June 2, 1936. J. HOLLAND-LETZ 2,042,946

ROUGHAGE MILL

Filed Jan. 11, 1932 2 Sheets-Sheet 1

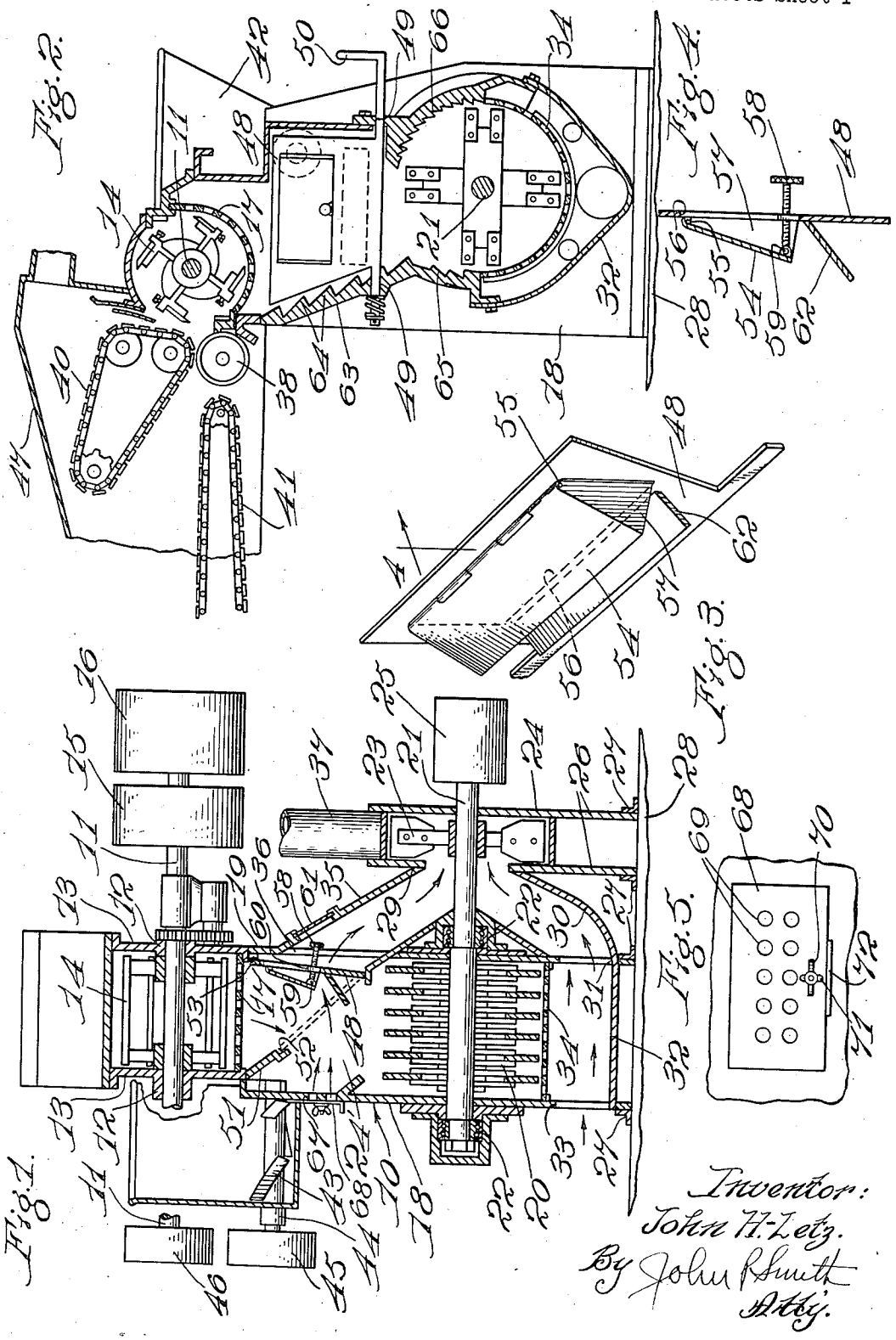


Fig. 1.

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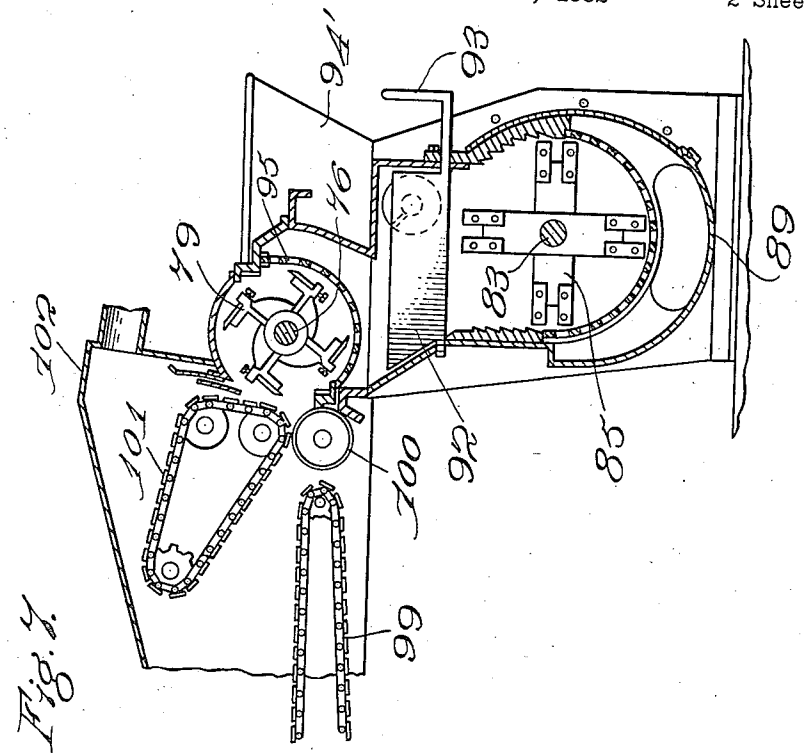


Fig. 5.

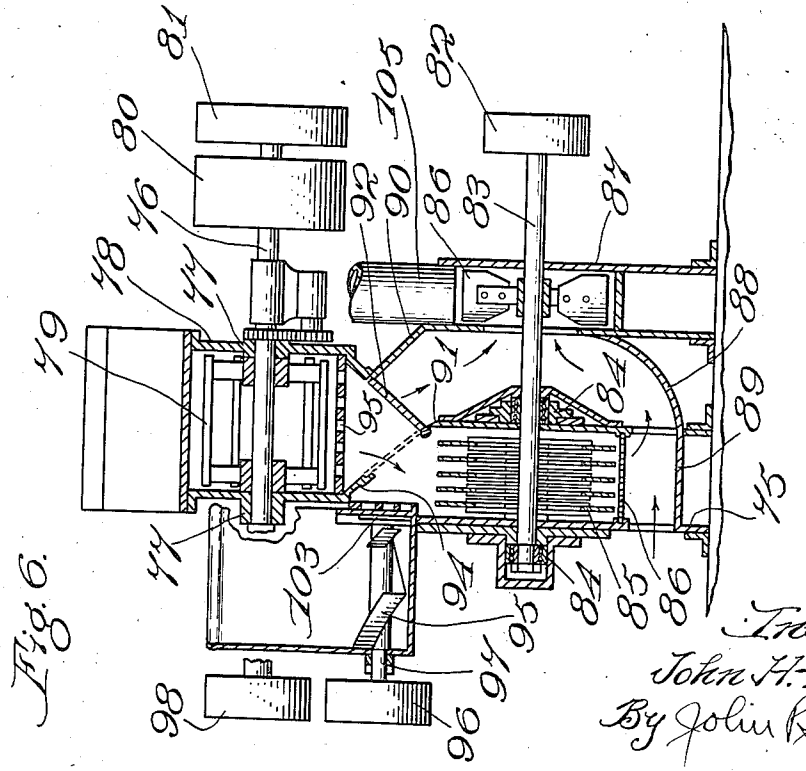


Fig. 6.

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Patented June 2, 1936

2,042,946

UNITED STATES PATENT OFFICE

2,042,946

ROUGHAGE MILL

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Application January 11, 1932, Serial No. 585,851

27 Claims. (Cl. 146—79)

The present invention is directed generally to a novel and improved type of roughage mill which may be adjusted for the purpose of preparing different types of forage.

One of the objects of the present invention is to provide a novel, improved and compact roughage mill which is capable of being converted into a conventional form of ensilage cutter for the purpose of cutting green fodder and elevating the same for filling a silo or for cutting dry fodder, separating the lighter material from the heavier material thereof and grinding the heavier material to a finer degree. The mill may also be adjusted for grinding all cut material and subsequently mixing and elevating the material thus comminuted.

A further object of the invention is to provide a novel, improved and compact form of roughage mill in which the parts are so arranged with respect to each other so as to occupy a minimum amount of space and in which currents of air may be utilized as the material falls from the cutter head mechanism to the grinding mechanism, so as to separate the lighter materials from the heavier materials and permit the heavier materials to be further comminuted and subsequently mixed with the lighter materials.

A further object of the invention is to provide a novel form of roughage mill in which a separating chamber is located between the cutter head and grinding mechanism so that the lighter material is separated from the heavier material as the cut material is falling from the cutter head to the grinding mechanism.

A still further object of the invention is to provide a novel form of roughage mill in which a single pneumatic fan performs the functions of separating the heavier materials from the lighter materials, mixes the material comminuted by the grinding mechanism with the lighter material and also conveys the material to and elevates the material into a suitable receptacle.

Another object of the invention is to provide a novel form of roughage mill having a separating mechanism embodied therein and in which a novel form of valve is provided for controlling and regulating the amount of air circulating through the separating mechanism.

These and other objects are accomplished by providing a construction and an arrangement of the various parts in the manner hereinafter described and particularly pointed out in the appended claims.

Referring to the drawings:

Fig. 1 is a front elevational view partly in cross section showing the preferred form of my improved roughage mill;

Fig. 2 is a longitudinal cross sectional view of the same;

Fig. 3 is an enlarged perspective view of the pivoted valve located between the cutter head, the hammer mill and the mixing mechanism;

Fig. 4 is a cross sectional view taken on the line 4—4 in Fig. 3 showing the manner in which the draft vane may be adjusted for regulating the amount of air passing through the valve;

Fig. 5 is an enlarged fragmentary side elevational view of an adjustable draft plate which permits or controls the amount of air passing into the mill below the cutter head for separating the lighter materials from the heavier materials;

Fig. 6 is a front elevational view partly in cross section of a modified form of my improved roughage mill; and

Fig. 7 is a longitudinal cross sectional view of the same.

In illustrating the preferred form of my invention, I have shown the same as comprising a main frame in the form of a housing structure generally indicated by the reference character 10, mounted in the upper end of which is a main drive shaft 11, which in turn, is journaled in opposite bearings 12, formed in the side plates 13 of the cutter head housing. Secured to the shaft 11 within the cutter head housing is a conventional form of rotary knife or cutter head 14. Secured to one end of the shaft 11 are two spaced apart pulleys, one of which, indicated at 15, is a drive pulley which is connected to the source of power, and the other indicated at 16, is connected by means of a belt for driving the hammer mill and mixing fan hereinafter described. Mounted between the side walls 13 of the cutter head housing, is a concave or arcuate grate 17 which extends around and adjacent to the periphery of the lower portion of the cutter head as clearly shown in Fig. 2 of the drawings. The frame structure of my improved mill includes two relatively large side plates 18 and 19 between which is mounted a rotary grinding or hammer mill, generally indicated by the reference character 20. This hammer mill 20 is secured to a shaft 21 which in turn is mounted in suitable bearings 22 located and secured to the outside of each of the side plates 18 and 19 as clearly shown in Fig. 1 of the drawings. Secured to the shaft 21 adjacent to the hammer mill 20 is a separating, conveying, mixing and elevating fan generally indicated by the reference character 23, which in turn, is mounted in a housing generally indi-

cated by the reference character 24. Secured to the outer end of the shaft 21 and in alignment with the pulley 16 on the shaft 11, is a pulley 25 which is operatively driven by means of a belt by the pulley 16. The housing 24 is formed between two vertical plates 26, which by means of angle irons 27 are secured with the plate 18 and 19 to a suitable base 28. The inner wall 26 of the fan housing 24 is provided with an axial opening, as shown at 29, and communicates by means of a conduit 30 to an opening 31 in side plate or frame member 19, which in turn communicates with a trough 32 located below the hammer mill 20. The trough 32 extends across the bottom of the mill between the plates 18 and 19 and communicates with an opening 33 in the side plate 18, so as to permit the air to pass through in the direction indicated by the arrow for conveying and elevating the material ground by the mill 20. Located below the hammer mill 20 adjacent the periphery thereof and extending substantially half way therearound is a concave or grinding mill grate 34 which in turn is secured to the side plate 18 and 19 in any well known manner. The axial opening 29 in the fan housing 24 is also connected to a separating chamber generally indicated by the reference character 24' by means of a conduit 35 to an opening 36 in the side plate 19 between the cutter head 14 and hammer mill 20. Connected tangentially with respect to the fan housing 24 is a vertically extending conduit 37 which may be connected to a suitable receptacle in which the material may be collected, in a manner well understood in the art.

Connected to the forward side of the cutter head is an idle feed roller 38 which cooperates with a floating feed belt, generally indicated by the reference character 40, for feeding the material to the cutter head 14. Cooperating with this feeding mechanism is a conventional form of horizontal conveyor, generally indicated by the reference character 41. Secured to the frame structure of the mill adjacent one side of the cutter head is a hopper 42 which has located at the bottom thereof, a feeding screw 43 mounted on a shaft 44 journaled in the side frame portions of the hopper. Secured to the outside of the shaft 44 is a pulley 45, which in turn, is operatively driven by a pulley 46 secured to the main shaft 11. Extending over the floating feed belt 40 and housing the delivery end of the conveyor belt 41 is a hood 47. The screw 43 is adapted to convey and feed material such as grain through an opening in the side wall 18 to the grinding or hammer mill 20.

One of the essential features of the present invention, in addition to the novel positioning of the various elements of the roughage mill, includes a novel separating chamber and valve construction and associate parts which permit the valve and these associate parts to form in effect a separating mechanism for separating the lighter material from the heavier material and permitting the heavier material to be further reduced by the grinding mechanism and subsequently mixed with the lighter material. This novel valve mechanism includes a pivoted plate or valve 48 which is pivoted as shown in the opposite wall members of the separating chamber as shown at 49 is provided with a handle 50 so that the same may be adjusted from the full line position to the dotted line position shown in Fig. 1. The pivoted plate 48 is adapted to rest in the dotted line position shown in Fig. 1 on an inclined extension 51 secured to and below the end housing member 13 of the cutter head casing. The lower end of this extension is provided with a depressed off-set portion as shown at 52 on which the free end of the plate 48 may rest for the purpose of conveying the cut material directly from the cutter head to the mixing fan 23 through the conduit 35. In the other position, the plate 48 is adapted to rest against a lug 53 secured to the side frame members 19, in which position the material is conducted directly from the cutter head-housing through the concave or grate 17 into the hammer mill 20. In this position the valve is so constructed as to permit the lighter material to pass through an opening therein, so that only the heavier material may be fed to the grinding or hammer mill 20. This novel arrangement includes a supplemental pivoted and adjustable valve or vane, generally indicated by the reference character 54. This adjustable vane 54 is pivotally connected, as shown at 55, at a point adjacent the free end of the valve 48 and is adapted to cover an opening 56 which is rectangular in form and extending through the valve or plate 48. The opposite ends of the vane 54 are provided with triangular and right angularly extending end portions 57 which are adapted to extend through the opening 56 when the vane is adjusted with respect thereto. In order to vary the separating effect of the air passing through the separating chamber, the vane 54 is adjustable with respect to the valve 48 by means of a hand screw 58 which has one end thereof pivotally connected, as shown at 59, to one side of the vane. An intermediate portion of the screw 58 is in threaded engagement with a portion 60 of the plate 48.

From the above description it will be readily seen that by adjusting the thumb or hand screw 58 the amount of opening between the vane 54 and the valve or plate 48 may be controlled. In order to provide easy access to the thumb screw 58, I have provided a removable slide plate 61 which is mounted in suitable grooves in the conduit or casing 35. Positioned below the vane 54 is an inclined baffle 62 which is secured to the plate 48 below the opening 56 therein, so that when the valve or plate 48 is in full line position shown in Fig. 1, material which may be ejected or projected from the hammer mill 20 will strike this baffle plate and be prevented from passing through the opening 56 in the valve 48. In order to retard some of the material which may be projected from the rapidly rotating hammer mill 20, I have provided the side wall members as shown at 63 with inclined retarding ribs or projections 64 which permit the material to fall downwardly toward the grinding mill and retard their upward movement. I have also provided beater teeth, as shown at 65 and 66, formed on the opposite side walls of the upper portion of the hammer mill to increase the grinding action of the hammer mill blades.

In order to adjust the mill to the requirement of the different material that may be separated and to supply the proper amount of air to effect an efficient separation of the lighter material from the heavier material as the same is falling from the cutter head mechanism to the grinding mechanism, I have provided a plurality of spaced apart holes or apertures 67 in the side plate 18 of the mill, opposite the valve 48. In order to control the amount of air passing through these apertures 67, I have provided an adjustable damper plate 68 which in turn, is provided with spaced apart apertures 69 which are adapted to

register with the apertures 67 or be partially covered by the plate for regulating the amount of air passing therethrough. This plate 68 is adjustably clamped to the side plate 18 by means of a thumb screw 70 which in turn, extends through a vertical elongated slot 71 in the plate 68. The plate 68 is provided with a hand grip 72 for effecting this adjustment.

From the above description it will be readily seen that I have provided a simple and compact roughage mill in which the material may be directed from the cutting head mechanism directly to the grinding mechanism or hammer mill with the lighter parts thereof separated therefrom, and subsequently mixed with heavier material from the grinding mechanism, or the machine may be adjusted by closing the wind vane 54 and positioning valve 48 as shown in dotted line of Fig. 1, so that all of the material from the cutting head mechanism may be conveyed directly to the mixing or elevating fan for converting the mill into a conventional form of ensilage cutter. This construction accomplishes this object without the necessity of positive actuated conveying mechanism between the cutter head, grinding mill and mixing fan and also provides a separating mechanism which separates the lighter material from the heavier material as the cut material is falling from the cutter head mechanism to the grinding mechanism, thereby increasing the capacity of the mill many fold. All this is accomplished by the simple construction of a valve and cooperating parts. As previously pointed out, if the operator desires to convert the machine into a conventional form of ensilage cutter, the valve 48 is adjusted so that the opening 56 is closed by the vane 54 by adjusting the thumb screw 58 and by positioning the valve or plate 48 in the dotted line position shown in Fig. 1. When in this position, green fodder may be cut and elevated for filling a silo. If the operator is desirous of cutting dry alfalfa and grinding corn, oats or wheat with the same, the valve 48 may be positioned in the full line position shown in Fig. 1. In this position the dry alfalfa may be fed into the cutter head and as the material falls from the cutter head mechanism to the grinding or hammer mill 20, the lighter material will be separated from the heavier material by the currents of air passing through the openings 67. The effective air currents may be regulated by the adjustable plate 68 over the opening 67. These currents of air will pass transversely of the separating chamber located between the cutter head and the hammer mill and passed upwardly under the vane 54 into the conduit 35 to the mixing fan, where it will be mixed with the material further comminuted by the grinding mechanism or hammer mill 20. In this connection, additional corn or oats may be placed into the hopper 42 and conveyed by the feed screw 43 through an adjustable opening into the hammer mill. It will be further noted that the effective separation of separating mechanism may be increased or diminished in accordance with the type of material being worked upon by adjusting the thumb screw 58 after the plate 61 has been removed.

From the above description it will be readily seen that I have provided a simple, compact and improved construction of a roughage mill which may be converted from a conventional form of ensilage cutter to a type of mill which is capable of not only grinding a variety of feed, but one whose capacity is increased many fold over conventional forms of roughage mill.

In the modified form of my invention as shown in Figs. 6 and 7, the essential features of the preferred form of my invention are embodied with the exception of the separating mechanism, which has been eliminated and permits the essential operating parts to be more compactly arranged. However, the construction disclosed in this modified form permits the material to be directed from the cutting head mechanism to the grinding mill or directly to the mixing fan, without the necessity of providing a positive or actuated conveying means. This modified form, as in the preferred form, consists of a general main frame structure, generally indicated by the reference character 75, which has mounted therein a main shaft 76 journaled in suitable bearings 77 on the cutter head housing 78. Secured to the main shaft is a rotary cutter head 79, main drive pulley 80 and a supplemental pulley 81 which operatively drives a pulley 82 secured to a shaft 83, which in turn is journaled in suitable bearings 84 secured to the housing of a hammer mill head 85. This hammer mill head 85 is secured to the shaft 83 and is provided with a concave or grate 86 which extends substantially half way around and adjacent the periphery of the hammer mill 85. Mounted on the shaft 83 adjacent the hammer mill is a mixing fan 86 which is mounted in the fan housing 87. An opening in one side of the fan housing 87 communicates by means of a conduit 88 with a trough 89 located below and adapted to receive the material passing through the grate 86. Also communicating with the same side of fan housing 87 is a second conduit 90 through which the material may be conveyed or directed to the mixing fan from the cutter head 79. Pivoted on the wall 91 between the hammer mill and the mixing fan is a valve 92 which may be manipulated by a crank handle 93 from outside the mill. The valve 92 is adapted to be positioned or adjusted to the dotted line position shown in Fig. 6 and rested on an inclined ledge 94 below and on one side of the grate or concave 95 which extends around adjacent the periphery of the cutter head 79. Positioned on one side of the cutter head 79 is a hopper 94' which has located in the bottom thereof, a feeding screw 95, which in turn is driven by a pulley 96 secured to a common shaft 97. The pulley 96 is driven by a pulley 98 which in turn is secured to the main drive shaft 76. Like the hammer mill in the preferred form of my invention, the modified form is provided with a horizontal conveyor belt 99, an idle feed roller 100 and an endless feeding floating belt 101, all of which is encased in a housing or hood 102. An adjustable plate 103 is provided at the inner ends of the conveyor screw for controlling the feed of the material or grain placed into the hopper 94'.

From the above description, it will be readily seen that when the pivoted valve 92 is in the dotted line position shown in Fig. 1, the material passing through the cutter head will be fed directly from the cutter head to the mixing fan, in which case, additional grain may be placed into the hopper and ground and mixed by the same passing into the trough 89 and up the conduit 88 into the mixing fan with the material coming from the cutter head, or, if the operator so desires, material cut by the cutter head may be directed into the grinding or hammer mill 85 and the same further comminuted with grain placed in the hopper 94' in which case both will

be mixed by the mixing fan and elevated through the conduit 105 to any suitable receptacle.

From the above description it will be readily seen that I have provided a simple, compact and novel type of roughage mill which is capable of being used in the manner of a conventional form of ensilage cutter, yet at the same time, may be converted for producing various types of forage in accordance with the desires of the operator.

While in the above specification I have provided a preferred form of my invention and one modification thereof, it will of course, be understood that still other modifications may be made without departing from the spirit and scope of the invention as expressed in the following claims:

What I claim is my invention and desire to secure by Letters Patent is:

1. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism located directly below said cutter head, a separating chamber located between said cutter head and said grinding mechanism, and a mixing fan mechanism communicating with said separating chamber and with said grinding mechanism for elevating and mixing the material ground by said grinding mechanism with the lighter material separated from the heavier material in said separating chamber.

2. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a hammer mill located vertically below said cutter head, a separating chamber located between said cutter head and said hammer mill, a mixing mechanism including a single fan mounted on said frame, and conduits connecting said hammer mill with said mixing mechanism, whereby the lighter material withdrawn from said separating chamber is mixed with the material ground by said hammer mill.

3. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a hammer mill located directly below said cutter head, a separating chamber located between said cutter head and said hammer mill, and a mixing mechanism including a single fan communicating with said hammer mill and with said separating chamber for separating the lighter material from the heavier material in said separating chamber and for elevating and mixing the material ground by said hammer mill with the lighter material separated in said separating chamber.

4. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a hammer mill located directly below said cutter head for grinding certain of the material cut by said cutter head, a separating chamber located between said cutter head and said hammer mill, a mixing mechanism including a rotary fan mounted on said frame and communicating with said hammer mill and said separating chamber, and a pivoted valve for controlling communications between said cutter head and said hammer mill.

5. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism located vertically below said cutter head, a hopper positioned above said grinding mechanism for feeding grain thereto, a mixing mechanism mounted in said frame, means for connecting said mixing mechanism with said cutter head, said last named means being operable to connect said grinding mechanism with said mixing mechanism, and means for diverting the material cut by said cutter head into said mixing mechanism or into said grinding mechanism.

6. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism located vertically below said cutter head, a hopper mounted above said grinding mechanism for feeding grain thereto, a mixing mechanism mounted on said frame, a conduit connecting said mixing mechanism with said cutter head, a second conduit connecting said mixing mechanism with said grinding mechanism, and a pivoted valve located below said cutter head for directing the material from said cutter head into said grinding mechanism or into said mixing mechanism.

7. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism located vertically below said cutter head, a hopper positioned above said grinding mechanism for feeding grain thereto, a mixing mechanism located adjacent said grinding mechanism, a conduit connecting said mixing mechanism with said cutter head, a second conduit connecting said mixing mechanism with said grinding mechanism, and a manually controlled valve located below said cutter head for directing the material from said cutter head into said grinding mechanism or into said mixing mechanism.

8. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism located vertically below said cutter head, a hopper positioned above said grinding mechanism for feeding grain thereto, a mixing mechanism positioned below said cutter head adjacent said grinding mechanism, a conduit connecting said mixing mechanism with said cutter head, a second conduit connecting said mixing mechanism with said grinding mechanism, and a manually controlled pivoted valve located between said first named conduit and said grinding mechanism for directing the material cut by said cutter head into said grinding mechanism or into said mixing mechanism.

9. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism mounted on said frame and located vertically below said cutter head, a separating chamber located between said cutter head and said grinding mechanism, pneumatic mixing mechanism located adjacent said grinding mechanism and communicating with said cutter head and with said grinding mechanism, a valve pivoted in said separating chamber, and a pivoted vane adjustably mounted on said valve for controlling the amount of air passing therethrough for separating the lighter material from the heavier material as the same is falling from said cutter head to said grinding mechanism.

10. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism located vertically below said cutter head, a separating chamber located between said cutter head and said grinding mechanism, pneumatic means located adjacent said grinding mechanism and communicating with said cutter head and said grinding mechanism, a manually controlled valve mounted in said separating chamber, an adjustable vane carried by said valve for controlling the amount of air passing therethrough whereby the lighter material cut by said cutter head is separated from the heavier material by said pneumatic

means, and subsequently mixed with the material ground by said grinding mechanism.

11. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism located vertically below said cutter head, a pneumatic mixing, elevating and separating fan mounted on said frame and adapted to communicate with said separating chamber and said grinding mechanism, a movable valve located between said pneumatic mixing mechanism and said separating chamber, and means for varying the amount of air passing through said valve for controlling the separation in said separating chamber.

12. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism mounted on said frame, a separating chamber located between said cutter head and said grinding mechanism, pneumatic elevating, conveying and separating fan mechanism mounted on said frame and communicating with said separating chamber and said grinding mechanism, a pivoted valve mounted in said separating chamber for controlling communication between said pneumatic fan and said separating chamber, an adjustable vane carried by said valve for varying the effect of air currents for separating the lighter material from the heavier material as the same is dropping from said cutter head to said grinding mechanism.

13. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism mounted on said frame, a separating chamber located between said grinding mechanism and said cutter head, pneumatic means for elevating, mixing and conveying material mounted on said frame and communicating with said separating chamber and said grinding mechanism, an adjustable vane for controlling the amount of air withdrawn from said separating chamber, and an adjustable damper located opposite said vane for controlling the amount of air passing through said separating chamber.

14. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism mounted on said frame and located vertically below and spaced from said cutter head, a separating chamber formed between said cutter head and said grinding mechanism, a pneumatic fan mounted on said frame adjacent said grinding mechanism and communicating with said separating chamber and said grinding mechanism, a valve pivoted in said separating chamber for controlling the communication between said pneumatic fan and said cutter head, an adjustable wind vane mounted on said valve for regulating the amount of air passing therethrough, and an adjustable damper mounted in one side of said separating chamber for controlling the amount of air passing therein.

15. In a machine of the class described comprising a frame, a shaft mounted in said frame, a cutter head mounted on said shaft, a second shaft mounted on said frame directly below said cutter head, a hammer mill mounted on said second named shaft, a pneumatic fan mounted on said second named shaft adjacent said hammer mill and communicating with said cutter head and hammer mill, a separating chamber located between said cutter head and said hammer mill, a valve for controlling communication between said cutter head and said pneumatic fan, an adjustable vane pivoted to said valve for controlling the amount of air passing therethrough, and an adjustable damper located in the side wall of said chamber opposite said vane for controlling the amount of air passing into said air separating chamber.

16. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism located vertically below said cutter head, a mixing mechanism mounted on said frame adjacent and laterally with respect to said grinding mechanism, a conduit connecting said mixing mechanism with said cutter head, a second conduit connecting said mixing mechanism with said grinding mechanism, and a valve located below said cutter head for directing the material from said cutter head into said grinding mechanism or into said mixing mechanism.

17. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism located vertically below said cutter head, a mixing mechanism located adjacent said grinding mechanism, a conduit connecting said mixing mechanism with said cutter head, a second conduit connecting said mixing mechanism with said grinding mechanism, and a manually controlled valve pivoted to one side of said grinding mechanism for directing the material from said cutter head into said grinding mechanism or into said mixing mechanism.

18. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism located vertically below said cutter head, a mixing mechanism positioned below said cutter head adjacent said grinding mechanism, a conduit connecting said mixing mechanism with said cutter head, a second conduit connecting said mixing mechanism with said grinding mechanism, and a manually controlled pivoted valve located between the said mixing mechanism and said grinding mechanism for directing the material cut by said cutter head into said grinding mechanism or into said mixing mechanism.

19. In a machine of the class described, comprising a frame, a shaft mounted on said frame, a cutter head mounted on said shaft, a second shaft mounted on said frame substantially vertically below said first named shaft, a grinding mechanism mounted on said second named shaft vertically below said cutter head for grinding the material cut by said cutter head, and a fan mounted on said second named shaft and communicating directly with said cutting mechanism and said grinding mechanism for mixing the material reduced by both of said mechanisms.

20. In a machine of the class described, comprising a frame, a shaft mounted on said frame, a cutter head mounted on said shaft, a second shaft mounted on said frame substantially vertically below said first named shaft, a grinding mechanism mounted on said second named shaft and associated with said cutting mechanism, means mounted below said cutter head for directing all of the material or a part of said material having certain characteristics into said grinding mechanism and a fan mounted on said second named shaft and communicating directly with each of said cutting and grinding mechanisms at a point adjacent the lower portion of said mechanism.

21. In a machine of the class described comprising a frame, a shaft mounted on said frame, a cutter head mounted on said shaft, a second

shaft mounted on said frame parallel to and located below said first named shaft, a grinding mechanism mounted on said second named shaft, a mixing fan mounted on said second named shaft and located to one side of said grinding mechanism, a diagonally disposed conduit connecting said mixing fan with said cutting mechanism, a second diagonally disposed conduit connecting said grinding mechanism with said mixing fan, and a valve located in the communication between said cutting mechanism and said mixing fan for controlling the direction of the material cut by said cutting mechanism.

22. In a machine of the class described comprising a frame, a shaft mounted on said frame, a cutter head mounted on said shaft, a second shaft mounted on said frame parallel to and below said first named shaft, a grinding mechanism mounted on said second named shaft, a mixing fan mounted on said second named shaft, a separating chamber located and forming the communication between said cutting mechanism and said grinding mechanism, a conduit communicating said separating chamber with said fan, a second conduit communicating said grinding mechanism with said fan, and a valve located in said separating chamber for controlling the communicating of said cutting mechanism with said grinding mechanism and said fan.

23. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism positioned vertically below and spaced from said cutter head forming a separating chamber therebetween, a fan mounted on said frame and communicating directly with said cutter head and said grinding mechanism for mixing the material ground by said grinding mechanism with the material cut by said cutting mechanism, and means mounted within said separating chamber for varying the effective separation of the material passing through said separating chamber.

24. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a hammer mill mounted on said frame and located vertically below said cutter head, a separating chamber located between said cutter head and said hammer mill, a valve located at one side of said chamber and directly under said cutter head for controlling communication between said cutter head and said hammer mill, a hopper mounted on said frame for supplying material to said hammer mill, and means including a rotary fan mounted on said frame for mixing the material and conveying the material from said hammer mill and from said cutter mill.

25. In a machine of the class described comprising a frame, a cutter head mounted on said frame for cutting the material into roughage, a separating mechanism located below said cutter head for separating the roughage into two portions having different characteristics, a grinding mechanism located vertically below said separating mechanism for grinding one of said portions, a mixing mechanism mounted on said frame for mixing the remaining portion with the ground portion, a valve located in said separating chamber for directing the material from said cutter head into said grinding mechanism or into said mixing mechanism, and means carried by said valve for controlling the separation of the material passing through said separating mechanism.

26. In a machine of the class described comprising a frame, a cutter head mounted on said frame, a grinding mechanism positioned vertically below and spaced from said cutter head forming a separating chamber therebetween, a fan mounted on said frame and communicating directly with said cutter head and said grinding mechanism for mixing the material ground by said grinding mechanism with the material cut by said cutting mechanism, and means mounted within said separating chamber for varying the effective separation of the material passing through said separating chamber or for controlling the communication between the cutter head and each of said grinding and mixing mechanisms.

27. In a machine of the class described, comprising a frame, a cutter head mounted on said frame, a grinding mechanism mounted on said frame vertically below said cutter head, a mixing mechanism comprising an elevating fan mounted on said frame for mixing the ground material with the cut material, a separating chamber communicating with said mixing mechanism and located between said cutter head and said grinding mechanism through which the material falls from the cutter to the grinder for effecting a separation of the material by the draft created by said mixing mechanism, and means whereby the draft created by said mixing mechanism effects a bodily lift and separation of the lighter material from the heavier material as the material is falling from said cutter head to said grinding mechanism.

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