Sept. 1, 1964 P. C. DE GRAFF 3,146,960

GRINDING MACHINE

Filed May 15, 1961 3 Sheets-Sheet 1

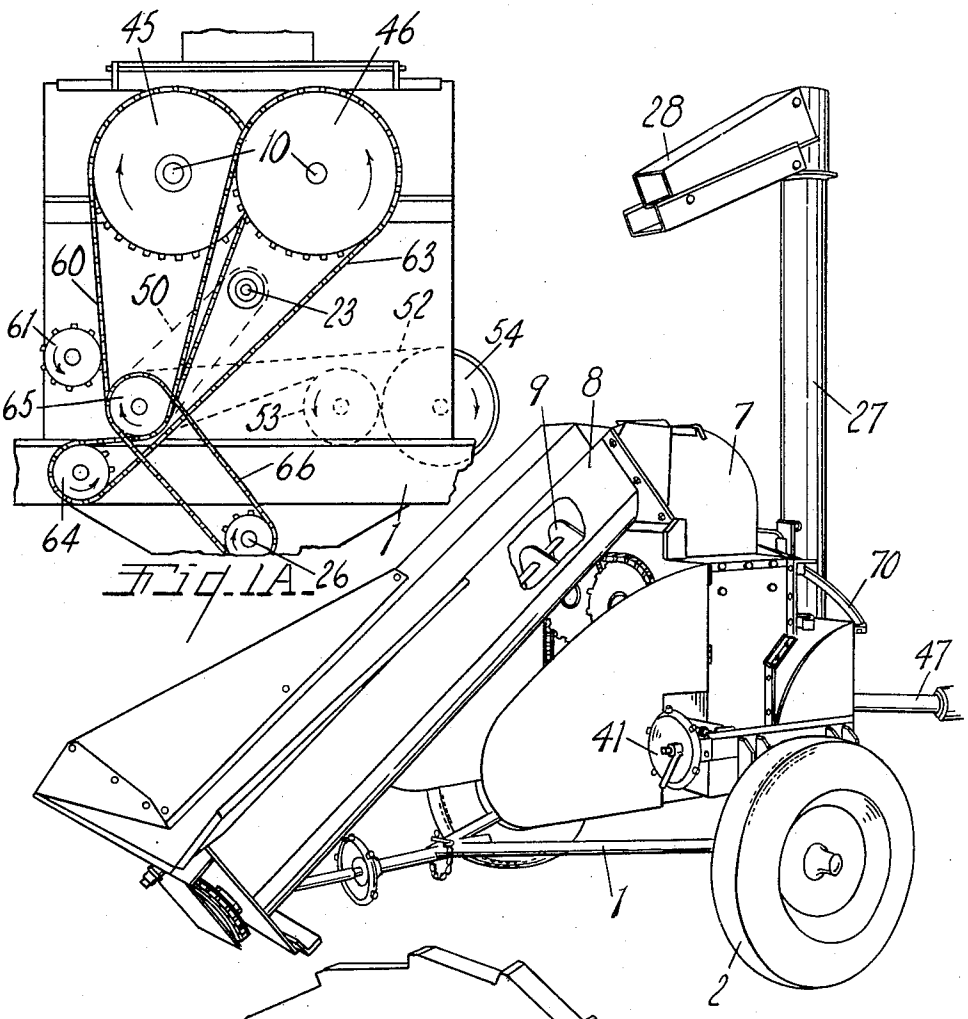

Fig. 1A

Fig. 1

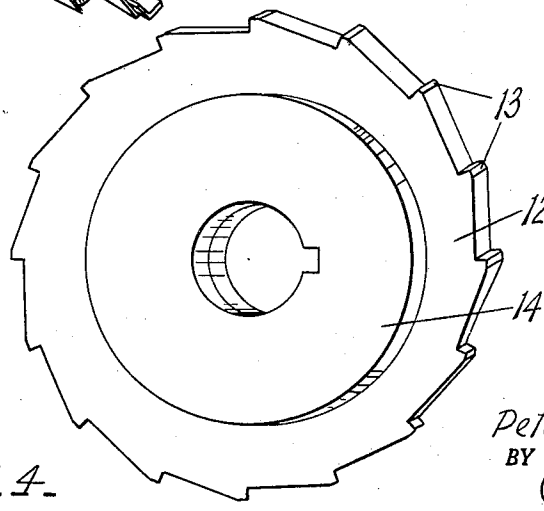

Fig. 4

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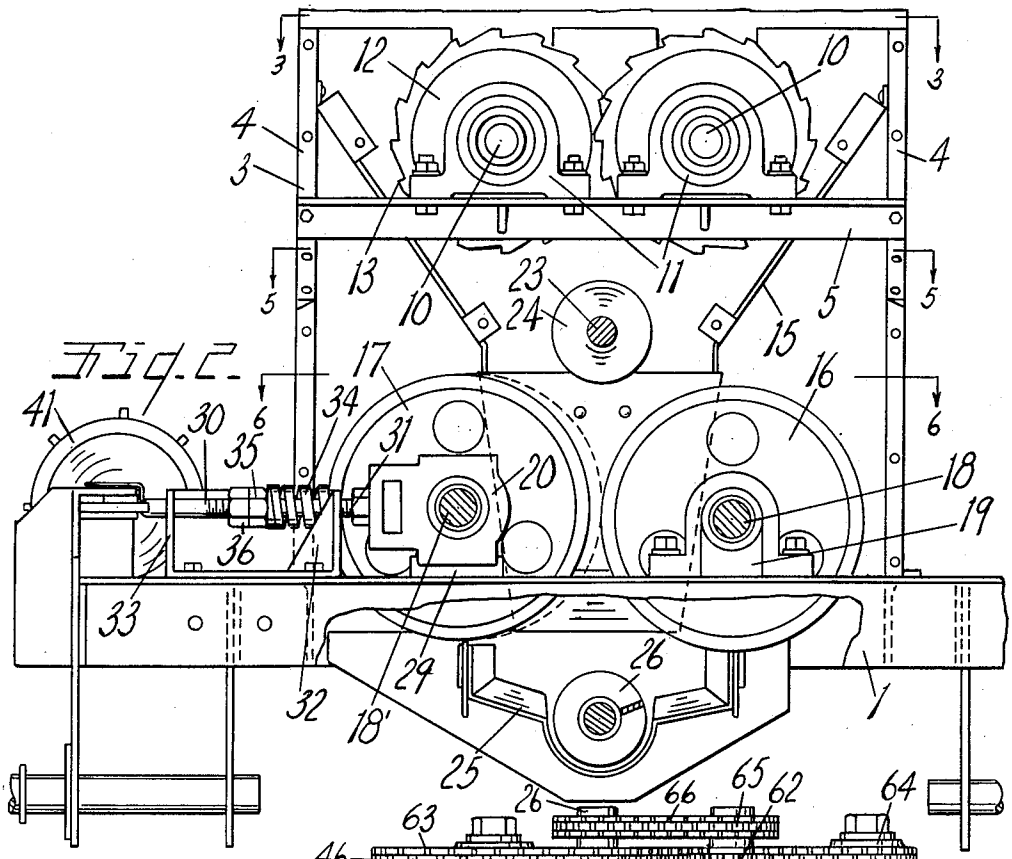

Fig. 2.

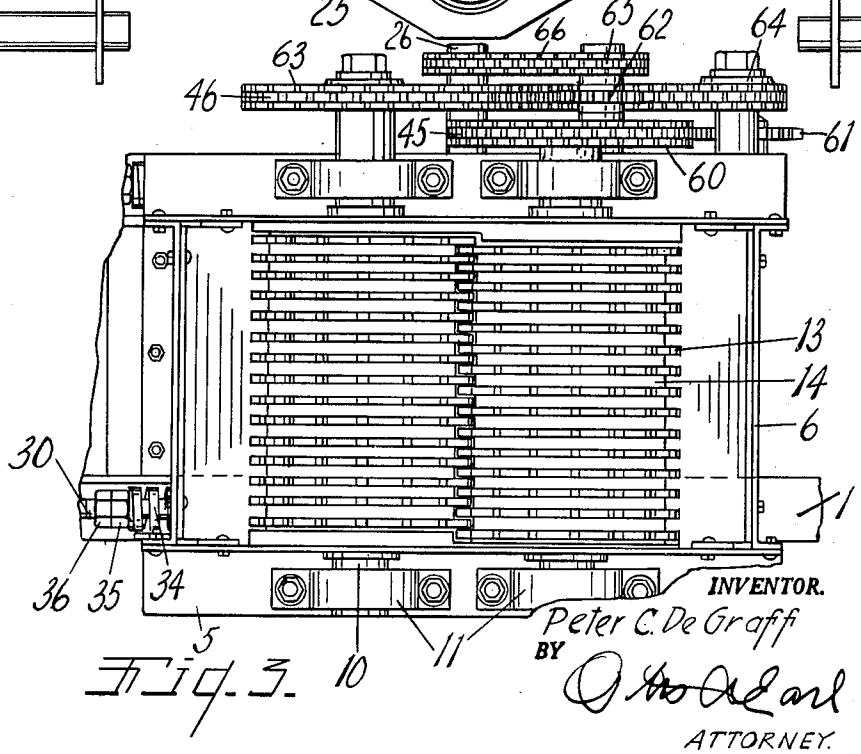

Fig. 3.

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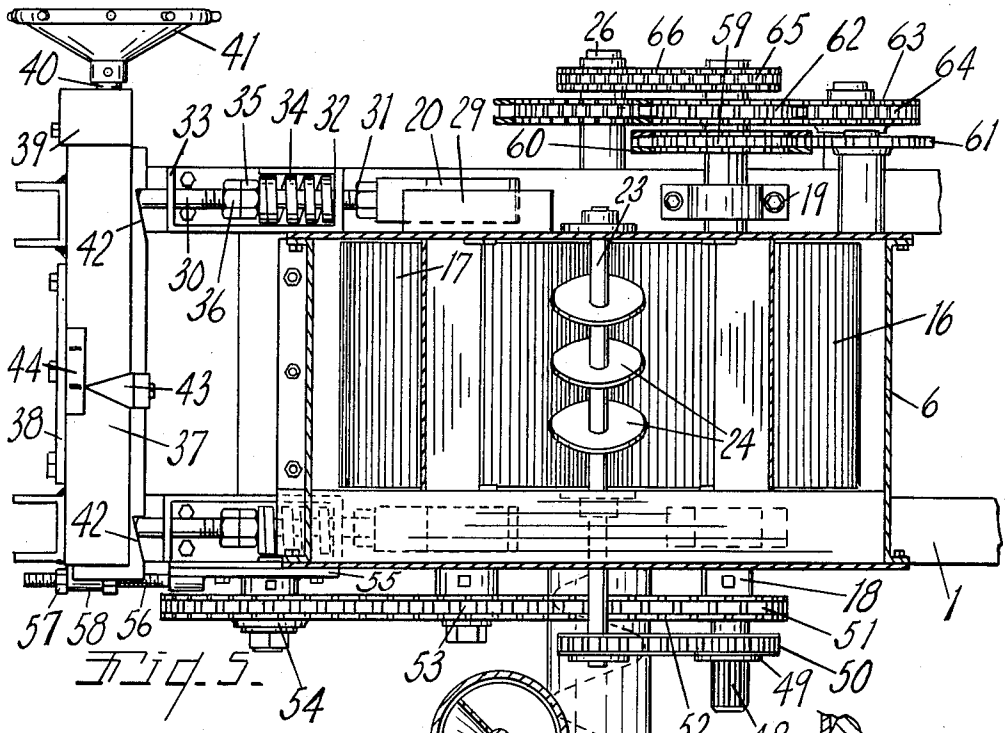

Fig. 5.

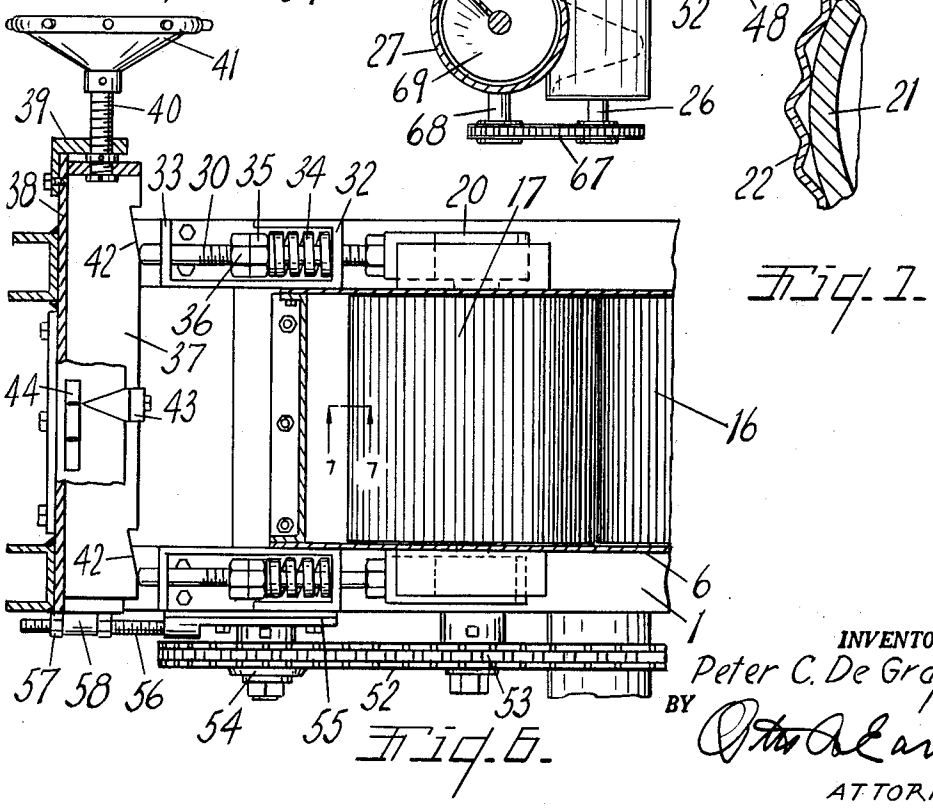

Fig. 7.

Fig. 6.

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GRINDING MACHINE

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4 Claims. (Cl. 241—159)

This invention relates to improvements in grinding machines. The principal objects of this invention are:

First, to provide a grinding machine which is well adapted and designed for the grinding of grains for animal feed including the grinding of ears of corn.

Second, to provide a grinding machine which is of portable dimensions and at the same time is of large capacity.

Third, to provide a machine having these advantages which may be readily adjusted to varying degrees of grinding and different kinds of grain.

Fourth, to provide a machine having these several advantages in which the ground material is very uniform.

Objects relating to details and economies of the invention will appear from the description to follow. The invention is defined and pointed out in the claims.

A preferred embodiment of the invention is illustrated in the accompanying drawing, in which:

FIG. 1 is a perspective view of a grinding machine embodying my invention, a portion of the feed chute being broken away to disclose a portion of the conveyor therein.

FIG. 1A is an enlarged fragmentary elevational view illustrating a portion of the driving means, some of the coacting parts being shown in full lines and others being shown in dotted lines.

FIG. 2 is a fragmentary elevational view with parts shown in sections with the housing walls being removed in order to illustrate the cooperating relation of the shredder, the spreader and the grinder.

FIG. 3 is a fragmentary plan view of parts shown in FIG. 2.

FIG. 4 is a perspective view of a pair of the shredder and spacer discs.

FIG. 5 is a fragmentary horizontal view on a line corresponding to line 5—5 of FIG. 2, housing wall portions not disclosed in that figure being included.

FIG. 6 is an enlarged fragmentary view on a line corresponding to line 6—6 of FIG. 1 illustrating adjusting means for one of the grinding cylinders.

FIG. 7 is an enlarged fragmentary section on a line corresponding to line 7—7 of FIG. 6 illustrating structural details of the embodiment of the cylinder of this embodiment.

The embodiment of my invention illustrated is a portable structure adapted for the grinding of grain for animal feed and well adapted for the grinding of corn on the cob.

The structural details of the supporting frame and housing are not described as they form no part of my present invention but it will be understood that the structure illustrated is a portable structure designed to be propelled and powered by a motor vehicle not illustrated.

The supporting frame designated generally by the numeral 1 is provided with wheels 2. The housing frame designated generally by the numeral 3 is mounted on this frame 1 and comprises four uprights 4, side and end members and horizontally disposed bearing support and reinforcing members 5.

The housing designated generally by the numeral 6, see FIGS. 5 and 6, is adapted to enclose the shredding units and the grinding cylinders.

As stated, the details of the frame and housing walls form no part of the invention except that the housing encloses various operating parts and that the housing is provided with a downwardly discharging inlet designated

generally by the numeral 7 to which the feed chute 8 delivers, the feed chute being provided with a conveyor designated generally by the numeral 9. Such conveyors, broadly considered, are old in the art. It is designed to receive grain to be ground including, as stated, ears of corn.

The inlet discharges upon coacting shredder units which comprise parallel shafts 10 rotatably mounted on the bearings 11 mounted on the frame crosspieces 5. These shredder units are reversely driven and each comprises the driven shaft 10 and a plurality of disc-like shredder plates 12 desirably of uniform thickness and provided with peripheral teeth 13. These shredder plates are uniformly spaced by the disc-like spacers 14, see FIGS. 3 and 4, the spacers 14 being of slightly greater thickness than the blades. Both the blades and the discs are fixedly mounted on the shafts 10 which are spaced so that portions of the blades of substantial radial width of one unit are in interlapping relation with corresponding portions of the blades of the other unit. These units are driven in reversed direction so that the material discharged thereon from the inlet is shredded and discharged downwardly.

The coacting downwardly converging or chute members 15 provide a discharge chute and direct the shredded material to grinding cylinders designated generally by the numerals 16 and 17. These cylinders 16 and 17 are duplicates but different numerals are used because in the embodiment illustrated, the grinding cylinder 17 is adjustably mounted relative to the grinding cylinder 16, the shaft 18 of the cylinder 16 being provided with bearings 19 fixedly mounted on the base 1 while the bearing 20 for the shaft 18′ of the cylinder 17 is slidably mounted to permit adjustment of the cylinder 17 to and from the cylinder 16 as is indicated by full and dotted lines in FIG. 2.

In the preferred embodiment illustrated, the cylinders are provided with axially disposed corrugations, the corrugations being conventionally indicated in FIGS. 5 and 6. As shown in FIG. 7, the cylinders comprise the body portions 21 with cylindrical corrugated or serrated sleeves 22 supportedly mounted thereon and constituting a part of the cylinder.

It should be understood that in the grinding of grain and cattle food, it is sometimes not desired that it be ground fine or reduced to powder form and further when the material ground is in the form of ears of corn, which frequently is not completely husked, it is important that the cob and the husk as well as the kernels be effectively shredded or broken up and discharged. That is accomplished by the applicant's shredder unit and the material is discharged therefrom to the grinding cylinders and further effectively ground thereby and discharged therefrom. To uniformly distribute the material discharged from the shredders upon the grinding cylinders, I provide a spreader which comprises the driven shaft 23 on which there are a plurality of axially spaced discs 24 disposed in inclined relation to the axis of the shaft, see FIG. 5. As these discs rotate they act to spread the material discharged thereon from the shredder upon the grinding rolls.

Below the grinding rolls is a spout or chute 25 provided with a conveyor designated generally by the numeral 26. This delivers to the vertical chute 27 having a discharge spout 28 at its upper end. As the details of this discharge chute and spout form no part of my present invention, they are not described in detail.

As stated, the bearings 20 of the shaft 18′ are adjustably mounted on the slideways 29 mounted on the base frame. Means for adjusting these bearings comprise the threaded rods 30 which are connected to the bearings 20 at 31 and are disposed through the brackets 32 and 33. Coil springs 34 are arranged on these rods in supported engagement with the brackets 32 and in thrust engage-

ment with the nuts 35 threaded upon the rods and secured in their adjusted position by the lock nuts 36. These springs act to retract the bearings 20.

The adjusting means of the embodiment illustrated comprise the slide 37 mounted on the support or slideway 33 which is provided with a bracket 39 with which the adjusting screw 40 is threadingly engaged, this adjusting screw being provided with a hand wheel 41. The slide 37 is provided with like cams 42 supportedly engaging the ends of the rods 30, see FIG. 6, in which the adjusting slide is positioned with the adjusting cylinder in its fully advanced position.

In the embodiment illustrated, the slide 37 is desirably provided with a pointer 43 which coacts with the index 44, see FIGS. 5 and 6. In FIG. 5 the adjusting member 37 is illustrated in its fully retracted position, that is, in position to permit the springs 34 to fully retract the cylinder 17. The main purpose of the pointer 43 and the index 44 is so that the operator may know when he has reached both limits of adjustment and to indicate the degree of adjustment. It will be understood that the member 37 may be adjusted to any point intermediate its two adjustments illustrated in FIGS. 5 and 6.

It will be understood that the shredding units are driven at uniform speeds and their shafts are provided with sprockets 45 and 46, see FIG. 1A.

The drive to the sprockets 45 and 46 and the grinding machine as a whole is delivered to the machine from a suitable powered shaft 47, see FIG. 1, detachably connected to the splined end 48 of the drive shaft 18, see FIG. 5. The drive shaft 18 at its forward driven end is provided first with a sprocket 49 connected by the chain 50 to the end of the spreader shaft 23. Behind the sprocket 49 is a drive sprocket 51 for the connecting chain 52 which drives the sprocket 53 on the end of the shaft 18' to drive the other crusher roller 17.

In order to obtain downwardly converging rotation of the shafts 18 and 18' and the crusher rolls 16 and 17, the chain 52 is trained over the top of an idler sprocket 54 then upwardly over the sprocket 53, see FIG. 1A. As appears more clearly in FIG. 6, the sprocket 54 is mounted on a transversely adjustable bearing bracket 55 which may be adjusted by the screw 56 and adjusting nuts 57 engageable with the ear 58 on the frame of the grinder in order to maintain proper tension in the chain 52 as the crusher roll 17 is adjusted, as previously described.

At its rear end, the drive shaft 18 is provided with three side by side sprockets to drive the other elements of the grinder. As appears in FIGS. 5 and 1A the first sprocket 59 drives a chain 60 which extends upwardly around the previously described sprocket 45 on one of the shredder units 10. Tension in the chain 60 is maintained by an idler sprocket 61.

The next or intermediate sprocket 62 drives a chain 63 which is trained upwardly around the drive sprocket 46 of the other shredder unit 10. The chain 63 is trained around an idler sprocket 64 to obtain downwardly converging rotation of the shredder units 10.

The third or rearmost sprocket 65 on the shaft 18 drives a chain 66 which drives the previously described auger shaft 26 for driving the delivery screw in the housing 25 at the bottom of the machine. The shaft 26 is coupled at its opposite end by the chain 67 with a drive sprocket and shaft 63 for the upright conveyor screw 69 in the delivery tube 27. For convenience in delivery of the output of the grinder, the delivery tube 27 is swingably adjustable about the axis of the shaft 26 to position the delivery tube at either side of the grinder.

The arcuate support rail 70, see FIG. 1, supports the delivery tube in its various adjusted positions.

As stated, details of the housing, the feed chute and the discharge conveyor are not illustrated and described herein as while they constitute important parts of the operating structure illustrated, these details are not regarded as part of my invention and they may be greatly varied in various possible adaptations and embodiments of my invention.

I have illustrated and described my invention in a highly practical embodiment thereof. I have not attempted to illustrate or describe other adaptations or embodiments which I contemplate, as I believe this disclosure will enable those skilled in the art to embody or adapt my invention as may be desired.

Having thus described the invention, what is claimed as new and desired to secure by Letters Patent is:

1. In a grinding machine, the combination of a housing having an inlet at the top and a discharge at the bottom thereof, reversely driven coacting shredder units disposed in said housing below said inlet to receive products therefrom, each unit comprising a driven shaft, a plurality of disc-like axially spaced toothed shredder blades and disc-like spacer members disposed between said blades with the peripheries thereof spaced radially inward relative to the peripheries of the blades, peripheral portions of substantial radial width of the blades of one of said units being in interlapping relation with corresponding peripheral portions of the blade of the other unit, reversely driven grinding cylinders disposed in downwardly spaced relation to said shredder units to receive material discharged therefrom, said grinding cylinders comprising cylindrical body portions and longitudinally corrugated sleeves supportedly mounted thereon, at least one of said cylinders being mounted for adjustment to and from the other, and a spreader disposed between said shredder unit and said grinding cylinders and comprising a driven shaft and a plurality of discs mounted thereon in inclined relation to the axis thereof.

2. In a grinding machine, the combination of a housing having an inlet at the top and a discharge at the bottom thereof, reversely driven coacting shredder units disposed in said housing below said inlet to receive products therefrom, each unit comprising a driven shaft, a plurality of disc-like axially spaced toothed-shredder blades and disc-like spacer members disposed between said blades with the peripheries thereof spaced radially inward relative to the peripheries of the blades, peripheral portions of substantial radial width of the blades on one of said units being in interlapping relation with corresponding peripheral portions of the blade of the other unit, reversely driven grinding cylinders disposed to receive material discharged from said shredder units, and a spreader disposed between said shredder unit and said grinding cylinders and comprising a driven shaft and a plurality of discs mounted thereon in inclined relation to the axis thereof.

3. In a grinding machine, the combination of a housing having an inlet at its top and a discharge at its bottom, reversibly driven coacting shredder units disposed in said housing below said inlet to receive products discharged therethrough, each of said units comprising a driven shaft, a plurality of disc-like shredder blades mounted on said shaft and having a plurality of teeth on their peripheries, disk-like spacer members for said shredder blades disposed on said shaft between said shredder blades, said spacer members being of such diameter relative to the shredder blades that there are portions of the shredder blades of substantial radial width between the bottoms of their teeth and the peripheries of said spacer members, said shredder units being positioned relative to each other so that their shredder blades are in interlapping relation with the tips of the teeth thereof closely adjacent but in clearance relation to the spacer members of the other unit as the units are rotated, a spreader comprising a driven shaft having a plurality of discs mounted thereon in inclined relation to its axis disposed below the shredder units to receive the material discharged therefrom, and a pair of coacting reversibly driven grinding cylinders disposed below said spreader.

4. In a grinding machine, the combination of a housing having an inlet, reversibly driven coacting shredder units disposed in said housing to receive products from said

inlet, each of said units comprising a driven shaft, a plurality of shredder blades mounted on said shaft and each having a plurality of teeth on their peripheries, the teeth of the several blades on the shaft being aligned, spacer members for said shredder blades disposed on said shaft between the blades and having cylindrical peripheries, said spacer members being dimensioned so that the shredder blades of one unit are disposed in interlapping relation with the blades of the other unit with the tips of their teeth in closely adjacent but in clearance relation to the spacer members of the other unit as the units are reversibly driven, a spreader comprising a driven shaft having a plurality of disks mounted thereon and axially spaced in inclined relation to the shaft disposed below said shredder unit to receive material discharged therefrom, and a pair of coacting reversibly driven grinding cylinders disposed below said spreader.

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