May 27, 1930. C. W. KEITH 1,759,905

ENSILAGE CUTTER AND GRINDER

Filed Dec. 6, 1926 2 Sheets-Sheet 1

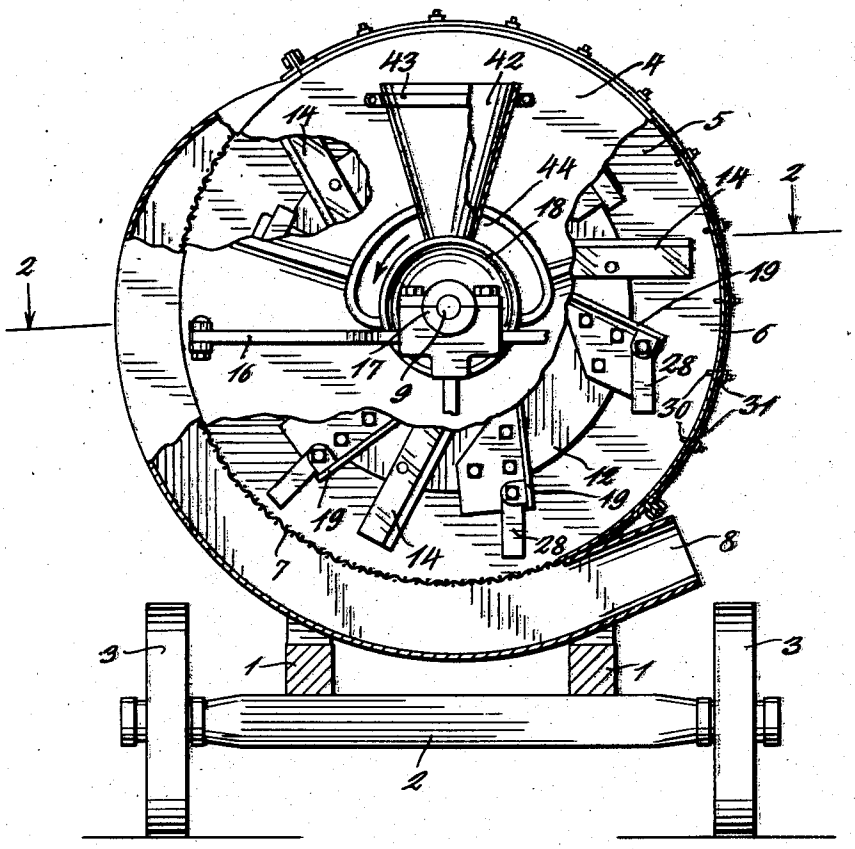


Fig. 1.

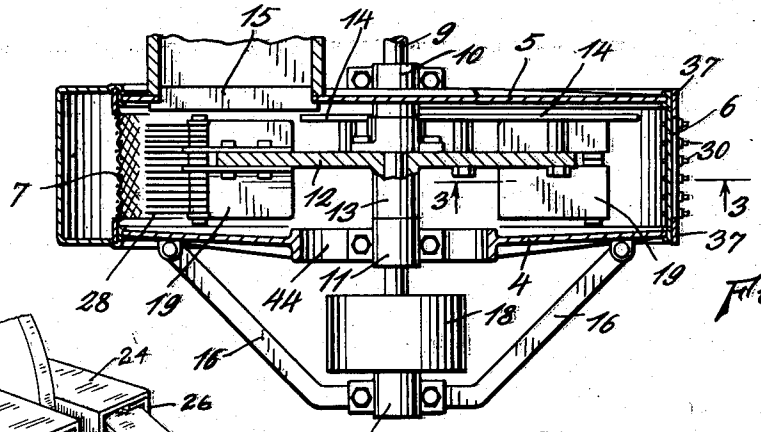


Fig. 2.

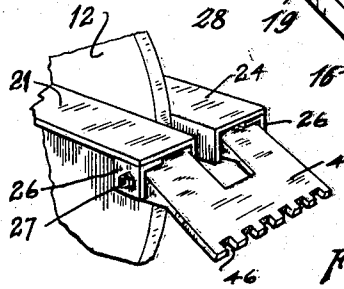


Fig. 10.

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ENSILAGE CUTTER AND GRINDER

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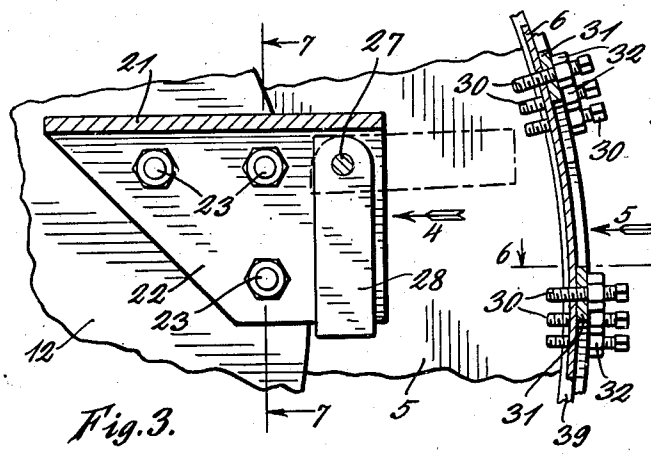


Fig. 3.

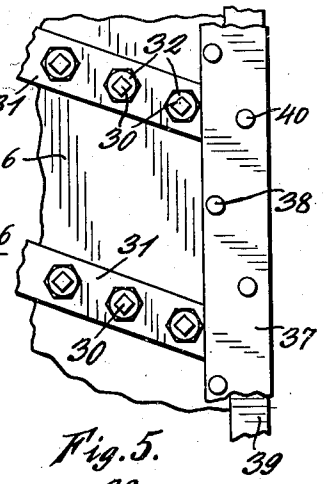


Fig. 5.

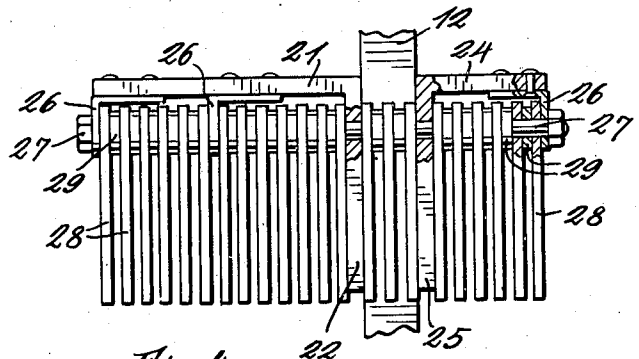


Fig. 4.

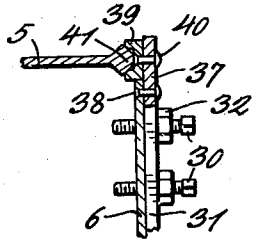


Fig. 6.

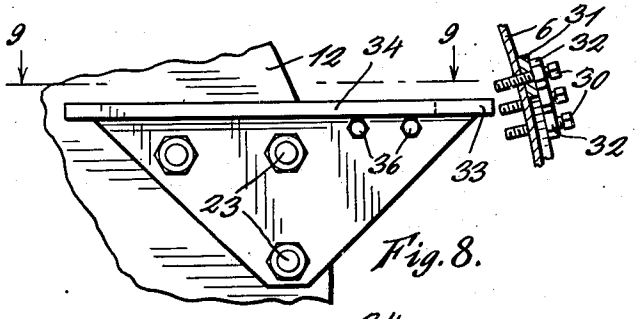


Fig. 8.

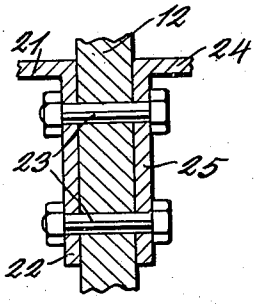


Fig. 7.

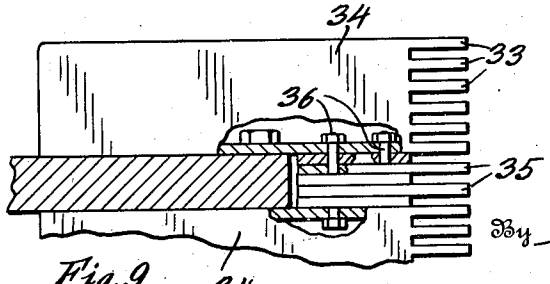


Fig. 9.

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UNITED STATES PATENT OFFICE

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ENSILAGE CUTTER AND GRINDER

Application filed December 6, 1926. Serial No. 152,851.

This invention relates to improvements in the construction of ensilage cutters and grinders of the type disclosed and claimed in United States Letters Patent No. 1,621,510 granted to me on the 22nd day of March, 1927.

In the patent referred to, I have described and claimed an ensilage cutter in which a screen or foraminated partition or wall is interposed in the opening from the fan chamber to the exhaust passage so as to prevent fodder from leaving until it has been ground or reduced to the proper size to pass through the foraminations in the wall, which is concentric with the center of rotation of the fan. In my present embodiment the foraminated partition is retained and functions in the same manner as described in said patent. In addition to the foraminated partition, I have provided the inner surface of the cylindrical wall of the fan housing with a large number of teeth which terminate adjacent the locus of the outer ends of the fan blades and which assist in tearing or grinding the fodder. The outer ends of the fan blades have been serrated so as to increase their effectiveness as a tearing or grinding device. As it frequently happens that the fodder or grain that is being ground contains some solid objects such as stones, pieces of wood, iron or other material which will bend or break the teeth on the ends of the fan blades or the inwardly projecting teeth carried by the casing, I have shown how the fan blades may be provided with a plurality of pivoted hammers or one or more plates that are pivoted at a point nearer one end than the other so that when the fan rotates, these will be thrown radially outwards by the centrifugal action and will form extensions of the fan blades, but which will yield when they strike a stone or other hard solid object and thereby prevent breakage.

The invention which has thus been briefly described will now be described in detail, and reference for this purpose will be had to the accompanying drawings in which the preferred embodiments have been illustrated and in which:

Fig. 1 is an end elevation of my improved machine with parts thereof broken away to better disclose the construction;

Fig. 2 is a section taken on line 2—2, Fig. 1;

Fig. 3 is a section to a somewhat enlarged scale taken on line 3—3, Fig. 2;

Fig. 4 is an end elevation of one of the fan blades looking in the direction of arrow 4 in Fig. 3;

Fig. 5 is a fragmentary view showing the outside of the cylindrical wall, said view being taken in the direction of arrow 5 in Fig. 3;

Fig. 6 is a section taken on line 6—6, Fig. 3;

Fig. 7 is a section taken on line 7—7, Fig. 3;

Fig. 8 is a view similar to that shown in Fig. 3 but showing a modified form of a fan blade;

Fig. 9 is a section taken on line 9—9, Fig. 8; and

Fig. 10 shows a modification in which the hammers have been replaced by a single plate.

Numeral 1 designates the supporting frame work one end of which rests upon an axle 2 to which the wheels 3 are attached. Supported from the frame work is a machine of which only a part has been shown in this application. The portion that has been shown consists of a casing having circular sides 4 and 5 whose peripheries are connected by means of a cylindrical wall 6. This wall extends entirely around the casing and has a portion thereof formed from foraminous material, which has been indicated by 7 and shown as a wire screen. This foraminous material is interposed between the interior of the casing and the arcuate exhaust passage 8 so that any material that passes out from the casing into the exhaust passage must first be ground to such size that it will pass through the meshes of this screen.

A shaft 9 is journalled in boxes 10 and 11, which are connected respectively to the sides 5 and 4. Secured to this shaft is a rotor 12 which is preferably formed of a circular cast iron disk having a hub portion 13 and which is keyed or oherwise nonrotatably fastened to the shaft. Secured to one side of this rotor is a plurality of knives 14, which cooperate with the shearing plate 15 for the purpose of shearing the fodder which is to be shredded, reduced or ground. The apparatus for feed-

ing the material to the cutter has not been shown because I intend to employ the ordinary feeding mechanism which, therefore, does not form a part of this invention. The knives and shear plate have been shown merely for the purpose of more clearly describing my invention. A bracket 16 is secured to the outside of the wall 4 and carries a bearing 17 in which the outer end of the shaft 9 is journalled. A pulley 18 is secured to the shaft between the side 4 and the box 17, and to which pulley the driving belt is secured. This belt, which has not been shown, is attached to the source of power in such a way that the rotor will be rotated in a counter-clockwise direction (Fig. 1). As the shear cutting means comprising the knives 14 pass the shear plate 15, any fodder that is in place will be cut in the ordinary manner. This cut fodder will then fall into the casing which encloses the rotor.

For the purpose of providing a blast of air which will carry the material through the exhaust opening 8 to the silo or other storage place, the rotor has been provided with a plurality of fan blades which have been indicated as a whole by numeral 19. These fan blades have been illustrated in considerable detail in Figures 3 and 4 from which it will be noticed that they are formed by having secured to one side of the rotor 12 an L-shaped member having a flange 21 and a side 22. The side 22 is provided with perforations for the reception of the bolts 23 by means of which the part is secured to the rotor. A similar part having a flange 24 and a side 25 is secured to the opposite side of the rotor by means of bolts 23. When these two parts are in place, they occupy the positions shown in Figures 3 and 4, and have the flanges 21 and 24 lying in the same plane. Secured to the underside of the flanges 21 and 24, are angles 26, which are perforated for the reception of the bolt 27, which serves as a pivot pin for a number of rotary impact reducing devices or hammers 28 which are spaced by means of washers 29. It will be observed that the hammers 28 are pivoted near one end and therefor when the rotor is turning about its axis the centrifugal force will throw these hammers out into a position substantially like that shown by dot and dash lines in Fig. 3. As the rotor turns at a high speed, and since the hammers 28 are quite heavy, they will form outwardly extending teeth which will retain a radial position against a considerable force, and will, in effect, form a prolongation of the fan blades. It is evident that if some hard solid substance such as a stone or a piece of hard material should accidentally come into the chamber and become wedged against a wall 6, that the hammers or teeth 28 instead of breaking, will yield and move about their pivots to a sufficient extent to permit the obstruction to be passed. This pivoted arrangement with respect to the teeth or hammers, is more particularly valuable in this combination because it will be observed from Figures 3 and 6, that I have provided the non-foraminous part 6 of the cylindrical wall with a plurality of teeth which extend inwardly from the concave side thereof. These teeth have been shown as formed from bolts 30 that have a threaded connection with the diagonal strips 31 which are secured to the outside of the part 6 in the manner shown most clearly in Figure 5. Strips 31 have been shown as extending diagonally but they may go straight across if desired, and may even be omitted. Each bolt has a lock nut 32 by means of which it can be positively locked in adjusted position. These teeth may, however, be formed in any other suitable way. These teeth are so adjusted that they terminate adjacent the locus of the peripheries of the hammers 28, and cooperate with the latter to tear and grind any of the material that is within the casing. It is obvious that if these teeth were not provided that the material could slide along the inner surface of the part 6 and therefore very little grinding or tearing would take place except where the screen section 7 is located. By providing teeth 30, the capacity of the machine is greatly increased and its effectiveness for the purpose of grinding, tearing or segregating is greatly enhanced. I intimated above that the pivoted arrangement of the teeth 28 is more particularly useful in this invention and this is for the reason that on account of the presence of the inwardly extending teeth 30, any solid material such as a stone would be locked against rotary movement, and, therefore, the parts would break whenever the ends of the teeth 28 would strike the stone. Whereas, with a pivoted arrangement of the teeth 28, no such breakage will occur. Even in the absence of solid material, it sometimes happens that, on account of dampness, the material which is being ground will accumulate at some point and therefore will cause the machine to stop and perhaps break if the fans have integral teeth, whereas with the pivoted arrangement, the rotor will continue to turn and gradually tear the accumulated material away until the operation becomes normal.

The fans 21—24, Fig. 4, in combination with the teeth or hammers, 28, attached thereto form a combination of fan and hammers which will, taken together, beat or hammer the fodder or grain in the chamber, reduce its size, and at the same time create a blast to drive the ground material through the foraminated partition and away through the outlet 8.

In Figures 8 and 9 I have shown fan blades which are composed of two angles similar to those employed in the arrangement shown in Figures 3 and 4, but which have integral

radially extending teeth 33, instead of the pivoted teeth 28. As intimated above, this arrangement may be satisfactory under ideal conditions but would be liable to breakage in case solid material should accidentally be introduced. The majority of the teeth 33 are cut integral with the flanges 34 but the gap between the two angles has been filled by teeth 35, which are held in place by means of bolts 36. In Figure 6 I have shown a detail which illustrates one manner in which the section 6 may be constructed. It will be noticed that a bar 37 is attached to the outside of section 6 by means of a rivet 38 and that a channel 39 is secured to the concave side of this bar. The concave portion of the channel bar 39 is adapted to receive the thickened peripheral edge 41 of the plate 5. In Figure 6 one edge only of the wall section 6 has been shown, but a corresponding construction is employed along the other edge. This construction may, of course, be replaced by any other suitable construction and has merely been shown as one example.

It is sometimes desirable to mix grain with ensilage, as corn with hay, and reduce them together. It is also often desirable to use the device as a grinder alone. Suitable means are provided for introducing the loose grain into the casing independently of the ensilage. Any convenient means may be employed for this purpose.

In Figure 10 I have shown a modification in which the hammers 28 have been replaced by a single plate 45 which is pivotally attached to the fan blades in the same manner as the hammers. This pivoted extension may, if desired, have its peripheral edge notched so as to form teeth 46 if this should be desirable.

In Figure 1 I have shown a hopper 42 secured to the side 4 by means of a strap 43 and this hopper is provided with an opening that communicates with crescent shaped air intake 44. Whenever grain, such as corn, oats, wheat or any other grain is to be ground, it is placed in the hopper from which it passes into the chamber and becomes acted upon by the rotor which reduces it to such a degree of fineness that it will pass through the screen 7. The ground material will be driven by the force of the air caused by the fan blades through the foraminated partition to the arcuate exhaust passage 8, which is connected by a suitable pipe with a receiving bin, condenser or silo.

I desire to call particular attention to the construction in which the fan blades are provided with a pivoted extension consisting either of a plurality of hammers or of a plate like that shown in Figure 10, which produces a device that will not be damaged by the accidental introduction of hard solids and which gives greater efficiency to the fan, both for the production of an air blast and for reducing by impact or by grinding and tearing.

In case it should be desired to make the machine for grinding small grain only and the knives are not needed for cutting hay, fodder or other roughage and in that case the fan blades could be on one side only of the fly wheel, if desired, or they could be between two fly wheels or a supporting wheel for the outside of the fan blade.

It should also be borne in mind that this is the only machine, so far as I am aware, having combined fan and hammers for grinding small grain and blowing the material thus ground through a foraminated partition into the chamber below and which receives the material at or near the axis, thus taking advantage of the suction in drawing in such material.

And the centrifugal impeller formed by the massive fan blades and hammers on the high speed rotor, acts not only to drive a blast of air through the peripheral screen formed by the foraminous plate, but will also impinge the grain and the cut material while in suspension in the casing with such an impact as to crush, and otherwise reduce it, in addition to or it may be independently of the cutting and grinding actions which have been described.

From the above it will be apparent that I have produced an improved shredding and grinding device by means of which it is possible to grind ensilage, alfalfa, cornstalks or any other kind of fodder to such a fine state that it will all be consumed and which can also be used for cracking shelled corn or grinding it or any other grain to a meal, and have thereby converted a machine which ordinarily had a very limited use for shredding ensilage into a shredding and grinding machine of general use.

Having thus described the invention, what is claimed as new is:

1. In an ensilage cutter and grinder, a rotor, fan blades mounted thereon, a casing enclosing said rotor, said casing having a cylindrical wall curved about the center of rotation of said rotor, said fan blades having extensions pivotally connected to their ends and adapted to assume a radial position when the fan rotates, the peripheries of said extensions being closely adjacent the inner surface of said cylindrical wall when the rotor is rotating about its axis.

2. In an ensilage cutter having a rotor, fan blades and cutter blades mounted thereon, and a casing enclosing said rotor, said casing having a cylindrical wall curved about the center of rotation of the rotor and lying closely adjacent the peripheries of the fan blades, a plurality of teeth extending inwardly from the concave side of the cylindrical wall, said teeth terminating adjacent the peripheries of the fan blades and means for adjusting the position of the teeth with respect to the fan blades, said fan blades having their outer

ends provided with pivoted means adapted to cooperate with the teeth carried by the casing wall.

3. In an ensilage cutter and grinder having a rotor, fan blades and cutter blades mounted thereon, a casing enclosing said rotor, said casing having a cylindrical wall curved about the center of rotation of the rotor and formed in part by a foraminous partition, said wall lying closely adjacent the peripheries of the fan blades, the foraminous partition providing an exhaust passage for material passing through its foraminations, and teeth projecting inwardly from the concave surface of the nonforaminous portion of the wall, said teeth terminating adjacent the locus of the peripheries of the outer ends of the fan blades.

4. In an ensilage cutter and grinder having a rotor, fan blades and cutter blades mounted thereon, a casing enclosing said rotor, said casing having a cylindrical wall curved about the center of rotation of the rotor and formed in part by a foraminous partition, said wall lying closely adjacent the peripheries of the fan blades, the foraminous partition providing a peripheral exhaust passage for material passing through its foraminations, a plurality of teeth pivotally attached to the outer end of each fan blade and teeth extending inwardly from the concave surface of the nonforaminous portion of the cylindrical wall.

In testimony whereof I affix my signature.

CHARLES W. KEITH.