May 5, 1970 W. W. MANN ET AL 3,510,075

HAMMER MILL

Filed March 3, 1967 3 Sheets-Sheet 1

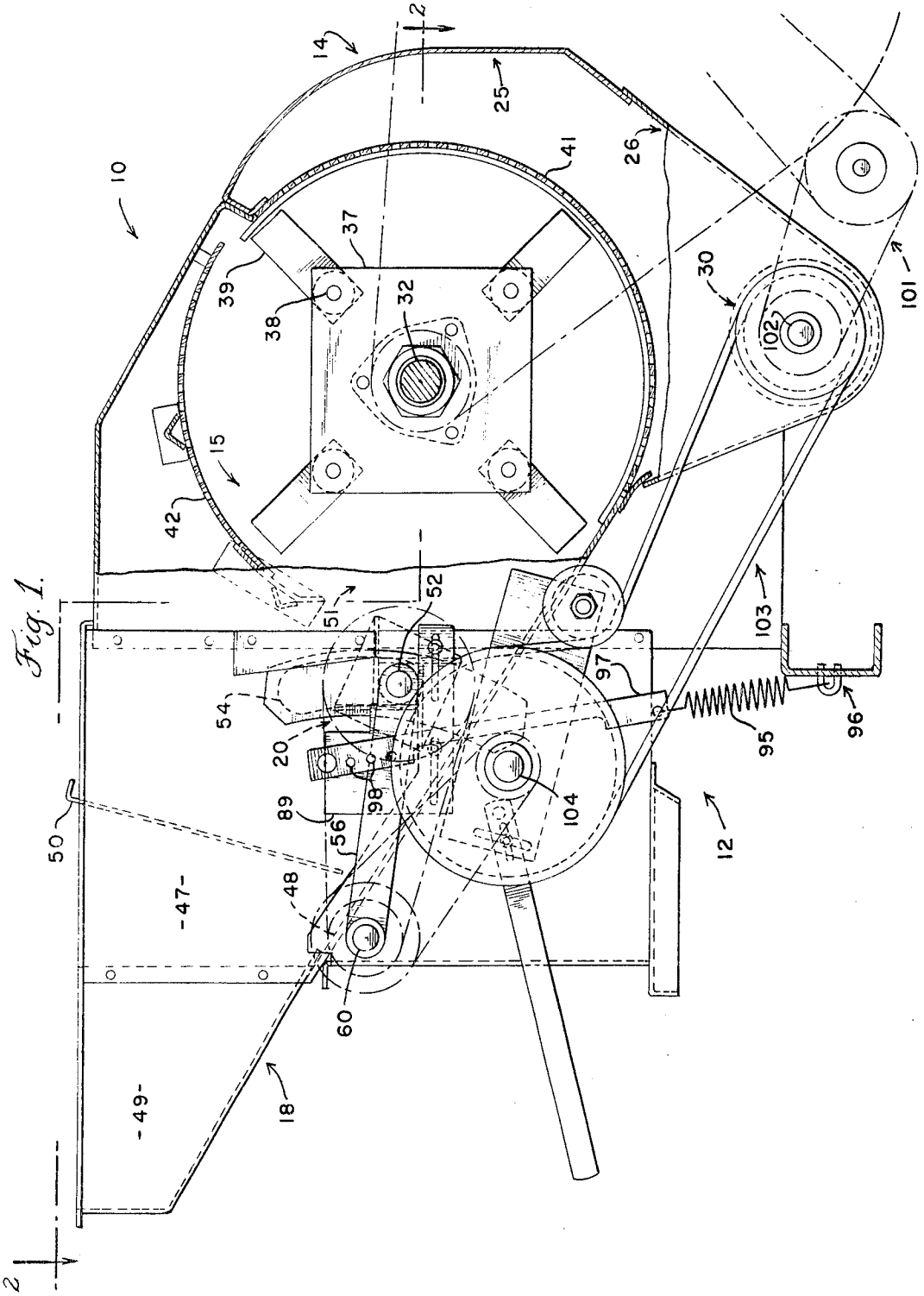

Fig. 1.

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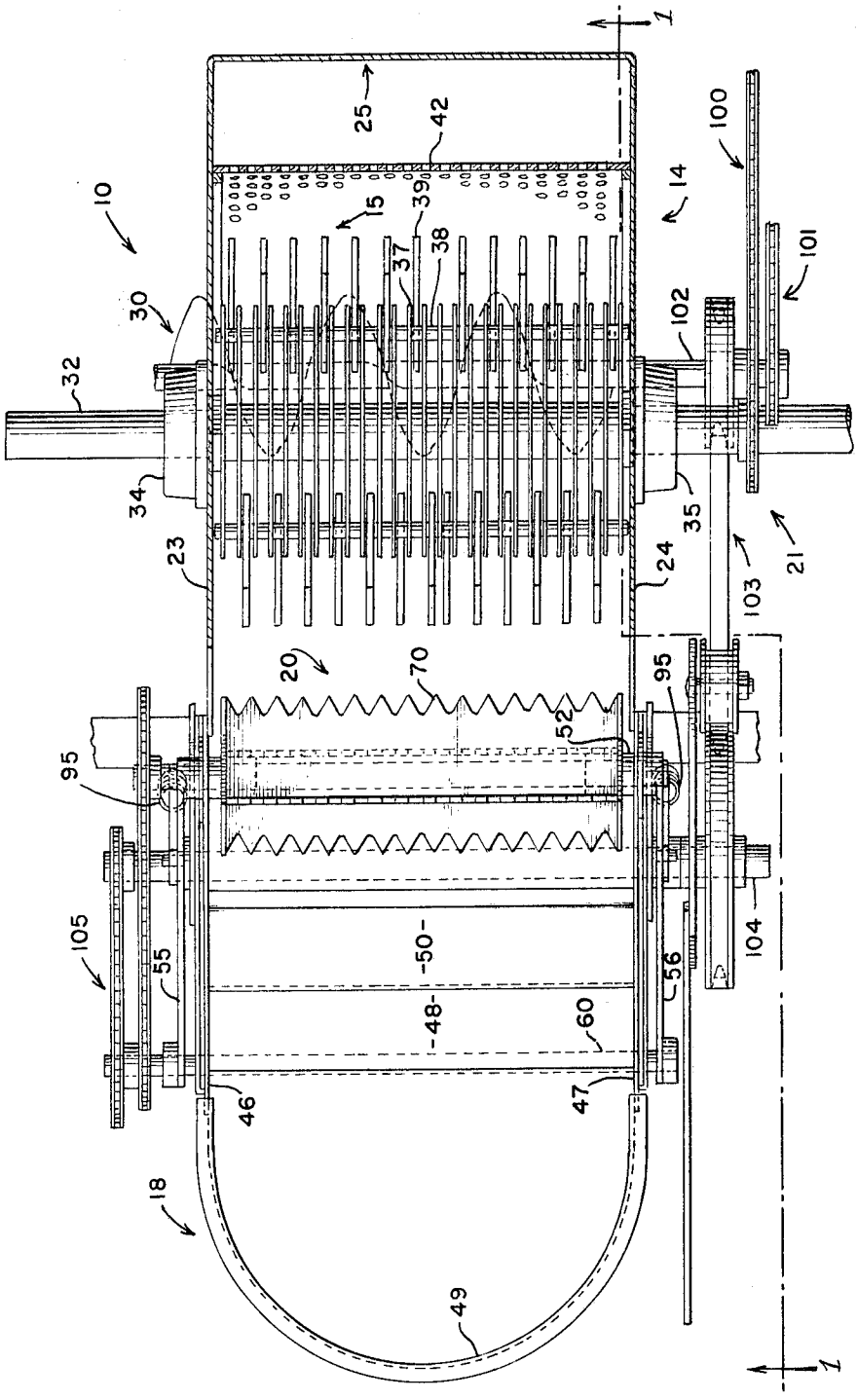

Fig. 2.

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Fig. 3.

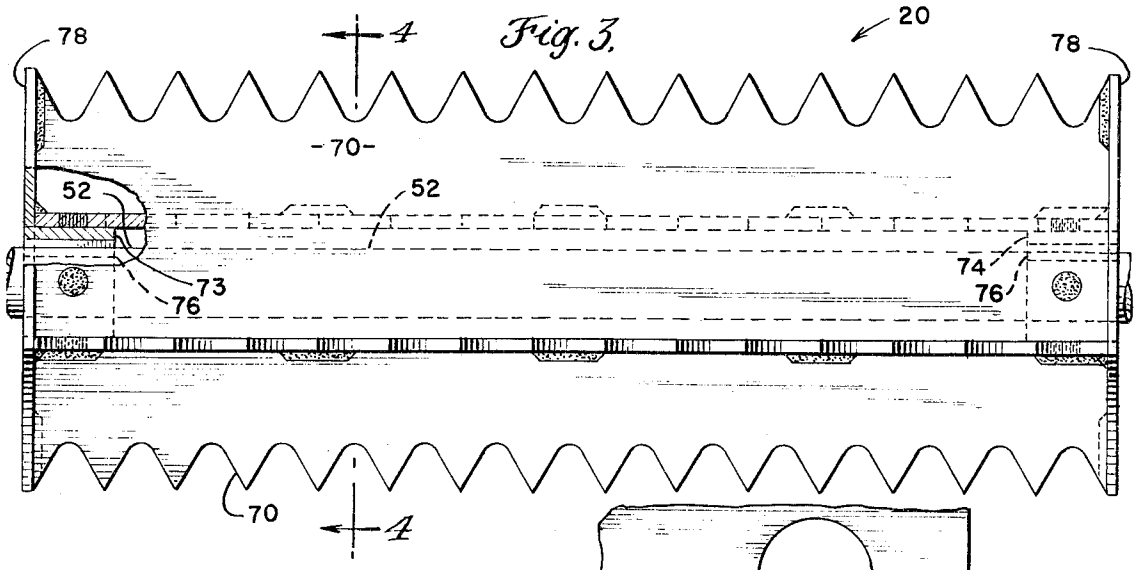
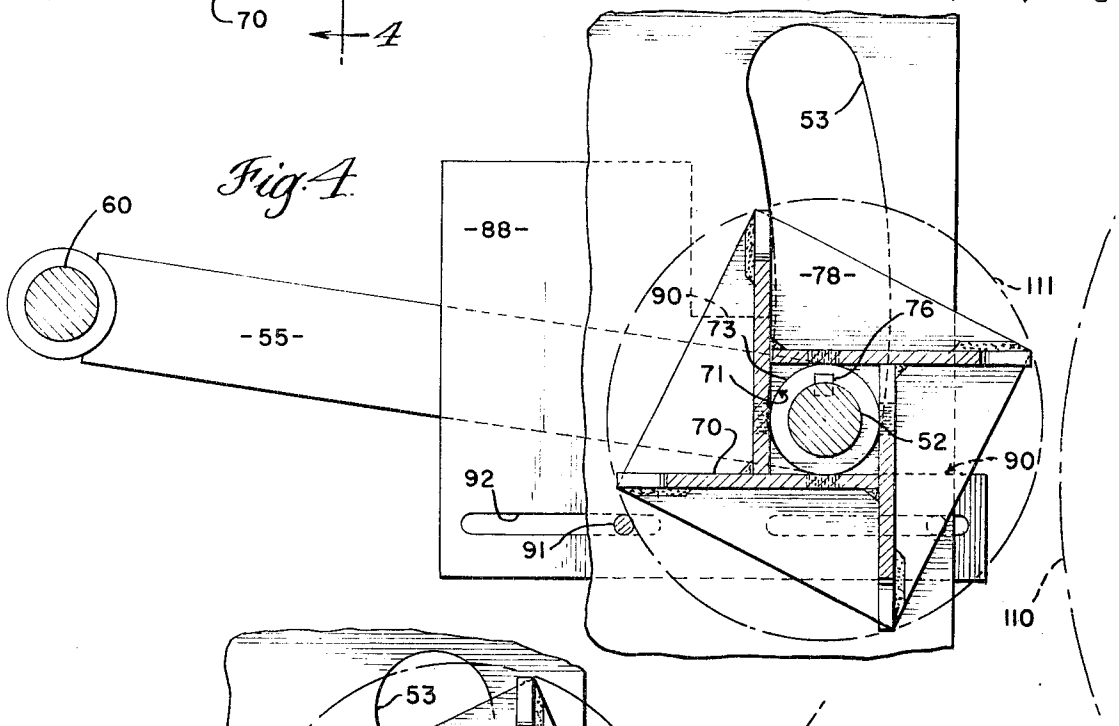


Fig. 4.



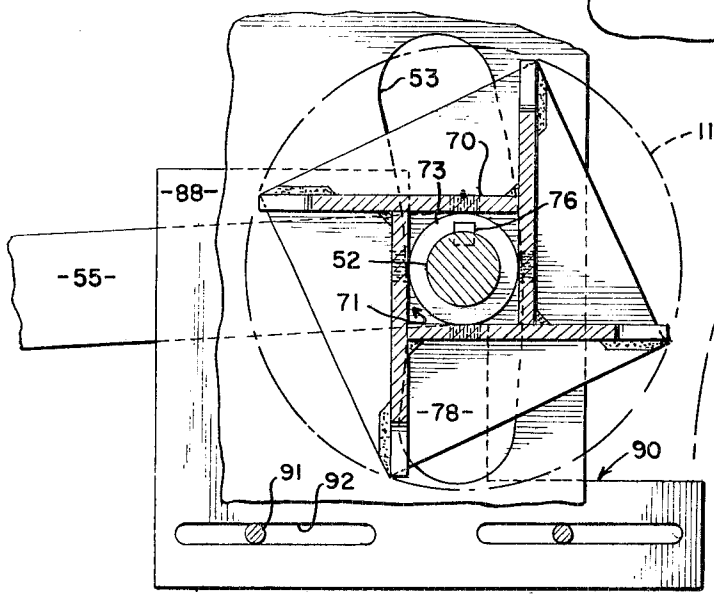


Fig. 5.

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3,510,075

HAMMER MILL

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U.S. Cl. 241—186 10 Claims

ABSTRACT OF THE DISCLOSURE

A hammer mill having a positively driven, pivotally mounted feed roll consisting of blades mounted tangentially about a cylinder which is adjustable and reversible relative to the mill rotor to regulate the aggressiveness and holding effect of the roll.

BACKGROUND OF THE INVENTION

Various types of mobile grinder-mixers have been developed in recent years for use by the individual farmer. The grinder-mixers generally comprise a hammer mill which is used to grind certain types of feed materials before they are conveyed to the mixing tank to be added to a feed mixture. A hammer mill of the type used on grinder-mixers must be adapted to handle many different types of feed material.

Because of the difference in the kinds of feed materials which must be processed through the hammer mill, the provision of an efficient feed mechanism for the mill has been a considerable problem. For some types of material, such as shelled grain, a relatively simple feed mechanism will insure a uniform intake into the hammer mill. However, if an attempt is made to use the same feed mechanism in materials such as hay, the hammer mill has a tendency to pull the hay in too fast which results in unevenly chopped material and failures in the machine components.

SUMMARY OF THE INVENTION

This invention is directed to a hammer mill having a feed roll which is adapted to uniformly convey material into the hammer mill rotor. The feed roll is positively driven and is journalled in a pair of support arms for vertical movement relative to the feed hopper floor. The feed roll is mounted closely adjacent the mill rotor. By so locating the roll, a maximum holding effect can be exerted on the material as it is moved into the rotor, and a stripping action is obtained on the feed roll blades by the rotor hammers.

The feed roll comprises a plurality of axially extending blades which are tangentially mounted to a pair of sleeves which are keyed to the roll shaft. The roll is mounted so that it can be turned end for end when a change in the holding effect and aggressiveness of the roll is desired.

A principal object of this invention is to provide, in a hammer mill of the type described, an improved feed roll which can be adapted to convey all types of feed material.

Another object of this invention is to provide a feed roll which can be selectively positioned in one of two operating positions to change the aggressiveness of the feed of the roll.

Another object of this invention is to provide a feed roll which is adapted to yield in a vertical direction as material moves thereunder and which remains a substantially constant distance from the rotor as it moves vertically.

Another object of this invention is to provide a feed roll having a novel arrangement of the blades thereon to obtain a greater holding effect on the material conveyed by the roll.

Other objects of the invention will be apparent hereinafter from the specification and from the recital of the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a sectional elevational view of the hammer mill, taken as indicated by the line 1—1 in FIG. 2;

FIG. 2 is a plan section, taken on line 2—2 in FIG. 1;

FIG. 3 is a detail view, on a larger scale, of the reversible feed roll;

FIG. 4 is a cross section of the feed roll, as taken on the line 4—4 of FIG. 3, and illustrating the relation of the feed roll to the path of the rotor, the rotor path being indicated in dot-and-dash lines; and

FIG. 5 is a view similar to FIG. 4, but with the feed roll reversed end for end and in another vertical position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings by numerals of reference, and particularly to FIGS. 1 and 2, the machine of this invention is designated generally **10**. Machine **10** comprises a frame structure **12**, a rotor housing **14**, a rotor **15**, a feed hopper **18**, a feed roll **20** in hopper **18**, and drive means **21** for the feed roll.

Rotor housing **14** comprises a pair of vertically extending side walls **23** and **24**, and an end wall **25**. A tapered bottom portion of the housing **26** guides the chopped material into a transfer auger **30**.

Rotor **15** comprises an elongated shaft **32** which is journalled in bearings **34** and **35** fixed respectively to side walls **23** and **24**. A plurality of generally square mounting plates **37** are fixed to rotor shaft **32** in an axially spaced relationship. Rods **38** pass through adjacent corners of plates **37**, and hammers **39** are pivotally mounted on the rods **38**, as shown in FIG. 2. A pair of screens **41** and **42** are fixed in housing **14** and are arranged closely adjacent the hammers **39** so that material will be forced through the screens in a well known manner.

Feed housing **18** is mounted to one side of housing **14** and comprises a pair of side panels **46** and **47** which are joined to housing walls **23** and **24** and are generally parallel thereto. A floor panel **48** extends between panels **46** and **47** at their bottom edges, and a rounded section **49** closes in the end of the hopper. A baffle **50** is removably mounted in the hopper to regulate flow of feed roll **20**.

Feed roll **20** is mounted in hopper **18** closely adjacent hammers **39**, and the roll is adapted to move through a path which extends slightly into an opening **51** formed by housing **14** and screens **41** and **42**. As best shown in FIGS. 3 to 5, feed roll **20** comprises a cetnral shaft **52**, which extends through arcuate slots **53** and **54** in panels **46** and **47** of the feed hopper. The ends of shaft **52** are pivotally mounted in support arms **55** and **56** which extend alongside panels **46** and **47** and which are connected to a transversely extending shaft **60** journalled in frame **12**.

Feed roll **20**, as shown in FIGS. 3–5, comprises a plurality of axially extending blades **70** which are welded together at their inner ends to form a closed center portion **71** which is generally square in cross section. Sleeves **73** and **74** are fixed to the interior of portion **71** at opposite axial ends of the roll, and the sleeves are fixed against movement on central shaft **52** by keys **76**. A pair of end plates **78** are welded to opposite ends of the blades **70** to give rigidity to the feed roll.

The amount of pivotal movement of roll **20** is controlled by a pair of stop plates **88** and **89** which are slidably mounted on hopper side panels **46** and **47**. The stop plates are provided with a series of steps **90** on one end thereof which can be moved into contact with roll shaft **52**. The plates are fixed on the hopper side panels by fasteners **91** which extend through slots **92** in the plates. It will be seen that by moving the stop plates toward the

hammer mill rotor, the lowermost position of feed roll **20** is progressively raised and the degree of roll movement becomes more limited. The feed roll is yieldably compressed against the stop plates by means of springs **95** connected at **96** to frame **12** and connected to the support arms **55** and **56** through elements **97**. Elements **97** can be adjustably positioned on the swing arms through the use of holes **98** to regulate the tension in springs **95**.

Drive means **21** comprises chain drives **100** and **101** connected to a power source not shown. Chain drive **100** serves to rotate rotor shaft **32** of the hammer mill. Chain drive **101** is operatively connected to shaft **102** of the transfer auger **30**. From auger shaft **102**, power is transferred by a belt drive **103** to a cross shaft **104**. A drive mechanism **105** drives the feed roll from cross shaft **104**.

An important feature of this invention is the provision for reversal of feed roll **20** to change the holding action of the feed roll and also the aggressiveness of feed. The feed roll is reversed in the following manner. First, support arms **55** and **56** and the roll drive mechanism **105** are disconnected from the feed roll central shaft **52**. Shaft **52** is then driven out through side panel **46**. The feed roll can now be removed from the hopper and turned end for end. The roll is installed by following the steps described above in reverse order.

In operation, rotor **15**, auger **30**, and feed roll **20**, will be driven at constant speeds. As viewed in FIG. 1, both roll **20** and rotor **15** will be turning in a counterclockwise direction. Material is fed into hopper **18** and moved against the rotating feed roll **20**. Roll **20** conveys the material into the rotor at a uniform rate. When materials, such as hay are handled, the feed roll will be mounted, as shown in FIG. 4, so that a maximum holding effect is exerted on the material as it is moved into the path of rotor **15**. When material, such as ear corn, is being fed into the hammer mill, the roll will be positioned as shown in FIG. 5 to obtain a more aggressive feed with less holding effect. It will be apparent that blades **70**, when in the position shown in FIG. 4, pass through the position where the holding effect is greatest, i.e. when the blade is perpendicular to floor panel **48**, at a point considerably closer to the rotor, than when the roll is positioned as shown in FIG. 5. When the roll is in the position shown in FIG. 5, the blades are in a higher vertical position relative to the floor panel **48** as they start down to take a new charge of material; thus, the blades are more aggressive in this position.

The feed roll shaft **52** is adapted to move vertically within the limits of the space determined by slots **53** and **54** and plates **88** and **89**. The path of rotor **15** is indicated by the dot-and-dash line **110** (see FIGS. 4 and 5), and the path through which roll **20** rotates is indicated by dot-and-dash line **111**. As best shown in FIG. 1, the axis about which roll **20** rotates will be below a line joining the rotor shaft axis and the axis of shaft **60** so that for a portion of the vertical movement of roll **20** from its lowest position, the roll will actually move closer to the rotor. For the entire range of vertical movement of roll **20**, the roll remains closely adjacent to the hammer mill rotor so that any material picked up by the feed roll will be stripped off by the rotor hammers.

While this invention has been described in connection with a particular embodiment thereof, it will be understood that it is capable of modification, and this application is intended to cover any variations, uses, or adaptations following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains, and as fall within the scope of the invention or the limits of the appended claims.

Having thus described our invention, what we claim is:

1. In a hammer mill, the combination of:

a rotor comprising an elongated shaft mounted for rotation about a horizontal axis and hammers mounted on said shaft to generate a cylinder on rotation;

means for rotating said rotor;

a floor for carrying material moved into the path of said rotor, said floor extending generally parallel to said axis;

a feed roll rotatably mounted above said floor and adjacent said rotor for moving material to be processed into the path of said rotor, said feed roll being adapted to move toward and away from said floor to accommodate varying quantities of material, said feed roll having a central shaft and a plurality of axially extending blades mounted thereon, and said blades being mounted generally tangential to a cylinder concentric to said central shaft.

2. A device, as recited in claim **1**, wherein mounting means are provided supporting said feed roll either in a first position or a second position and said feed roll exerts a greater holding effect for a given material in said first position than in said second position, said feed roll when in said first position has the feed roll approaching blade between said central shaft and said rotor when the rotor approaching blade is sweeping across said floor and in said second position, the central shaft is between said feed roll approaching blade and said rotor when the feed roll approaching blade is sweeping across said floor.

3. A device, as recited in claim **1** wherein means are provided for mounting said feed roll in either of two positions with one in end-for-end reversal to the other to change the holding effect and aggressiveness of feed of the roll.

4. A device, as recited in claim **1**, wherein said central shaft is rotatably mounted in a pair of support arms spaced on opposite ends of said shaft, said support arms are pivotally mounted on a support frame for swinging movement about a horizontal axis, stop means are provided to limit the arc through which said arms and the roll carried thereby can swing, and springs are connected between frame member and the arms whereby the feed roll is yieldingly compressed on the material fed under the roll.

5. A device, as recited in claim **1**, wherein sai dfeed roll comprises four blades, said blades are joined to form a square tube about the central shaft, a pair of sleeves are mounted in said tube at opposite ends thereof, and said sleeves are keyed to said central shaft.

6. A device, as recited in claim **1**, wherein said feed roll is mounted for movement closely adjacent to said rotor whereby any material picked up by said feed roll will be stripped off by said rotor hammers.

7. In a hammer mill, the combination of:

a support frame;

a housing on said frame, said housing having a pair of vertically extending side walls and a tapered bottom portion;

a rotor journalled in said walls and adapted to rotate about a horizontal axis, said rotor comprising an elongated shaft and a plurality of hammers mounted on said shaft in axially spaced relationship, said hammers generating a cylinder on rotation;

means for rotating said rotor;

a pair of screens adjacent said rotor and mounted within said housing;

an auger for transferring processed feed material from the housing, said auger comprising a shaft journalled in said bottom portion;

a hopper fixed to one side of said housing and supported on said frame, said hopper having a pair of vertically extending side panels generally parallel to said side walls, a floor in said hopper extending downwardly to a feed opening in said housing;

a pair of support arms pivotally mounted on said frame and extending in a generally horizontal direction and parallel to said side panels;

a feed roll comprising an elongated central shaft journalled in said support arms, said central shaft ex-

tending through arcuate slots in said panels, a plurality of axially extending blades mounted on said central shaft, said blades being mounted generally tangential to a cylinder concentric to said central shaft, and a pair of end plates fixed to opposite axial ends of said blades.

8. A device, as recited in claim 7, wherein means are provided for mounting said feed roll in either of two positions with one reversible end for end to the other to have the aggressiveness of the roll greater in one position than the other.

9. A device, as recited in claim 7, wherein a stop plate is slidably mounted on each of said side panels adjacent said arcuate slots, and each of said plates has a stepped end portion sliding with said respective plate across said respective slot for contact by said central shaft on movement towards said stepped portions whereby the lowermost position of said shaft can be set at different positions by slidably positioning said stop plates relative to said central shaft.

10. A device, as recited in claim 7, wherein a cross shaft is mounted in said frame, a power source is connected to said auger shaft, a belt drive connects said cross shaft to said auger shaft on one side of said device, and chain drive means connects said cross shaft to said feed roll shaft on an opposite side of said device whereby said feed roll will be driven when power is supplied to said auger shaft.

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