March 4, 1958 J. J. BYBERG 2,825,511

FEED MIXER AND GRINDER

Filed May 26, 1953 3 Sheets-Sheet 1

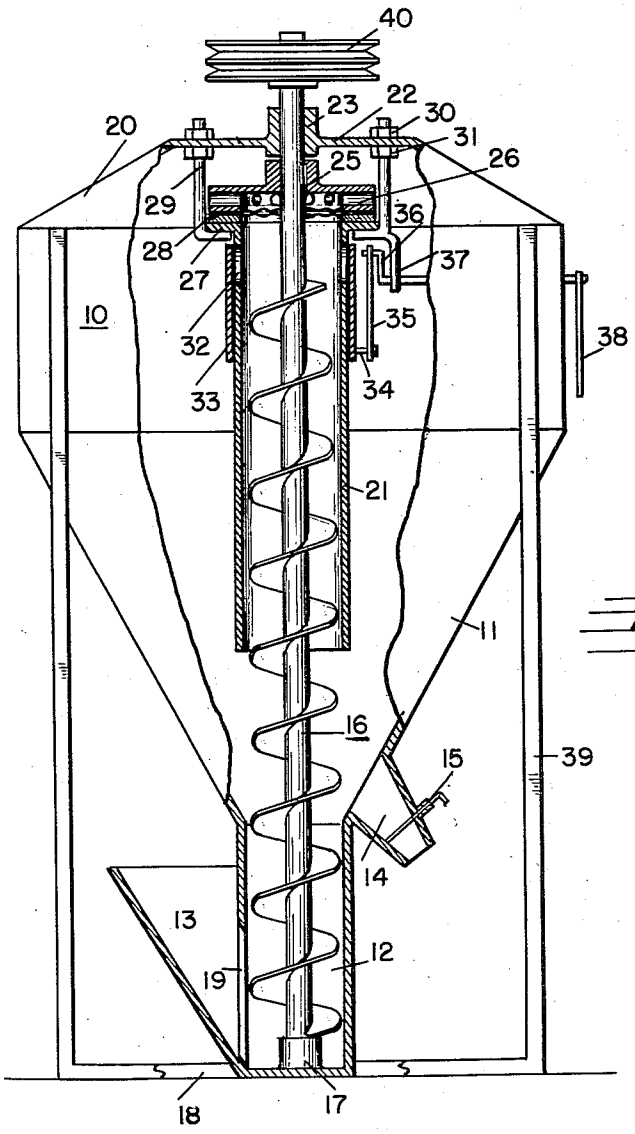


Fig 1

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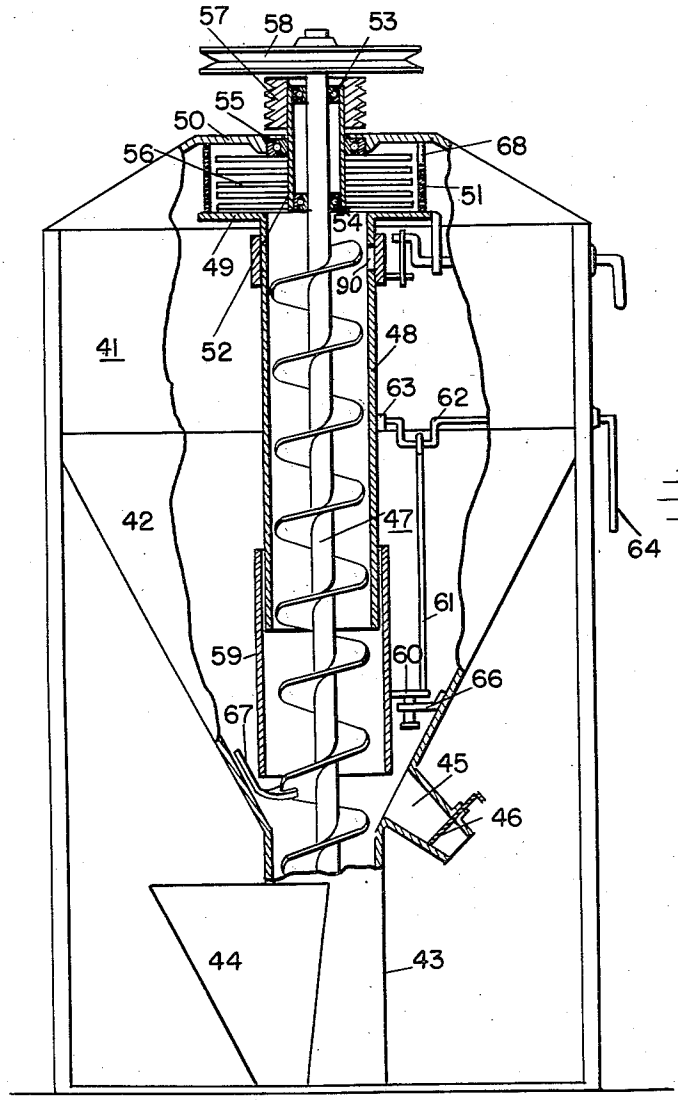


Fig 2

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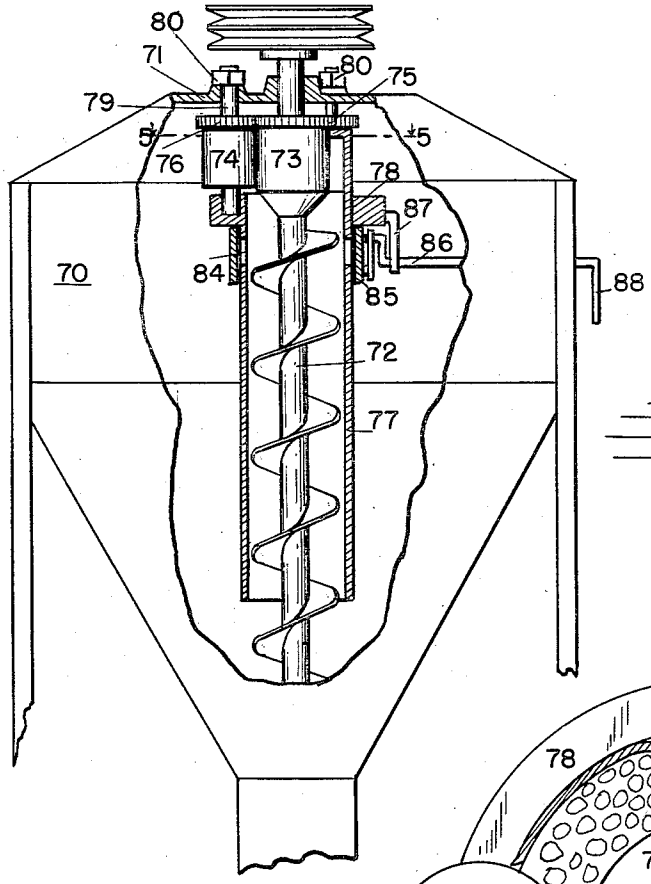
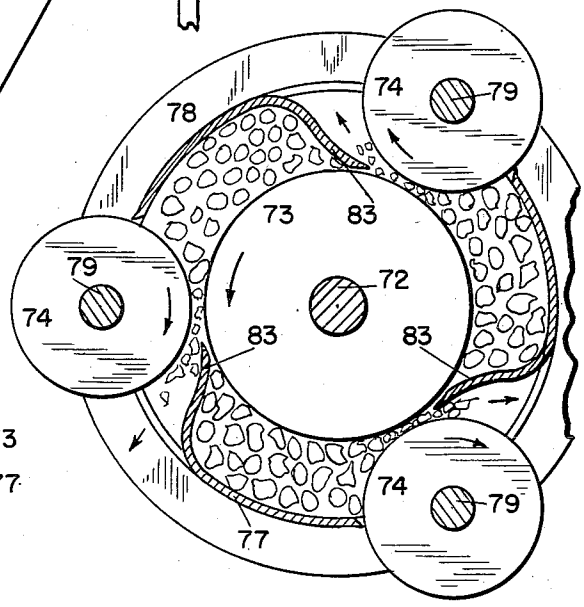


Fig 3

Fig 5



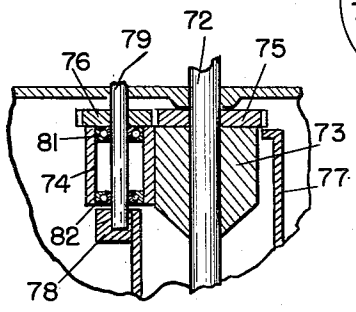


Fig 4

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2,825,511

FEED MIXER AND GRINDER

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Application May 26, 1953, Serial No. 357,540

4 Claims. (Cl. 241—97)

This application is a continuation-in-part of my pending application Serial No. 227,862 filed under date of May 23, 1951, and subsequently issued under date of June 9, 1953, as Patent No. 2,641,412 and bearing a similar title; and the invention described in the present application, like that in my said patent, also relates to the mixing and grinding of feed for farm animals.

Heretofore it has been customary practice to grind the feed or whole grain first before the feed or grain is mixed, such grinding being done by separate operation through the medium of conventional grinders, as for instance a burr mill or a hammer mill, or grinders of any of the various well known types. After such necessary grinding the mixing is done in a feed mixer. The type of feed mixer which has been used most extensively for many years in the past comprises a mixing tank, preferably having conically shaped bottom, and a rotating auger extending up from the bottom through the center of the tank to the top, which auger, by lifting the material to be mixed from the bottom of the tank and discharging it at or near the top of the tank, produces a circulating and mixing of the material in the tank with a repetition of this cycle.

An object of the present invention is to provide an improved device in which both the grinding and mixing of the grain or feed will be accomplished and in this way reduce the time, expense and labor of having the grinding and mixing performed separately and successively as heretofore.

A related object of the invention is to provide an improved feed grinder and mixer which will perform the grinding and mixing automatically when the material to be ground and mixed is delivered to the machine and the machine placed in operation, thereby requiring only a minimum of supervision and care in the grinding and mixing.

A further object of the invention is to provide a combination grinder and mixer which will be simple and practical in construction and moderate in cost, and which can be set up and employed wherever conventional feed mixers have previously been used.

My invention may be carried out with the employment of either the burr mill or hammer mill type of grinder or with the rolling mill type of grinding or treating means, as desired, and accordingly in the following specification, with reference to the accompanying drawings, I describe the use of each of these types of grinders in my combined grinder and mixer.

In the accompanying drawings:

Fig. 1 is a sectional elevation of my feed grinder and mixer equipped with a pair of grinding rings or grinding mill of the familiar burr mill type;

Fig. 2 is a corresponding sectional elevation of a slightly modified form of my feed grinder and mixer in which a hammer mill type of grinder is substituted in place of the burr grinding mill of Fig. 1;

Fig. 3 is a sectional elevation of a further modification of my grinder and mixer with crushing rolls for the grain employed as the grain grinding mill;

Fig. 4 is a fragmentary enlarged sectional elevation of the grinding mill shown in Fig. 3, the section being taken on the axis of the auger shaft; and

Fig. 5 is an enlarged plan section taken on line 5—5 of Fig. 3.

Referring first to Fig. 1, the tank in which the grinding and mixing of the feed takes place is indicated in general by the reference character 10. This tank has the customary conical bottom portion 11 terminating in a lower bottom cylindrical portion 12 of reduced diameter. A hopper 13 adjoins the bottom cylindrical portion 12 and is connected with the channel in the portion 12 by the intake opening 19. The tank has the customary discharge outlet 14 which is controlled by a shutter slide 15, or other suitable control. The tank is supported on a framework which includes legs 39 and a base 18, the rest of the framework being omitted from the drawings for the sake of clarity.

An auger, designated in its entirety by the reference character 16, extends upwardly through the center of the tank. The auger shaft is mounted in a bearing 17 at the extreme bottom of the tank and the auger extends up through the top portion 20 of the tank and through a suitable bearing 23 carried by the top plate 22. A belt pulley 40, secured to the top of the auger shaft above the tank, is connected by a suitable driving belt (not shown) to an electric motor or other source of power as usual.

A stationary tubular housing or conveyor tube 21 surrounds the major upper portion of the auger. This conveyor tube 21 terminates at the top in an annular flange 27, which flange is secured to a plurality of bracket hangers 29 by which the conveyor tube is held supported in place. The top ends of these bracket hangers 29 are threaded and extend through the top plate 22 and the hangers are adjustably secured to the plate by means of nuts 30 and 31.

A grinding ring 28, of the burr mill type, having a top grinding surface, is secured on the flange 27. A spider 25 is keyed on the auger shaft and supports a cooperating grinding ring 26. Thus, as the material from the tank is moved upwardly through the conveyor tube 21 by the rotation of the auger, the material, upon reaching the top of the conveyor tube, passes between the stationary ring 28 and the rotating ring 26 and is subjected to the grinding or burr mill action of the rings before being discharged back into the tank and on top of the other material in the tank. Adjustment of the spacing between the opposed grinding surfaces of the rings 28 and 26 can be accomplished by adjusting the nuts 30 and 31 causing the top flange 27, and with it the stationary ring 28, to be raised or lowered.

Should the material in the tank be moved upwardly through the conveyor tube 21 by the auger more rapidly than it can pass outwardly between the grinding surfaces of the rings 28 and 26 the excess material will be thrust through the spider 25 and discharged back into the tank and its grinding accomplished in the course of a subsequent cycle. I have found it convenient to provide discharge openings or by-pass outlets 32 in the conveyor tube 21 below the top flange 27 in order to enable part or all of the material passing up through the conveyor tube to be discharged back into the tank without being subjected to the grinding action. In order to control the by-pass outlets 32 I provide a movable sleeve 33 adapted to close these by-pass outlets 32, either entirely or partially as desired. Adjustment of the control sleeve 33 up or down is accomplished by a crank 36, which is supported on a bracket 37 and the outer end of which extends through the tank wall and carries a handle

38. A link 35 connects the inner end of the crank with a pin 34 secured on the sleeve 33. Thus, by lowering the sleeve 33 until the by-pass outlets 32 are entirely open, the material passing up through the conveyor tube 21 will be discharged out into the tank without being subjected to grinding and under such conditions the device will function only as a feed mixer. On the other hand, partial or entire closing of the by-pass outlets 32 will result in some or all of the material passing up through the conveyor tube 21 being subjected to grinding action as desired.

In Fig. 2 the tank 41 is similar to the tank of Fig. 1, having a conical lower portion 42, a cylindrical bottom extension 43, a loading or feeding hopper 44, and a discharge outlet 45 controlled by a suitable shutter or similar means 46. The auger 47 extends up through the center of the tank and its major upper portion is enclosed by the conveyor tube 48. In this modification of my device as illustrated in Fig. 2, the conveyor tube 48 has a wider annular flange 49 at the top, and a cylindrical screen plate 51 has its top edge secured to the top plate 50 of the tank while the flange 49 of the conveyor tube 48 is secured to the bottom edge of the cylindrical screen plate 51. As a result a cylindrical screen chamber is provided above the top of the conveyor tube in the top of the tank.

A tubular shaft 52 is rotatably mounted on the upper portion of the auger shaft through the intermediary of the upper and lower bearing supports 53 and 54. A further bearing for the tubular shaft 52 and also for the auger shaft is provided at 55 in the top plate 50 of the tank. A plurality of hammer mill hammers 56 are attached to the shaft 52, and, upon rapid rotation of the tubular shaft 52, hammer mill grinding action takes place within the cylindrical chamber of the screen 51 so that the material delivered into this chamber from the conveyor tube 48 will be subjected to the desired grinding until it passes through the screen plate 51 and is discharged back into the tank. Preferably the cylindrical screen plate 51 has some enlarged over-flow outlets 68 at its top so as to allow excess material to be discharged into the tank, when the rate at which material is delivered from the top of the conveyor tube exceeds the rate at which such material can be ground sufficiently to be passed through the small openings in the screen plate 51.

A pulley 57 is secured on the tubular shaft 52 to enable the hammer mill to be operated at a desired rate of speed, which of course will be more rapid than the speed of rotation of the auger. The auger shaft in turn has a pulley 58 which is secured to the top end of the auger shaft. Both pulleys 57 and 58 are arranged so as to be belt driven from a motor or other source of power (not shown). By proper adjustment of the balance of speeds at which the respective pulleys 57 and 58 are driven, the material can be delivered into the hammer mill chamber from the conveyor tube 48 at the rate at which the ground material can be discharged, without overloading the hammer mill.

Controlled by-pass outlets can be provided in the conveyor tube 48 below the top flange, as indicated at 90 in Fig. 2, similar to the by-pass outlets 32 shown in Fig. 1 and thus enabling the mixing of the material in the tank to take place with or without further grinding as desired.

Instead of reducing the auger speed to limit the amount of material delivered from the conveyor tube to correspond to the amount which can be ground by the grinding means, and since reducing auger speed might be too slow for efficient operation at all times, for example when the device is to be used only for mixing or when the tank is being filled through the loading hopper 44, I show in Fig. 2 means for reducing the rate at which the material will be caused to be delivered through the conveyor tube without reducing the rate of rotation of the auger. An adjustable sleeve 59 is slidably mounted

on the lower end of the conveyor tube 48. A crank shaft 62, the inner end of which is rotatably suppported at 63 and the outer end of which extends through the tank wall and carries a handle 64, is connected by a link 61 to a bracket 60 on the sleeve 59. A stationary bracket 66, secured to the tank wall, carries a stop screw which limits the downward movement of the sleeve 59 so that when the bottom edge of the sleeve 59 is in maximum lowered position a passageway will always be provided between the bottom edge of the sleeve and the adjacent sloping wall of the lower portion of the tank, even though this is a restricted passageway for the material moving into contact with the auger. In this manner the amount of material moved upwardly by the auger will be limited to the amount which can be taken care of by the grinding means without reducing the auger speed. Then the raising of the sleeve 59 will increase the rate at which the material is moved by the auger without changing the auger speed. To prevent any clogging or plugging of the reduced passageway when the sleeve 59 is in low position, I attach a clearing finger 67 to the auger which keeps the passageway open at all times.

With certain types of feed it may be desirable to use grain which is ground or crushed by a rolling mill action in place of grain which is cut or chopped by the other types of grinding previously mentioned.

In the modified form of my device shown in Figs. 3, 4 and 5 I illustrate how my invention can be carried out with the employment of grinding rollers.

In Fig. 3 the tank 70, similar to the tank 10 of Fig. 1 and the tank 41 of Fig. 2, has the customary auger 72 and a stationary conveyor tube 77. A collar 78 is secured on the conveyor tube 77. Suspension shafts 79 have their bottom ends secured in the collar 78. The upper ends of these shafts extend through the top plate 71 of the tank and are held by nuts 80.

A central grinding roller 73 is secured on the auger shaft in the top of the tank and in the top of the conveyor tube. A plurality of equally-spaced cooperating grinding rollers 74 (thus three as shown in Fig. 5) are rotatably supported on the shafts 79 by upper and lower bearings 81 and 82 (see Fig. 4). A gear 75, secured on the auger shaft and secured to the central roller 73, meshes with gears 76 secured to the cooperating grinding rollers 74 respectively. Thus rotation of the auger shaft produces rotation of the central grinding roller and of the cooperating grinding rollers 74.

The wall of the conveyor tube 77 is cut away to accommodate the outer or cooperating grinding rollers 74 as shown in Fig. 5. Preferably a part of each cut wall portion of the conveyor tube is bent inwardly so as to form a lip or tongue 83 extending into close proximity to the central roller 73, as shown in Fig. 5, and sloping inwardly in a direction opposed to the direction of rotation of the central roller 73. These tongues 83 serve the dual purpose of removing any rolled grain that might have a tendency to adhere to the rollers and of directing the crushed or rolled grain outwardly for deposit in the tank.

In Fig. 3, as in Fig. 1, the conveyor tube is shown with controlled by-pass outlets located below the grinding means. Thus the outlets 84 of the conveyor tube 77 are controlled by the sleeve 85 operated by the crank 86 supported in the bracket 87 and having an operating handle 88.

Obviously minor changes could be made in any of the grain grinding mills which I have described for use in my invention without departing from the principle of the invention. It is not my intention to limit my invention exactly to the construction described and illustrated except as set forth in the claims. The grinding mills which I have described, however, provide a controllable and variable grinding operation attainable in a practical and simple manner with a single device in which the desired mixing is also performed. Only a moderate amount of

power is required for operation of the device and only a minimum amount of attention and maintenance.

The term "grinding" as herein used is intended to include not only the breaking up of material into small particles but also the crushing, rolling or the giving of any other treatment which is customarily given grain in grain grinding mills to change either the size or shape of the individual kernels.

I claim:

1. In a feed mixer and grinder, a tank, a rotating auger extending vertically upwardly through said tank and adapted to convey material upwardly in said tank, a stationary conveyor tube surrounding the upper portion of said auger and terminating a short distance below the top of said tank, supporting means for said conveyor tube, a grain grinding mill mounted in said tank at the top of said conveyor tube, said grain grinding mill so positioned and arranged that material in said tank moved upwardly on said auger through said conveyor tube will be delivered to said grain grinding mill and, after passing through said mill, will be discharged back into said tank, and a by-pass outlet opening in said conveyor tube below said grinding mill, a sleeve slidable on said conveyor tube controlling said by-pass opening, and means for positioning said sleeve with respect to said by-pass outlet, whereby material in said tube can be discharged out into said tank for mixing without grinding when so desired.

2. The combination set forth in claim 1 with said grain grinding mill including a cylindrical screen between the top of said conveyor tube and the top of said tank co-axial with said tube and said auger, a plurality of rotated hammers within said screen, whereby material delivered from said conveyor tube into the space enclosed by said screen will be subjected to hammer mill grinding until discharged through said screen and back into said tank.

3. In a feed mixer and grinder, a tank having a conically-shaped, downwardly-extending lower portion, a rotating auger extending vertically upwardly through the center of said tank and lower portion and adapted to convey material upwardly in said tank, a stationary conveyor tube surrounding the upper portion of said auger and terminating a spaced distance below the top of said tank, supporting means for said conveyor tube, a cylindrical screen between the top of said conveyor tube and the top of said tank co-axial with said tube and said auger, a tubular hammer shaft centrally positioned within said screen, a plurality of hammers attached to the hammer-mill shaft within said screen, and means for rotating said hammer-mill shaft, whereby material delivered from said conveyor tube into the space enclosed by said screen will be subjected to hammer mill grinding until discharged through said screen and back into said tank, a by-pass outlet opening in said conveyor tube below said screen, a sleeve slidable on said tube controlling said by-pass opening, and means extending to the outside of said tank for positioning said sleeve, whereby material in said tube can be discharged out into said tank for mixing without grinding when so desired.

4. A feed mixer and grinder including a tank having a co-axial conically-shaped, downwardly-extending lower portion, a rotating auger extending vertically upwardly through the center of said tank and lower portion and adapted to convey material upwardly in said tank, a stationary conveyor tube surrounding the upper portion of said auger and terminating a short distance below the top of said tank, supporting means for said conveyor tube, a pair of cooperating grinding rings co-axial with said auger and said conveyor tube, stationary supporting means for one of said rings, means carried by said auger shaft for supporting the other of said rings causing said latter mentioned ring to be rotated with said auger, means for adjusting one of said rings with respect to the other in axial direction, a by-pass outlet in said conveyor tube below said pair of grinding rings, means on said tube controlling said by-pass outlet, and means for operating said last mentioned means, whereby material in said tube can be discharged out into said tank for mixing without grinding when so desired.

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