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APPARATUS FOR GRINDING AND PULVERIZING EAR CORN AND THE LIKE

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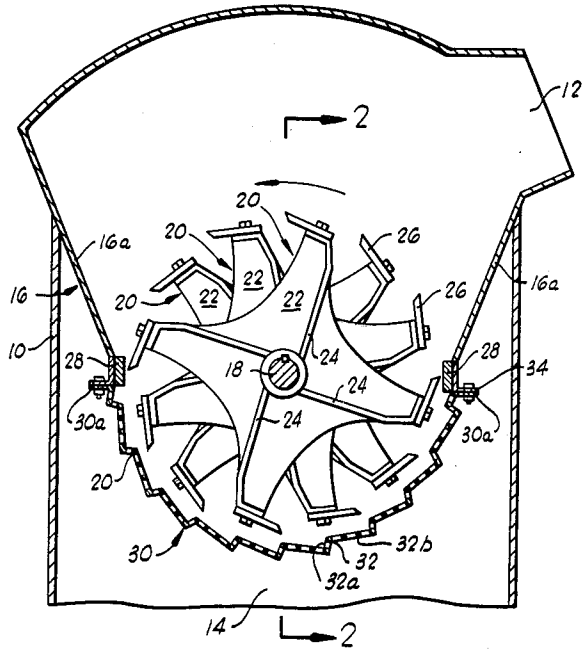


Fig. 1

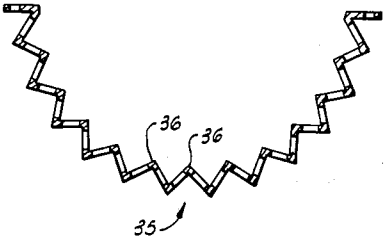


Fig. 3

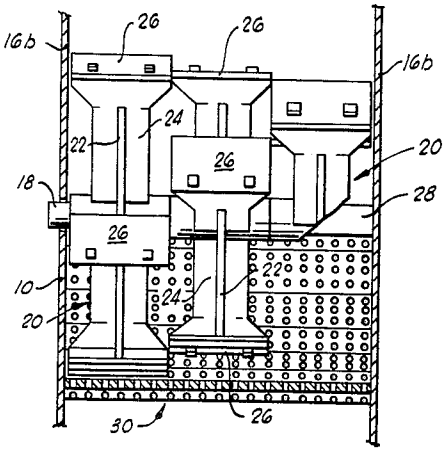


Fig. 2

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APPARATUS FOR GRINDING AND PULVERIZING EAR CORN AND THE LIKE

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This invention relates to grinding and pulverizing apparatus. More particularly, but not by way of limitation, the present invention relates to apparatus for grinding and pulverizing materials such as ear corn and the like.

Hammer mills and related devices which function to effect the disintegration of various materials are well known and find application in a variety of uses. One of the previous applications of such devices has been in the production of ensilage or feed for livestock, for example, from ear corn. Such mills as have previously been utilized for this purpose function to separate the corn kernels from the cobs, disintegrate or grind up the cobs, and chop up the corn shucks. The shelling of the kernels from the cob, as well as the grinding and disintegration of the shucks and cobs, is effected by entrapping the ears of corn between stationary bars and a plurality of helical bars mounted on the periphery of a rotating rotor structure. After the kernels have been separated from the ear, and the ear and shucks have been pulverized, the mass of pulverulent material falls downwardly into a screen through which it ultimately passes and is received in a suitable container for further disposition, such as fine grinding by use of cooperating pressing rollers.

Several disadvantages have characterized hammer mills, burr mills and similar devices of the type described in their application to the grinding or pulverizing of ear corn and other grains having substantial roughage or fibrous portions corresponding to the shucks of the corn. Thus, the use of cooperating bars to accomplish the shelling of the ears and also to effect the disintegration and pulverizing of the shucks has presented the undesirable result of the shucks or other fibrous material often being merely compressed or folded by the cooperating bars rather than being completely cut through and disintegrated. As a consequence of the failure of such mills to efficiently reduce the shucks or fibrous portions to particulate form, these portions of the material which is fed to the mill accumulate on the screens which are disposed below the rotor and soon result in the screens becoming clogged to the extent that further operation is impossible. This condition has been aggravated by the previous design of such screens. In most of the types of such screens with which applicant is familiar, a plurality of bars or ribs extend longitudinally of the screen along its upper surface for the purpose of reinforcing the screen and guiding or directing the pulverized material through the openings in the screen. Such ribs are usually of generally rectangular cross section and actually present obstacles to the downward movement of the pulverized material into the lowest portion of the screen.

The ribs constitute a ledge or dam behind which the fibrous material which has not been properly pulverized by the cooperating bars is free to accumulate and thus bridge the perforations in the screen. Moreover, the utilization of such ribs adds substantially to the cost of the screen and the overall cost of the pulverizing apparatus.

The present invention contemplates an apparatus for pulverizing ear corn and related materials, which apparatus is characterized by a plurality of rotating cutting members which cooperate with stationary bars during rotation to effect the substantially complete disintegration of both fibrous and non-fibrous materials. The invention further contemplates the utilization of a novel semi-circular screen which is disposed beneath the bars and rotating cutting members to receive the pulverulent material and screen it as to particle size before it is permitted to gravitate to a receptacle beneath the screen. In a preferred embodiment, the screen is constructed of a single semi-cylindrical metallic plate which is longitudinally corrugated to provide a series of alternating ridges and depressions. The screen is secured coaxially beneath the rotating cutting members so that the ridges and depressions extend substantially parallel to the axis of rotation of the rotating cutting members. Each of the ridges and depressions is perforated to prevent the accumulation of materials on the upper surface of the screen in sufficient quantities to result in the blockage or choking thereof.

It is an object of the present invention to provide an apparatus for pulverizing materials of partially fibrous nature such as ear corn and the like in an efficient manner.

Another object of the present invention is to provide apparatus for pulverizing ear corn and the like which is capable of extended trouble-free operation without the occurrence of jamming or blocking of the screen associated therewith.

Another object of the present invention is to provide an apparatus which is capable of efficiently disintegrating fibrous material such as corn shucks, wheat stalks and the like while pulverizing and reducing to particulate size the solid portions such as cobs, kernels, grains and the like which are associated with such fibrous portions.

An additional object of the present invention is to provide an apparatus for pulverizing ear corn and the like which is less expensive to manufacture, yet more efficient in operation, than similar devices as previously known.

Other objects and advantages will be evident from the following detailed description, when read in conjunction with the accompanying drawings which illustrate my invention.

In the drawings:

FIGURE 1 is an end view in elevation of the pulverizing apparatus of the present invention as it appears when it is viewed from one end with the end portion of the internal wall removed.

FIGURE 2 is a sectional view taken along the lines 2—2 of FIG. 1 with the rotor shown in elevation and with a portion of the rotor structure broken away to illustrate the relative arrangement of the rotor structure, stationary bars, and screen of the invention. The end portion which is removed in FIGURE 1 is replaced in FIGURE 2.

FIGURE 3 is a transverse section taken through the center of a modified form of screen which may be used in a modified embodiment of the present invention.

Referring now to the drawings and particularly to FIG. 1, reference character **10** generally designates a housing for the pulverizing apparatus of the present invention. The housing **10** has an inlet **12** in its upper portion and an outlet **14** at its lower side. An internal wall **16** having side and end portions **16***a* and **16***b*, respectively, is disposed inside the housing **10** and tapers downwardly and inwardly from the upper portion thereof to form a gravity feed chute.

A shaft **18** extends horizontally across the gravity feed chute formed by internal wall **16** and is rotatably journaled in each of the end portions **16***b* thereof. A plurality of cutter heads **20** are enclosed within the internal wall **16** and are coaxially keyed to the shaft **18**. Each of the cutter heads **20** comprises a supporting plate **22** of generally four-cusped, hypocycloidal configuration, a plurality of radially-extending web members **24** reinforcing the supporting plate, and four cutting members or blades **26**, one of which is bolted to each of the cusps of said plate. The cutter heads **20** are keyed to the shaft **18** so that the blades **26** of adjoining cutter heads **20** are

circumferentially offset from each other by an angle of approximately 30°. The composite cutter head structure thus formed may be termed a rotor and will be so referred to hereinafter.

It will be noted, in referring to FIGURE 1, that each of the flat blades **26** extends tangentially to an imaginary circle drawn through its point of attachment to its respective cutter head and concentric to the axis of rotation of said rotor. This particular arrangement of the blades **26** affords a substantial improvement in the efficiency of the pulverizing apparatus in shelling kernels of corn from their cobs as will be hereinafter explained.

A pair of elongated bars **28** is secured to the lower end of opposite side portions **16***a* of the internal wall **16**, and extend parallel to each other and to the shaft **18** in a common horizontal plane. At their lower ends, the side portions **16***a* of the internal wall **16** support a perforated screen designated generally by reference character **30**. The screen **30** is disposed beneath the rotor in coaxial relation to the shaft **18** and is bolted at each of its longitudinal edges **30***a* to a flange **34** formed at the lower end of each of the side portions **16***a* of the internal wall **16**. The screen **30** is semi-cylindrical in configuration and is characterized by a plurality of longitudinally-extending, ratchet-like ribs **32**. Each of the ribs **32** has a first side **32***a* which extends at an angle of about 30° to a projected diameter of the rotor and which may be said to extend generally inwardly toward the center of said rotor, and a second side **32***b* which extends parallel to a tangent of the rotor and is wider than the first side **32***a*.

A modified type of screen which may be utilized in the present invention instead of the screen depicted in FIG. 1 has been illustrated in FIG. 3. It will be perceived that the screen **35** of FIG. 3 is characterized by a plurality of longitudinal corrugations or ridges **36** not unlike the ribs **32** of the screen **30** depicted in FIG. 1. However, the ridges **36** of screen **35** differ from the ribs **32** of screen **30** in that each of the sides which form the ridges **36** are of equal width, whereas, as has previously been explained, the ratchet-like ribs **32** of the screen **30** depicted in FIG. 1 are characterized by two sides **32***a* and **32***b*, one of which is substantially wider than the other. Stated differently, the screens **35** of FIG. 3 may be described as having a plurality of integrally-connected ridges and depressions which alternately adjoin each other and which are complementary in configuration to each other.

Operation

To commence the operation of the pulverizing apparatus, a suitable motor (not shown) which is drivingly connected to the shaft **18** is energized and drives the rotor structure in rotational movement. When the rotor has obtained operating speed, the ear corn or like material to be pulverized is introduced into the inlet **12** in housing **10**. The direction of rotation of the rotor is counterclockwise, as indicated in FIG. 1, and as the ears of corn fall downwardly in the housing **10**, they are directed by the internal walls **16** into the path of the rapidly rotating cutter heads **20**. The cutter heads **20** carry the ears of corn across the housing **10** and entrap them between the blades **26** and the longitudinally-extending bar which is secured on the inside face of the internal wall **16**.

When the corn ears have been entrapped between the bar **28** and the blades **26**, they are sheared off and disintegrated by successive contact with the rapidly rotating blades. At the same time, the kernels of corn are shelled from the cobs and the shucks are chopped up and sheared into many small pieces. The axial offset of the cutter heads from each other provides a relatively even distribution of the blades **26** around the periphery of the rotor and thereby assures a substantially constant power requirement for the rotation of the rotor. The axial offset of the cutter heads and the even distribution of the blades **26** around the periphery of the rotor also assures that no appreciable spaces exist around the periphery of the rotor which are large enough to permit the ingress of the ears of corn to the inside of the rotor adjacent its shaft **18**.

As has been indicated, the fibrous material or roughage, such as shucks, stalks, etc., are chopped or disintegrated into fine particles which then fall downwardly into the screen **30** along with the disintegrated cobs and the kernels or grains which have been shelled therefrom. The particular configuration and construction of the screen **30** is an important feature of the present invention. The ratchet-like ribs **32** of the screen depicted in FIG. 1 act as abutments or dams which arrest the downward movement of the pulverized material and enable it to be subjected to further action by the blades **26**. As the blades **26** pass over the screen **30**, they will press all of the pulverized material which is of sufficiently small size through the screen. In the case of portions of the cob or shucks which have not been reduced sufficiently in size to pass through the apertures or perforations in the screen **30**, the blades **26** cooperate with the ribs **32** and also with the second longitudinal bar **28** to effect a further reduction in size. The relative positions of the breaker bars **28**, sides **32***a* of ribs **32**, and blades **26** is such that when unshelled corn ears are positioned between either the breaker bars **28** and the blades **26**, or between the sides **32***a* and the blades **26**, with the axes of the ears of corn extending parallel to the axis of the rotor, the blades **26** pass through a line extending approximately through the roots of the corn kernels. The kernels are therefore stripped cleanly from the cobs. Since the shorter side **32***a* of each rib **32** is perforated in the same manner as the longer side **32***b*, the shorter side **32***a* does not present a barrier behind which the pulverized material may accumulate in quantities sufficient to permit the screen to become clogged. Moreover, screens of the type depicted in FIGS. 1 and 3 are considerably less expensive to manufacture than the less efficient screens of the prior art which have been characterized by longitudinally-extending, solid bars or ribs placed upon the upper surface of the screen.

The modified form of screen which may be utilized in place of the screen **30** depicted in FIG. 1 is shown in FIG. 3. It will be apparent that the ridges **36** of the screen **35** are analogous to the ratchet-like ribs **32** which characterize the screen **30** and the two screens function in substantially the same manner.

From the foregoing discussion it will be apparent that the pulverizing apparatus of the present invention is capable of simultaneously reducing solid materials such as corn cobs and kernels to particulate size, while also cutting or chopping the fibrous materials or roughage associated therewith into small particles. An improved screening of the pulverulent material so produced is also afforded by the present apparatus.

Although this invention has been described with a certain degree of particularity, it is manifest that many changes may be made in the details of construction and arrangement of the components without departing from the spirit or the scope of this disclosure. Accordingly, this invention should be considered as limited only by the scope of the appended claims.

I claim:

1. Apparatus for grinding and pulverizing ear corn and the like comprising a housing having an inlet in one side thereof and having an outlet in the lower portion thereof; an internal wall disposed inside, and connected at its upper end to, said housing and tapering downwardly and inwardly to form a gravity feed chute leading downwardly from said inlet; a horizontal shaft extending through said internal wall and rotatably journaled therein; a horizontal, generally cylindrical rotor inside said gravity feed chute and coaxially keyed to said shaft for rotation therewith, said rotor comprising a plurality of cutter heads each

including a support member of generally four-cusped, hypocycloidal configuration, and a blade secured to each cusp thereof, said cutter heads each being keyed to said shaft in circumferentially-offset relation to the next adjoining cutter head whereby the blades of adjoining cutter heads are spaced from each other approximately 30° around the periphery of said rotor; a pair of breaker bars extending parallel to said shaft and to each other and secured to said inner wall at two of its lower edges, said breaker bars being located generally in the horizontal plane containing said shaft and closely adjacent the cirlar path described by said rotating cutter heads whereby said ears of corn may be entrapped between said cutter heads and said breaker bars during rotation of said shaft; and a semi-cylindrical, longitudinally corrugated, perforated screen disposed coaxially beneath said rotor with each of its longitudinal edges secured to said lower edges of said internal wall adjacent said breaker bars.

2. Apparatus for grinding and pulverizing ear corn and the like comprising wall means forming a gravity feed chute for the material to be ground; a horizontal, generally cylindrical rotor rotatably supported in said chute adjacent the lower end thereof, said rotor comprising a plurality of support members of generally four-cusped hypocycloidal configuration having a blade secured to each cusp thereof with said support members being spaced longitudinally along the axis of rotation of said rotor in abutting relation, each of said blades on said support members being positioned equi-distantly from the axis of rotation of said rotor and circumferentially offset in relation to the blades on the next adjacent support member; a pair of breaker bars extending parallel to the axis of rotation of said rotor in the horizontal plane thereof and secured to the inner surfaces of said gravity feed chute, said breaker bars being located closely adjacent the circular path described by said blades during rotation of said rotor whereby said ears of corn may be entrapped between said blades and said breaker bars during rotation of said rotor; and a semi-cylindrical, longitudinally corrugated, perforated screen disposed coaxially beneath said rotor with each of its longitudinal edges secured to said gravity chute adjacent said breaker bars.

3. Apparatus for grinding and pulverizing ear corn and the like comprising wall means forming a gravity feed chute for the material to be ground; a horizontal, generally cylindrical rotor rotatably supported in said chute

adjacent the lower end thereof, said rotor comprising a plurality of cutter heads spaced longitudinally along the axis of rotation of said rotor in abutting relation, each of said cutter heads having a plurality of blades secured in circumferentially spaced relation around its outer periphery and positioned equi-distantly from the axis of rotation of said rotor, the blades on each of said cutter heads being circumferentially offset in relation to the blades on the next adjacent cutter heads; a pair of breaker bars extending parallel to the axis of rotation of said rotor in the horizontal plane thereof and secured to the inner surfaces of said gravity feed chute, said breaker bars being located closely adjacent the circular path described by said blades during rotation of said rotor whereby said ears of corn may be entrapped between said blades and said breaker bars during rotation of said rotor; and a semi-cylindrical, longitudinally-corrugated, perforated screen disposed coaxially beneath said rotor with each of its longitudinal edges secured to said gravity chute adjacent said breaker bars, said screen comprising a plurality of integrally connected ratchet-like ribs, said ribs each having a first side extending substantially radially inwardly toward said rotor and having a second side wider than said first side and extending parallel to a tangent to said rotor, the second sides of said ribs each being connected between the radially outer edge of one of said first sides and the radially inner edge of another of said first sides, said second sides each extending away from the radially inner end of the first side to which it is connected in a direction corresponding to the direction of rotation of said rotor and away from the leading edges of the cutter heads adjacent said screen.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 16,759	Snyder	Oct. 4, 1927
766,699	Jorgensen	Aug. 2, 1904
1,477,502	Killick	Dec. 11, 1923
1,666,014	Kershner	Apr. 10, 1928
1,945,054	MacGregor	Jan. 30, 1934
2,141,664	Ossing	Dec. 27, 1938
2,833,484	Gooding	May 6, 1958

FOREIGN PATENTS

462,128	Great Britain	Mar. 2, 1937
944,780	France	Nov. 8, 1948