Oct. 20, 1931. W. J. CLEMENT 1,828,490

HAMMER MILL

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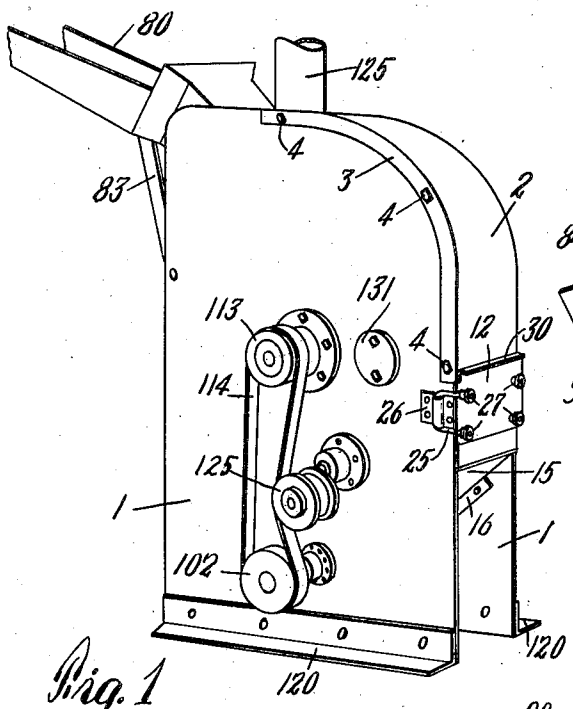

Fig. 1

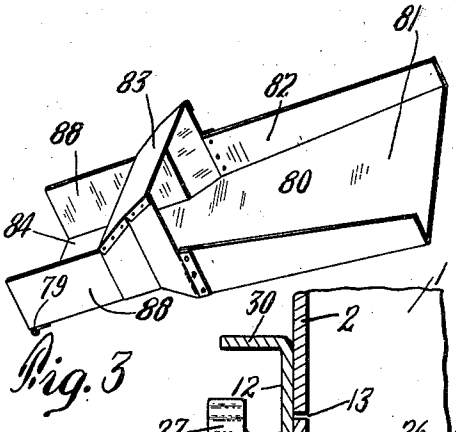

Fig. 3

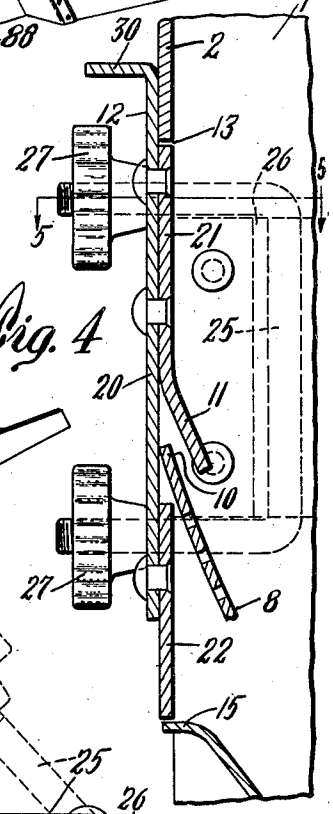

Fig. 4

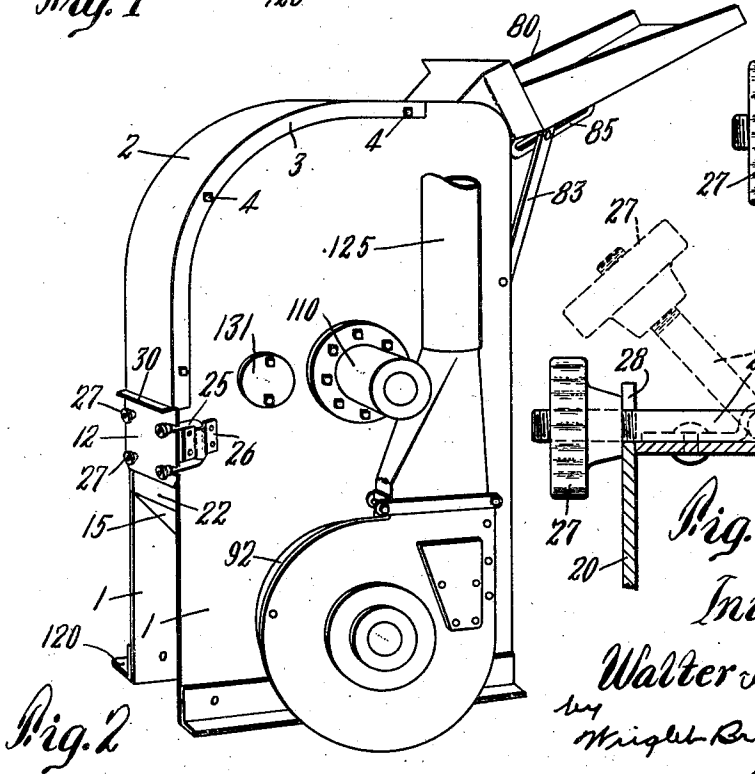

Fig. 2

Fig. 5

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Fig. 6

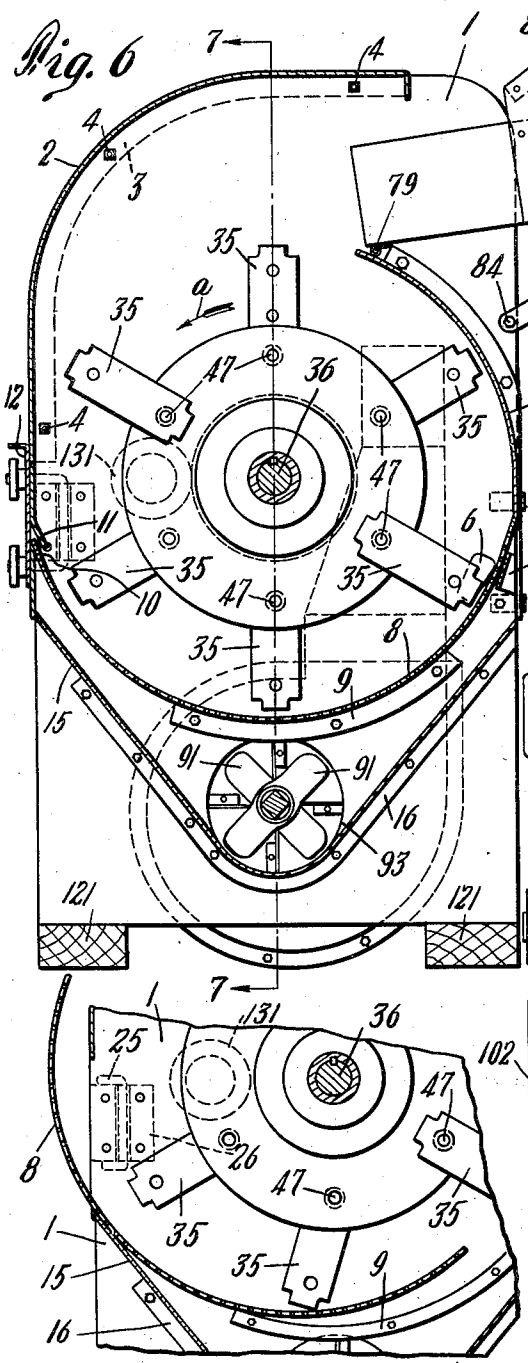

Fig. 7

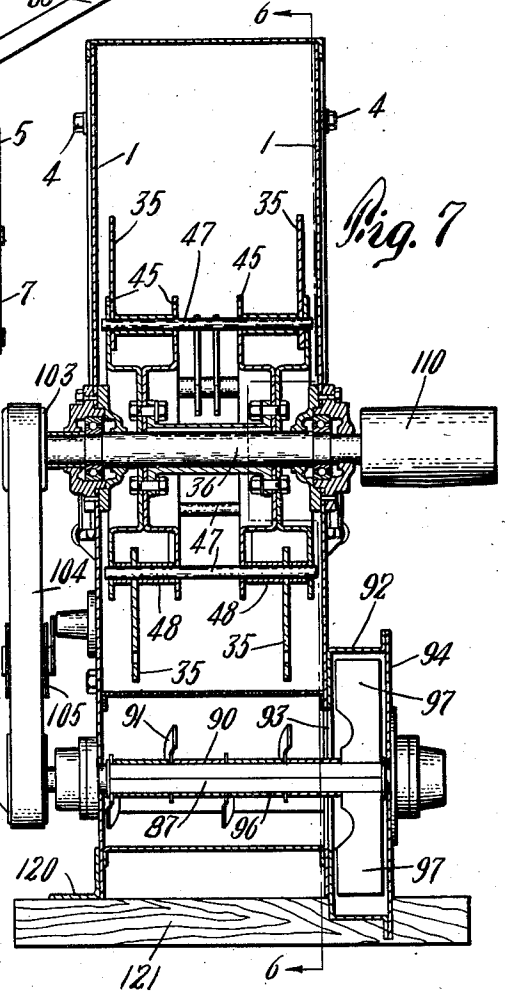

Fig. 8

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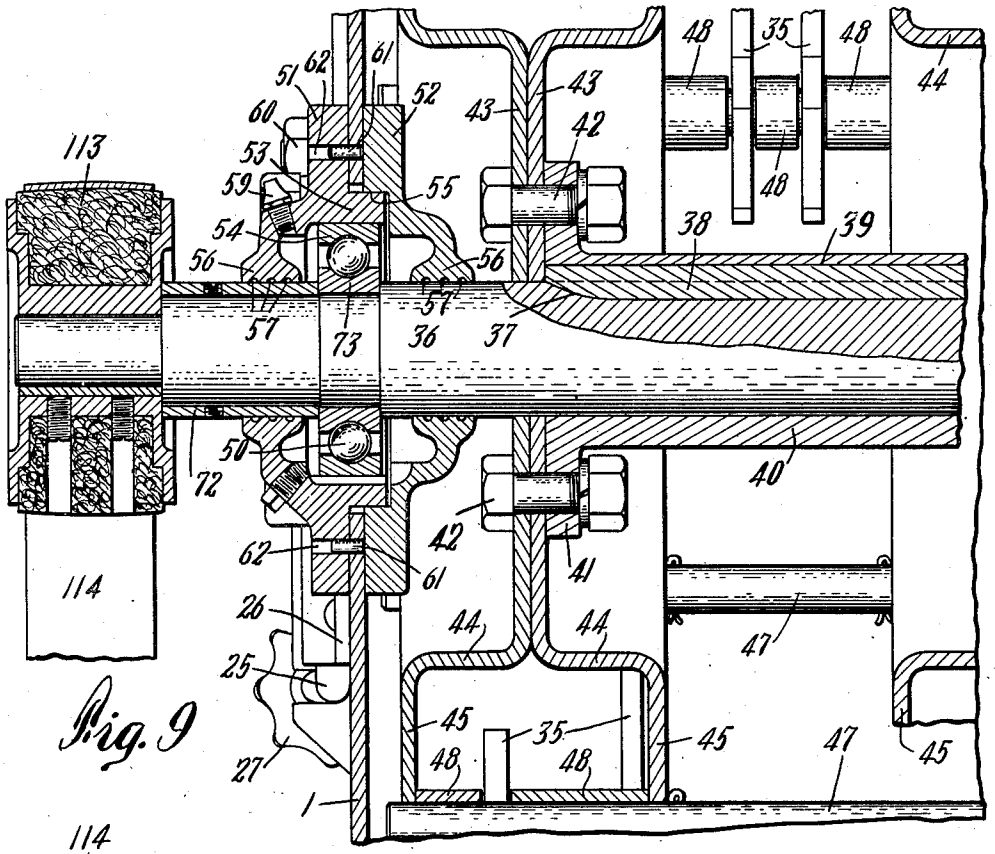

Fig. 9

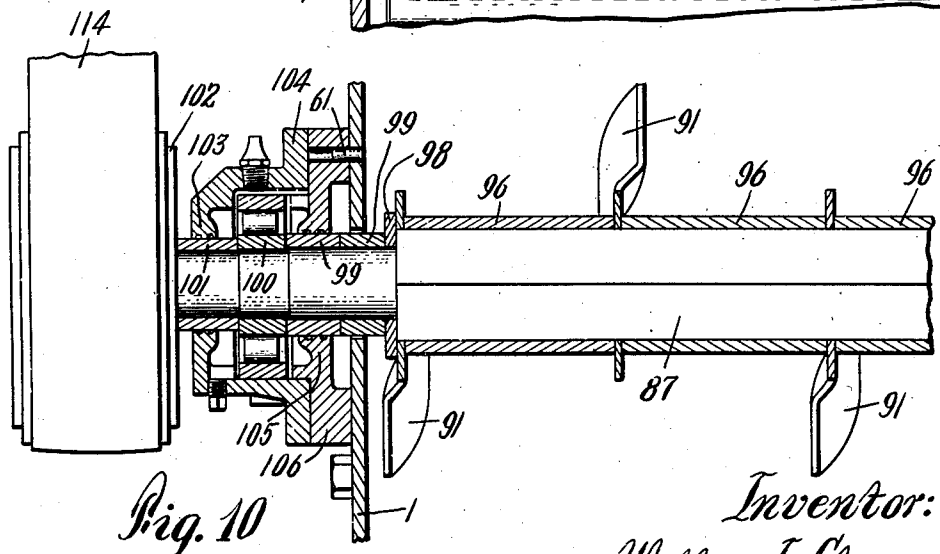

Fig. 10

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UNITED STATES PATENT OFFICE

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HAMMER MILL

Application filed November 13, 1929. Serial No. 406,843.

This invention relates to grinding and crushing mills of that type which employ hammers rotatable about an axis within a casing into which the material to be treated is introduced, and has for one of its objects to produce a mill of this type which is particularly suitable for portable or semiportable use, as, for example, on farms or the like where the relatively heavy mills having cast metal casings would not be suitable. The casing of the mill, according to this invention, therefore, is so designed that it can be fabricated from sheet metal and structural shapes. An improved mounting for the hammer-carrying shaft is also provided by which the weight of the rotor is placed in line with the side walls of the mill and by which the distance between the centers of the bearings may be reduced over that of prior constructions, thus reducing the necessary shaft length.

Improved mounting for the hammers by which the number and weight of the parts and the space for lodgment of material out of the hammer paths within the casing may be reduced is also an important feature of the invention.

An improved screen mounting by which the changing of screens is facilitated is also provided.

A still further feature of the invention relates to the construction of feed table by which the material to be treated is introduced into the mill and by which construction the possibility of injury to the operator in attempting to feed the material is minimized.

A further feature of the invention relates to the mechanism for withdrawing the ground material, and more particularly to a conveyor which forms a part thereof whereby its assembly and removal from the mill is facilitated.

Further objects and advantageous constructions will be apparent from a more complete description of an embodiment of the invention illustrated in the accompanying drawings in which

Figures 1 and 2 show the improved mill in perspective from opposite sides.

Figure 3 is a perspective of the feed table or chute detached from the mill.

Figure 4 is a detail section through the rear end wall of the mill casing at the door which normally closes an opening through which the screen may be inserted or removed.

Figure 5 is a section on line 5—5 of Figure 4.

Figure 6 is a vertical section on line 6—6 of Figure 7.

Figure 7 is a vertical section on line 7—7 of Figure 6.

Figure 8 is a view similar to a portion of Figure 6, but showing the screen partly removed.

Figures 9 and 10 are fragmentary detail sections to a larger scale than Figure 7, showing the hammer and conveyor shaft constructions, respectively.

Referring to these drawings, more particularly to Figures 1, 2, 6 and 7, it will be seen that the mill comprises a casing having a pair of oppositely disposed side walls 1 formed of flat sheet material. These walls are connected together by a combined end and top plate 2, which, as shown, is provided with a marginal flange 3 engaging outwardly of each of the side wall plates 1 and adapted to be secured thereto at intervals as by bolts 4. The casing also is provided with an end plate 5 forming the front wall of the casing. Below the end plate 5 the side walls 1 are each provided with a pair of spaced stop elements 6 and 7 designed to removably hold in position the forward upper end of a curved screen 8 which forms the bottom of the casing. Intermediate portions of this screen plate are designed to rest upon the upper edges of curved strips 9 fixed to the inner walls of the side plates 1. The rear edge portion 10 of the screen plate 8, as shown, rests beneath a downwardly extending deflector plate 11 of a door 12, which normally closes an opening 13 beneath the end plate 2. As shown best in Figures 4 and 6, this opening 13 extends from the lower end of the plate 2 to the upper end of a hopper plate 15, which is of substantially V form, and is removably supported on correspondingly formed strips 16 riveted or otherwise secured to the inner face of the side wall member 1. This door 12 (see Figure 4) comprises an outer plate

20 to which the plate 21 having the portion 11 integral therewith is attached, and also an inner plate 22 secured to its lower edge and forming with the portion 11 a pocket to receive the rear edge 10 of the screen plate 8. The upper edge of the plate 21 is positioned beneath the lower edge of the plate 2 when the door is closed. The plate 20 is of a width slightly greater than the space between the side walls 1 and may be supported in closed position against these edges by means of suitable latch mechanism. As shown herein this latch mechanism comprises a pair of U shaped members 25, each having its intermediate portion pivotally mounted as by the strips 26 on the outside face of a side wall member, the legs of the U shaped latch being threaded to receive manually operable nuts 27 thereon which may be screwed down against the outer face of the plate 12 when the latch members are swung into notches 28 in the edges of the plate 20, thus to clamp the door against the edges of the side plates 1 as best illustrated in Figure 5. By loosening the nuts 27, these latches may be swung out of engagement with the door, as shown by dotted lines in Figure 5, whereupon by grasping the upper outwardly turned margin 30 of the plate 20, it may be pulled outwardly slightly and then lifted upwardly and outwardly and removed from its closing position. When so removed the rear edge of the ridge 10 of the screen may be grasped and the entire screen removed from its position as illustrated in Figure 8 and a new screen may be substituted therefor, it being often desirable to change a screen for one having a different size of mesh where a different class of material is to be treated in the mill.

Within the casing is mounted a rotatable mechanism. This mechanism, as shown, comprises a series of hammers 35 mounted to rotate about the axis of a shaft 36. They are shown as fixed to rotate with this shaft in the following manner. Referring to Figures 7 and 9, it will be seen that the shaft 36 is provided with a longitudinal keyway 37 at its median portion within which is seated a key 38, which also engages in a keyway 39 mating the keyway 37 in the shaft, this keyway 39 being in the inside face of a sleeve 40 which surrounds the shaft 36. This sleeve 40 has outwardly flanged ends 41 to each of which are secured, as by bolts 42, inwardly dished confronting central portions 43 of a pair of disks 44 whose outer margins 45 are arranged in spaced parallel planes. It will be noted that the dished portions of the disk are fixed together in face to face relation by the bolts 42. By this means the disks are fixed for rotation with the shaft 36 and by reason of their engagement over the ends of the key 39, which is axially fixed in the shaft 36, they are held from axial movement relative to the shaft. These marginal portions 45 of the two pairs of disks have positioned therethrough bars 47 arranged in circular series about the axis of the shaft 36. On these bars are pivotally mounted the inner ends of the hammers 35 and these hammers are fixed axially of the bar 47 by means of spacer sleeves as 48 of various lengths, these sleeves and the hammers filling the spaces between adjacent pairs of marginal portions 45. By this means the hammers may be arranged throughout the axial extent of the rotatable mechanism so that as they are revolved their paths of rotation occupy substantially the entire volume of the casing to their extreme radii.

The shaft 36 is shown as mounted in ball bearings as 50 which are positioned substantially in the planes of the side walls 1. In order to support them in this manner pairs of cooperating mating bearing supports 51 and 52 have been provided. One of these supports, as 51, is shown as engaging the outer face of its side plate 1 at its margin and is provided with a hub portion 53 with which the outer raceway 54 of the ball bearing is engaged. The opposite support 52 engages the inner face of the wall plate 1 at the margin of its shaft opening and is shown as provided with a socket 55 to receive the inner end of the hub portion 53. Each of these support members 51 and 52 is provided with a central dust guard portion 56, which is positioned closely adjacent to the outer face of the shaft 36 and is provided with internal circumferential grooves 57 therein to receive oil to form a seal to the shaft 36, thus to prevent the entrance of dust or other foreign matter from within or without the mill casing to the ball bearings. The space surrounding the ball bearings and between the supports 51 and 52 may be filled with a suitable lubricant through openings which are normally closed by screw threaded caps 59. The supports may be fixed in position by cap screws 60 extending through the support 51, and holes in the side plate 1, and threaded into the support 52 and centering pins 61 positioned in perforations 62 in the support 51 and engaging mating perforations in the side plate 1 may also be employed to facilitate assembly of the parts.

It will be seen that the inwardly dished center portions of the end disks of the rotating mechanism provide room for the inward extension of the bearing supports 52 while permitting the end hammers of the mechanism to be rotated close to the inner faces of the side walls 1 outwardly of the inner ends of said bearing supports. The outer end portions of the shaft 36 may be of reduced diameter to facilitate assembly, these reduced diameter portions having fixed thereon sleeve 72 with the outer faces of which the outer sealing portions 56 cooperate, these sleeves engaging against the outer faces of the inner

raceways 73 of the bearings to hold these bearings against undue axial motion.

From an inspection of Figure 6 it will be noted that the screen plate 8 is curved on a radius slightly larger than the extreme arc of swing of the hammer and that it is positioned slightly eccentric to the shaft 36 so that at its rear edge it is spaced further from the hammer path than at its forward edge. As the hammers are rotated when in action in the direction of arrow *a*, shown in this figure, it will be seen that the screen is thus positioned further from the hammers where the hammers approach the screen than where they recede therefrom at the forward end wall of the casing. It is found in practice that this reduces the wear on the screen by permitting the material to pass more readily between the hammers and the screen when the hammers are in those angular positions where they have had little time to act on the material, the hammers approaching close to the screen in their assumed angular positions where they are about to move away from the screen.

Referring also to Figure 6, it will be seen that the upper end of the plate 2 is spaced considerably above the upper end of the plate 5. Between these plates is positioned the inner end of a feed table or chute 80. This feed table is shown as pivotally mounted at 79 between the side plates 1 and its inclination is adjustable by means of the links 83 pivoted at 84 to the side plates, the outer ends of these links 83 being adjustably secured in slotted guides 85 secured to the lower face of the table or chute 80. As shown best in Figure 3, this table 80 comprises an outer chute portion 81 having upstanding and rearwardly flaring side walls 82. Rearwardly of these side walls the lower wall of the chute narrows and at this narrow portion the chute is provided with a rectangular tubular or hopper portion 83 which tapers downwardly and rearwardly and leads into a trough shaped portion 84 having side walls 88 but open at the top. This tubular hopper portion acts to guide the material laid in the upper chute portion so that it may pass downwardly into the mill, the closed top of this hopper portion acting to prevent the operator from inserting his hands too far into the mill where they might be in danger of coming into the paths of the hammers. This particular portion is, however, sufficiently spaced from the casing walls to permit the entrance of air into the casing therearound.

As the material placed in the hammer casing is reduced to a sufficiently small size to pass through the holes in the screen plate 8, which is preferably of sheet metal provided with holes of the desired sizes therethrough, it falls into the lower hopper portion defined by the hopper plate 15 from which it is removed. This removing means as shown comprises a conveyor 90, which is provided with vanes 91 thereon acting by their rotation to prevent the ground material from packing in the lower portion of the hopper and to move this material into a fan casing 92 positioned at one side of the hammer casing. As shown best in Figure 7, the inner wall of the fan casing and the adjacent side wall 1 is provided with an opening 93 of sufficiently large size to permit the conveyor shaft with its vanes 91 thereon to be removed through this opening upon the removal of the closed end wall 94 of the fan casing. The vanes 91 are shown as fixed to a sleeve 96 carried by a squared portion 87 of the central operating shaft. This sleeve 96 is held in position axially of the shaft by engagement at one end with the inner edges of the fan blades 97 and at its opposite end by engagement with a washer 98 which is held in position by spacer sleeves 99, the outer end of which engages the inner edge of the inner raceway 100 of a roller bearing. This inner raceway is held against the end of the sleeve 99 by a sleeve 101, which abuts against a pulley 102 fixed to the shaft and by which the shaft 97 is rotated. This sleeve 101 has cooperating therewith a dust guard portion 103 of a bearing holder 104 and a similar dust guard portion 105 is carried by a member 106 directly fixed to the adjacent side wall member 1 through which is a relatively small opening to permit the passage of sleeve 99. Thus it will be seen that the conveyor shaft mechanism, together with the inner raceway of the roller bearing, may be removed bodily through the hopper and the fan casing when the pulley 102 is removed therefrom. The pulley 102 is designed to be driven from the pulley 113 on one end of the shaft 36 as by means of a belt 114, which also engages a belt tensioning device 125. At the opposite end of the shaft 36 it carries a belt pulley 110, or any other suitable means by which it may be driven. The ground material is blown out from the fan casing into a pipe 115 which leads to a suitable dust separator (not shown) as is usual practice.

The lower edges of the side plates 1 are shown as reinforced by angle members 120, which may, if desired, be fixed to timbers 121 which furnish a substantial foundation for the mechanism. It will also be noted that the side plates 1 are provided with openings 130 opposite to each other and in line with which the hammer supporting bars 47 pass serially as the shaft 36 is rotated. These openings are for the purpose of obtaining access to these bars when it is desired to remove or replace hammers, and they are normally closed as by means of cover plates 131 which may be screwed to the outer faces of the side plates 1.

One embodiment of this invention having thus been described, it should be evident to those skilled in the art that various changes

and modifications might be made therein without departing from the spirit or scope of this invention as defined by the appended claims.

I claim:

1. A machine of the class described comprising a casing having side walls provided with oppositely disposed openings, a journal bearing fixed in each of said openings substantially in the plane of the side walls, bearing supports extending inwardly of said walls, a shaft journaled in said bearings, and hammers carried by said shaft between said side walls, certain of said hammers being positioned outwardly of the inner faces of said bearing supports.

2. A machine of the class described comprising a casing having side wall plates provided with oppositely disposed openings, a pair of cooperating bearing supports on opposite faces of each plate at its respective opening, a bearing held by each pair of said supports substantially in the plane of the corresponding side wall plate within its opening, a shaft journaled in said bearings, said bearing supports presenting dust guard portions to said shaft spaced from said bearings and hammers carried by said shaft, certain of said hammers being positioned adjacent to said wall plates and outwardly of said dust guard portions.

3. A machine of the class described comprising a casing having side wall plates provided with oppositely disposed openings, a pair of cooperating bearing supports on opposite faces of each plate at its respective opening, a bearing held by each pair of said supports substantially in the plane of the corresponding side wall plate within its opening, and inwardly of said side plates, disks carried by said shaft between said side plates, bars carried by said disks in circular series about said shaft, and hammers carried by said bars between pairs of disks, the end disks being dished away from said side plates adjacent to said shaft to clear said bearing supports while permitting the end hammers to swing closely adjacent to said side plates as said shaft is rotated.

4. A machine of the class described comprising a shaft, a pair of disks each centrally fixed to said shaft, said disks having centrally dished portions arranged face to face and marginal portions lying in spaced parallel planes, bars extending in circular series about said shaft through said marginal portions, and hammers carried by said bars between said disks.

5. A machine of the class described comprising a shaft, a plurality of disks each centrally fixed to said shaft, each disk having a dished central portion and said disks being arranged in pairs with the dished portions of each pair face to face and having marginal portions positioned in parallel planes spaced axially of said shaft, bars arranged in circular series about said shaft through said marginal portions, spacing sleeves on said bars between said marginal portions, and hammers on said bars between said spacers and between said spacers and disks.

6. A machine of the class described comprising a shaft having a longitudinal keyway at its median portion, a sleeve on said shaft having a keyway mating the keyway in said shaft, a key seated in said keyways, a disk having a central opening through which said shaft passes at each end of said sleeve, means for fixing said sleeve to each of said disks over the ends of said key, and hammers carried in circular series about said shaft by said disks.

7. A machine of the class described comprising a casing having side, end and top wall members, a rotatable mechanism within said casing, one of said end members having an opening therethrough, supports on said side walls upon which a screen inserted through said opening may be supported to form a bottom for said casing, and a cover for said opening having a portion overlying the inner face of the adjacent edge of said screen to guide material engaged by said mechanism onto said screen.

In testimony whereof I have affixed my signature.

WALTER J. CLEMENT.