in rotation. Of course, as many segments 111 as is desired can be employed and the established angular relationship can be varied for achieving an adequate mixing of the contents of the tank 14. In any event, it is to be understood that as the auger 40 is driven in rotation, the slats 114 are caused to advance along a cylindrically configured path, which is disposed in close proximity to the internal surface of the shell 20. Thus a continuous agitation and resulting mixing of all material contained within the tank are achieved.

Should the slats 114, as they are advanced, encounter an obstruction, the shaft 44 of the primary auger 40 rises in radial displacement as the mounts 70 are elevated through the slots 104, for thus permitting the slats 114 to pass over the encountered obstructions. Since the auger is permitted to rise the encountered obstructions are bypassed and an overloading of the auger 40 thus is precluded.

The capability of the auger 40 to undergo radial displacement is of particular significance where the mixer 10 is employed in delivering unchopped hay. As is well recognized, long strands of hay have a tendency to "ball" and obstruct rotating feed mechanisms. However, due to the fact that the auger 40, with its associated agitator 65, is adapted to be displaced

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relative to the bottom wall 21, any tendency to obstruct rotation of the auger 40, by clogged materials, effectively is precluded. Furthermore, while a radial displacement of the primary auger 40 functions quite satisfactorily for achieving the desired results, it is deemed desirable to mount the journals 46 and 48 within the bearing mounts 70 at the walls 22 and 24 of the mixing tank 14 in a manner such as to accommodate a pivotal displacement of the auger 40.

As is best illustrated in Fig. 3, the gear box 17 fixedly is mounted to the front wall 24 through any suitable means, including suitable welds and stud bolts, not designated. Preferably, the gear box 17 includes a housing, not designated, provided with an output shaft 116 having mounted thereon a sprocket 118 for receiving thereabout a continuous drive chain 120. The drive chain 120 serves to couple to the sprocket 118 with a larger sprocket 122. The sprocket 122, in turn, is mounted on an extended portion 124 of the shaft 52 of the secondary auger 42. The portion 124 is extended through the associated bearing 68 and terminates exteriorly of thewall 24. Thus the shaft 52 is coupled with the gear box 17 and is driven in rotation in response to a driving energization of the gear box.

The shaft 52 also includes a portion 126 which is extended through an associated bearing housing 68 and receives thereon a sprocket 128. About this sprocket there is trained a continuous drive chain 130. The drive chain 130 serves to couple the shaft 52 with the shaft 44 of the primary auger 40, through a sprocket 132 mounted on an extension of the shaft 44. Preferably, an idler sprocket 134 is mounted on a stub-shaft, not designated, and serves to support the chain 130 adjacent to the sprocket 128. The various sprockets 118, 122, 128, 132 and 134 are coupled to their respective shafts through any suitable

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means, including pins, key-ways and plain bearings, not designated. Since the specific manner in which the various sprockets are coupled with their associated shafts can be varied, and is well within the skill of the art, a description thereof is omitted. As a practical matter, the sprocket 128 is so related to the direction of travel of the chain 130 as to impart reversed direction of rotation to the augers 40 and 42 for selectively advancing the materials within the shell 20.

It is important to note that since the shaft 44 of the auger 40 is permitted to undergo vertical displacement, relative to the rear wall 22, the effective length of the chain 130 operatively is varied. In order to accommodate such variations in the effective length of the chain 130, a pivoted arm 136 is coupled to the wall 122 at a pivot pin 138. At its distal end the arm 136 is provided with an idler sprocket 140 having teeth mated with the chain 130. The arm 136 continuously is urged in pivotal displacement by a tension spring 142 suitably coupled therewith. Consequently, the arm 136 is afforded pivotal displacement about the pivot pin 138 in a manner such as to maintain suitable, constant tension within the drive chain 130.

Second Form Of Agitator

While the first form of the agitator designated 65, as hereinbefore described, functions quite satisfactorily for its intended purposes, it may be found desirable to employ a second form of the agitator, herein designated 65' and illustrated in Figs. 10 through 13. A use of the second form of the agitator normally occurs where operational requirements are such as to suggest use of a mixing tank having a capacity somewhat greater than that of the mixing tank with which the first form of the agitator 65 is found to be practical.

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It is, however, to be understood that the purposes served, the basic structure employed, and the function of the second form of the agitator is quite similar to that of its first form, although the structure which facilitates avoidance of developed obstructions varies significantly. Accordingly, for purposes of providing a description of the second form of the agitator, structure common to both forms of the agitators is, with reference to Figs. 10 through 13, designated employing primed reference numerals. Since the structure common to both forms of the agitators hereinbefore has been described in detail, a brief reference to such structure is deemed sufficient for providing a complete understanding of the invention.

As best illustrated in Figs. 10 and 11, the agitator 65' also is configured to conform to a segmented paddle wheel having coaxially aligned and angularly related segments 111' concentrically supported about a primary auger 40'. The primary auger 40', similar to the auger 40 as hereinbefore discussed, is disposed in a mixing tank 14' and includes a helical rib 50' which serves to transport fluid materials between the opposite transverse bulkheads or end walls 22' and 24', as is provided for the mixing tank 14'.

Each of the segments 111' also includes a plurality of substantially coplanar, radially extended arms 112', which terminate in parallel slats 114' adapted to be displaced along a path adjacent to the internal surface of the shell 20' so that the slats are caused to advance along a cylindrically configured path in close proximity to the internal surface of the shell 20' for thereby achieving a complete and thorough mixing of fluid materials, not shown, deposited within the tank 14'.

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Due to the fact that the auger 40', which supports the second form of the agitator 65', is somewhat longer than the auger 40 which supports the agitator 65, the combined weight of the auger 40' and its associated agitator 65' is somewhat greater than the combined weight of the auger 40 and its associated agitator 65. Consequently, it is desirable to support the auger 40' in a manner such that radial displacement of the agitator 65', relative to its axis of rotation, is impeded.

To accommodate such a mounting, a front journal 48' is provided for a shaft 44', which supports the auger 40' and the agitator 65' in a manner similar to that which the auger 40 is supported. However, the journal 48' is seated within a front journal bearing 200, adequately sealed against penetration of the materials being mixed, welded or otherwise suitably secured to the transverse bulkhead or front wall 24' of the mixing tank 14'.

Similarly, the auger 40' is provided with a rear journal 46' received within a suitable bearing 202 rigidly fixed to the internal surface of the transverse bulkhead or rear wall 22'. As a practical matter, the bearings 200 and 202 are of similar construction and are so mounted on the internal surfaces of the walls 22' and 24' as to serve to support the primary auger 40' against radial displacement. While the bearings 200 and 202 are of any suitable configuration, a bearing race and retainer, such as the bearing race 66 and retainer 68 hereinbefore described, can be employed for purposes of supporting the opposite ends of the primary auger 40' and the associated agitator 65'. In any event, it is to be understood that the agitator 65' is mounted in a manner such that radial displacement thereof effectively is precluded.

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A driving rotation of the agitator 65' is achieved through a sprocket 204 coupled to the shaft 44'. The sprocket is supported by a suitable mounting collar 206, Fig. 13, bolted or otherwise secured to the shaft 44'. As a practical matter, the sprocket 204 is displaced from the shell 20' through the use of a separator bulkhead 208 arranged in parallelism with the transverse bulkhead or rear wall 22'.

As best illustrated in Fig. 10, the bulkhead 208 is spaced from the end wall 22' a distance sufficient to define within the mixing tank 14' a sprocket housing, generally designated 210. The sprocket housing 210, in practice, is a substantially sealed housing which is provided with a body of oil 212 within which the sprocket 204 partially is emersed for purposes of lubrication.

About the sprocket 204 there is trained a drive chain 130' which functions in a manner quite similar to the drive chain 130. This chain serves to impart rotation to the shaft 44' of the auger 40' in order to effect rotation of the agitator 65'. The chain 130' is driven through a drive train including an input sprocket, not shown but of a construction similar to the sprocket 134 hereinbefore described. Since the drive train employed in driving the sprocket 204 is quite similar to that hereinbefore described with respect to the agitator 65, a duplicate description is omitted in the interest of brevity.

In order to avoid introducing into the sprocket housing 210 fluid materials being mixed within the shell 20', the separator bulkhead 208 is provided with a special-purpose seal 214, Fig 13, through which is extended the shaft 44' of the auger 40'.

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The seal 214 includes a sleeve 216 rigidly mounted on the separator bulkhead 208, by any suitable means including a collar 218 bolted to the bulkhead. The sleeve 216 is so dimensioned as to be provided with a diameter slightly greater than the diameter of the shaft 44' for purposes of receiving therewithin a helical rib 220. This rib circumscribes the adjacent concentric portion of the shaft 44' and is in constant engagement with the internal surfaces of the sleeve. The rib 220 is of a pitch such as to continuously force foreign matter from the sleeve, in a direction away from the sprocket housing 210, as the auger 40' is driven in operative rotation. As a practical matter, an annular felt pad or wiper ring 222 concentrically is related to the shaft 44' and is suitably seated within the sleeve 216 to impede seepage of oil through the sleeve as the sprocket 204 is driven through the oil bath 212. Hence, it can be appreciated that, due to the effects of the helical rib 220, passage of fluid materials contained within the tank 14' to the sprocket housing 210 is impeded, while passage of oil from the sprocket housing 210 to the shell 20' is, through the wiping effects of the wiper ring 222, impeded.

In view of the fact that the bearings 200 and 202 preclude radial displacement of the agitator 65', each of the slats 114' is coupled with its associated radially extended arms 112' through pivot couplings 224, Fig. 12. These couplings serve to couple each of the slats 114' to the distal ends of its associated radially extended pair of arms 112' in a manner such that the slats are afforded substantially radial displacement away from the internal surfaces of the shell 20'. Hence, the coupling 224, in effect, serves as a relief mechanism which is intended to overcome the effects of obstructions encountered by the slats 114' during operation of the agitator 65'.

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In practice, each of the pivot couplings 224 includes a pivot arm 226 welded or otherwise secured at its distal end to an associated slat 114'. The arms 226, in turn, are pinned to the distal ends of an associated radially extended pair of arms 112', employing pivot pins 228, in a manner which permits the slats 114' to be pivotally advanced relative thereto. As a practical matter, the operative length of the pivot arms 226 is such as to accommodate a pivotal displacement of the slats 114' about only the leading edge portions of the distal ends of the arms 112'.

In practice, the slats 114' are formed from right angle extrusions and, consequently, include angularly related planar surfaces having edge surfaces employable as stops for limiting the extent of pivotal displacement of the slats 114' about the distal ends of the arms 112'. In operation, the surfaces of the extrusions forming the slats 114' are acted against with certain force components being inwardly directed in a manner such that the slats 114' are caused to vary their positions, with respect to the radial planes of the agitator 65', as obstructions which tend to impede rotation are encountered. Hence, it can be appreciated that a responsive inward pivotal displacement of the slats 114' is achievable for thereby accommodating a passage of the slats 114' over encountered obstructions of a practical dimension. Of course, it is important to understand that the extent to which the slats 114' are afforded inward displacement serves to determine the dimension of obstructions or "balls" of hay and the like which can be passed over by the slats as the agitator 65' is driven in rotation.

In view of the foregoing, it should readily be apparent that the agitator 65' can be employed in a manner quite similar

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to that in which the agitator 65 is employed, and is particularly suited for use wherein larger payloads operatively are required.

It is to be further understood that the tank 14' is, in operation, mounted on a suitable transporting structure, and is employed in a manner and for a purpose similar to that in which the tank 14' is employed.

OPERATION

It is believed that in view of the foregoing description, of the mixer, the operation of the mixer will readily be understood and it will at this point be briefly reviewed.

Referring first to the operation of the form of the agitator, designated 65, and described in connection with the mixer illustrated in Figs. 1 through 9, the mixing tank 14 is transported to a storage bin for receiving therein materials to be mixed. Where employed in mixing feed for livestock, the feed components are deposited within the tank and mixed through an actuation of the agitator 65 as the mixing tank is transported to the feeder pens.---

Signed and sealed this 26th day of December 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents