Jan. 30, 1934. W. F. MacGREGOR ET AL 1,945,054

HAMMER MILL

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FIG.-2

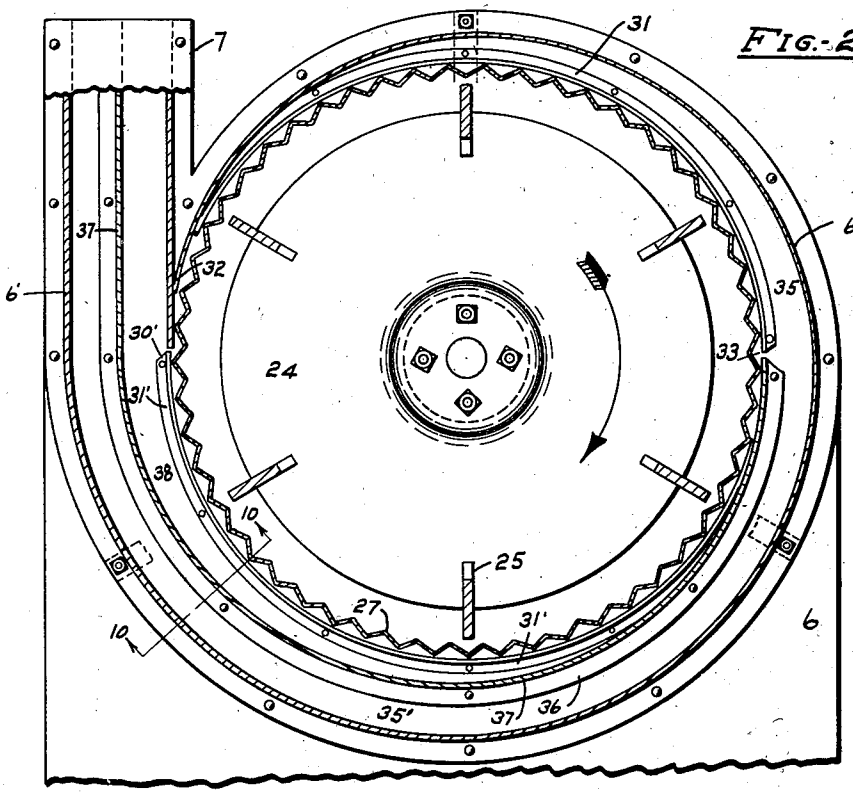


FIG.-1

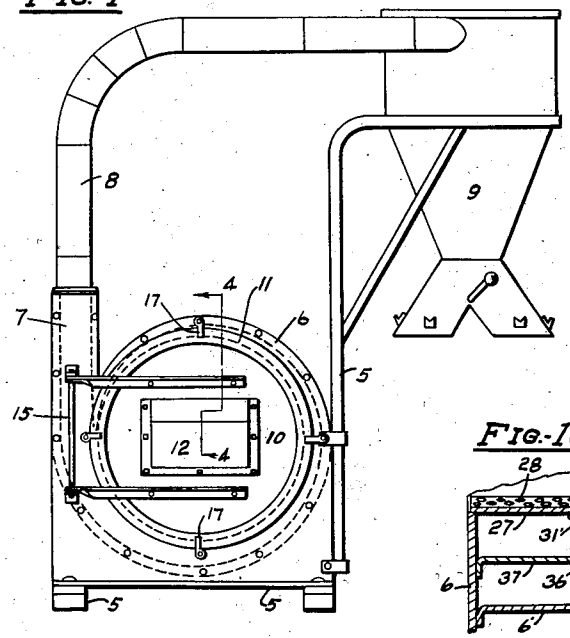


FIG.-3

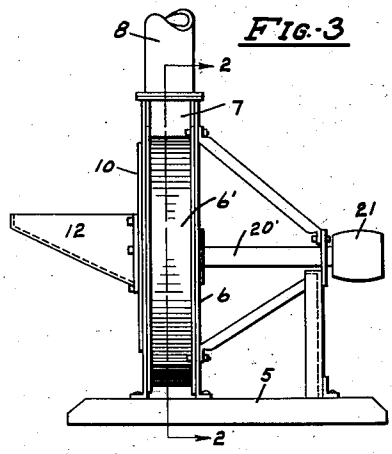


FIG.-10

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FIG.-4

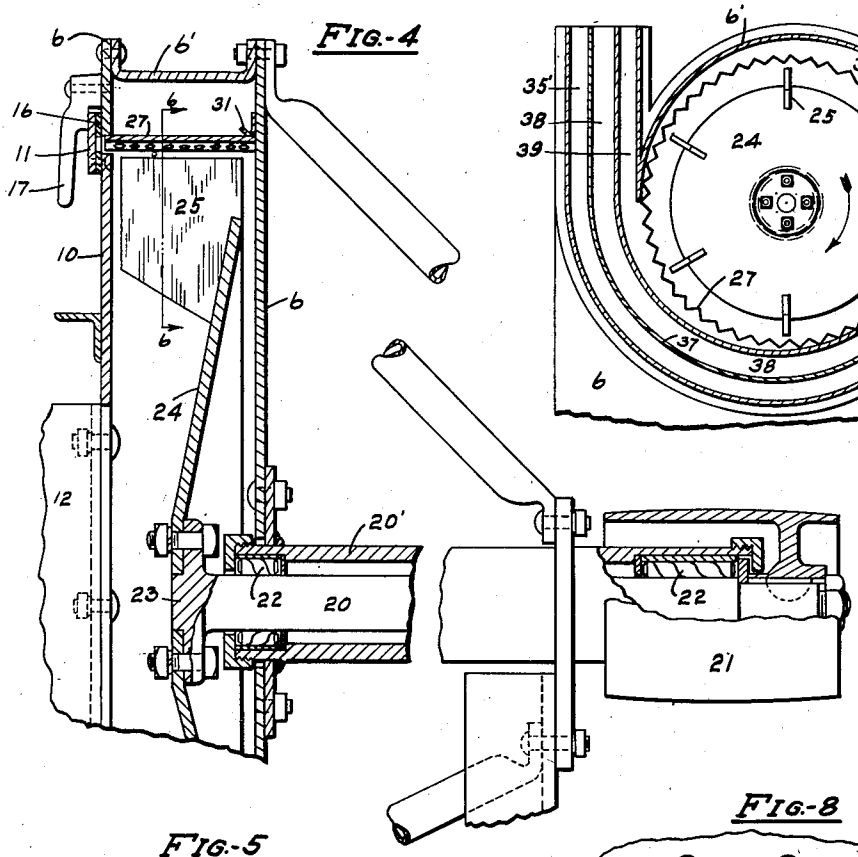


FIG.-7

FIG.-5

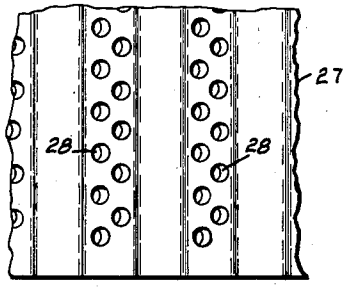


FIG.-8

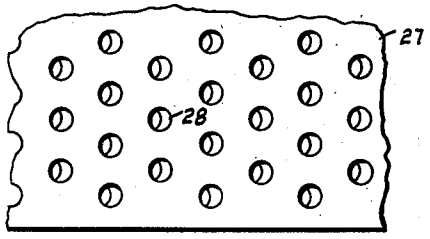


FIG.-6

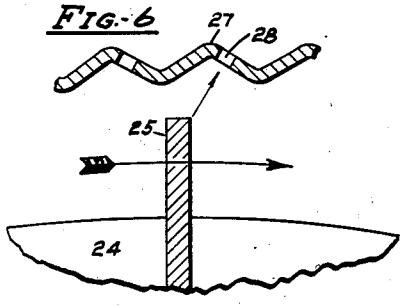
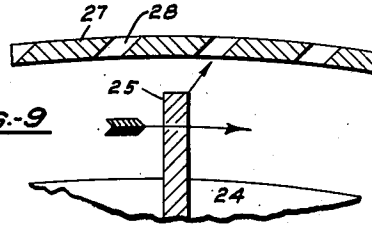


FIG.-9



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Patented Jan. 30, 1934 1,945,054

UNITED STATES PATENT OFFICE

1,945,054

HAMMER MILL

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Application May 31, 1932. Serial No. 614,434

10 Claims. (Cl. 83—11)

Our invention relates to hammer mills particularly adapted for grinding feed and the like, and consists in certain improvements whereby high efficiency in operation and increased capacity are obtained, as the ground material is rapidly removed from contact with the hammers or blades and distributed in predetermined directions about the interior of the machine casing to be conveyed therefrom in divided portions and discharged from a common outlet in massed form, in which manner the load is equalized and the machine not burdened at one point only as is common. The portions of the material which have been sufficiently ground become separated in different parts of the casing from the coarser material being fed into the machine, and instantly discharged therefrom, so that such finished product is not again unnecessarily subjected to the continuous action of the revolving hammers or blades, and therefore does not mix with or interfere with the flow of the rough material being constantly and rapidly introduced in large volumes into the machine, which operation is particularly desirable when preparing cracked feed, which escapes from further action of the hammers when reduced to the requisite fineness, and will not be carried around continuously and treated until it reaches objectionable flour gradations. These and other advantages will be apparent in the construction and operation of our improved mill as disclosed and which will hereinafter more fully appear.

In the accompanying drawings, forming part hereof, Figure 1 is a side elevation of a hammer mill embodying our improvements; Fig. 2, a detail section of the material receiving and discharging casing taken on the dotted line 2—2 in Fig. 3; Fig. 3, an end elevation; Fig. 4, a transverse vertical sectional view through the casing, taken on the dotted line 4—4 in Fig. 1, showing the manner of mounting the hammers in relation to the driving shaft; Fig. 5, a detail fragmentary view of the corrugated grinding screen employed; Fig. 6, a fragmentary detail section on the dotted line 6—6 in Fig. 4 showing the relation of the hammers to the grinding screen; Fig. 7, a detail section of a modified form of the casing and parts associated therewith; Fig. 8, a detail fragmentary view of a modified form of grinding screen which we may employ; Fig. 9, a fragmentary detail section showing the relation of the hammers to the modified form of screen shown in Fig. 8; and Fig. 10 is a detail section taken on the dotted line 10—10 in Fig. 2.

In said drawings the numeral 5 indicates a supporting frame, which may be of any desired construction and arrangement, and upon which we mount our improved mill comprising in part a material receiving and discharge casing 6 having an outlet 7 and a discharge pipe 8 adapted to deliver into a receiver 9 for sacking or otherwise disposing of the finished product.

From the front wall of the casing 6 we stamp a door 10 the edge of which is reinforced by a batten 11. The door is provided with an opening about the edges of which a gravity hopper 12 is detachably secured, so that it may be disconnected from the door and shipped or stored as a unit, and which door is hinged, at 15, to the casing 6. The edge of the door opening is provided with a felt or other sealing means 16, Fig. 4, against which the batten 11 contacts so that the door may be held in fixed position by clamps 17 which jam the batten against the seal 16 to prevent leakage of material between the door and casing.

In our preferred form, as shown in Figs. 3 and 4, we mount a shaft 20 on frame 5, driven by a pulley 21 from a suitable source of power, said shaft being held in a casing 20′ and running in antifriction bearings 22 as is common. The shaft extends through the rear wall of the casing 6 and is provided with a hub 23 upon which a conical disk 24 is mounted, its outer edge terminating in proximity to the rear wall of the casing, and to which disk a series of hammers or blades 25 are fixedly secured in offset relation by welding or otherwise, said hammers being positioned as indicated in Fig. 4 so that the center of resistance thereof will be approximately coincident to the end of bearing 22, and ample space provided between the hammers and hub 23 for receiving oncoming material introduced thereinto.

Surrounding the hammer disk 24 is a cylindrical grinding screen or plate 27, preferably corrugated and having perforations 28 through its ribs in inclined relation to the hammers 25 when the latter are in the position shown in Fig. 6, but which screen may be of plain smooth character and perforated substantially as indicated in Fig. 8, or otherwise.

In the upper side of the casing the screen 27 is secured to the rear wall by a binding strip 31 or other means and extends across and is supported in the front wall as shown in Fig. 4, which casing is in eccentric relation to the screen, as clearly shown in Fig. 2, so that from approximately the point 32 the rim 6′ of the casing gradually recedes from the screen to the opposite side, at 33, thus forming a volute channel 35 be-

tween the screen and casing rim. From the point 33 a binder 36 is extended around through the casing duct until it reaches the discharge outlet 7 through which it extends on a vertical line, and to which binder or equivalent fastening means a partition 37 is secured and its opposite edge supported by the front wall of the casing 6 as indicated in Fig. 10. The screen 27 continues around the circumference of the casing and its lower portion is retained in position by a binding strip 31' similar to the binder 31 and terminates in the outlet 7 at 30', and which relation of said screen and the partition 37 forms a volute channel 38 in the casing duct. While we have specifically shown binding strips for securing the screen to the casing it will be understood, as indicated, that any practical means for the purpose may be employed. By thus arranging the grinding screen and partition as described we provide two volute channels in the casing for conveying ground material from the mill, which we have found efficient and satisfactory in practice, but which may be increased to a greater number, as indicated in Fig. 7, in which modified construction three channels 35', 38 and 39 may be employed.

In operation, material is fed into the casing 6 through the gravity hopper 12 and is caught by the rapidly revolving disk 24 and hammers 25 and beaten and disintegrated by the impact of the hammers and, when finely enough reduced or pulverized, the ground product by the action of the hammers is driven through the perforations in the screen into the channels 35 and 38, and by the blast created by the rotary elements such material when forced through the upper screen perforations is carried through the channel 35 and its continuation 35' and discharged through the outlet 7. At the same time the pulverized material in the lower portion of the casing passes through the corresponding screen perforations and into the channel 38, from which latter it is conveyed by the air blast in like manner as the operation in the upper portion of the casing and carried into the outlet 7 to commingle with that portion of the material coming through channel 35', so that the finished product from both channels will be massed and thus discharged through pipe 8 into the receiver 9 to be disposed of. In the manner described it will be apparent that the load being fed into and ground in the casing will be divided as it is being reduced or pulverized so that a part of the finished product passes through the upper portion of the screen and is conveyed away through a channel, and a part is passed through the lower screen portion to be independently conveyed through another channel, with the result that the disk, hammers and casing will not be overloaded and damaged, as frequently occurs when all of the ground material must be conveyed through a single discharge duct. In carrying out our invention we have demonstrated in practice that the efficiency of the mill is materially increased by corrugating the grinding screen and arranging its perforations tangentially inclined, as an irregular and rough surface cooperating with the hammers is provided by which the material is effectively reduced and pulverized into fine particles, which pass from the hammers in the direction of the small arrow, Fig. 6, to be readily forced by the influence of the hammers assisted by the air currents produced thereby in a straight path through the tangentially inclined screen perforations and into the channels as described; but we desire to be understood, however, as not limiting ourselves to the use of such specifically constructed screen, as a screen of modified form embodying perforations substantially as shown in Figs. 8 and 9, or other design, may be effectively employed.

We claim as our invention:

1. In a hammer mill, a casing embodying a material receiving opening and a discharge duct, a cylindrical grinding screen mounted in the casing, means rotatable within and cooperating with said screen for grinding material and discharging the ground product through the screen, and means in a portion of the casing substantially concentric with and in curvilinear relation to the screen and casing for dividing the discharge duct of the casing into concentric channels whereby material discharging through a predetermined portion of the screen will be conveyed through the duct separately from material discharging through another predetermined portion of the screen.

2. In a hammer mill, a casing embodying a material receiving opening and a discharge duct, a perforated cylindrical element mounted in the casing, a grinding rotor within and cooperating with said element for grinding material and discharging the ground product in divided portions through different parts of said element and into the casing, and a partition in a portion of the casing substantially concentric with and in curvilinear relation to said cylindrical element and casing for dividing the discharge duct of the casing into concentric channels whereby material discharging through a predetermined portion of the screen will be conveyed through the duct separately from material discharging through another predetermined portion of the screen.

3. In a hammer mill, a casing embodying a material receiving opening and a discharge duct, a perforated cylindrical element mounted in the casing, a rotor within said element having grinding means cooperating with said element for grinding material and discharging it through separate predetermined portions of said perforated element into the casing, and a partition in a portion of the casing substantially concentric with and in curvilinear relation to said cylindrical element and casing for dividing the discharge duct of the casing into concentric channels whereby material discharging through a predetermined portion of the screen will be conveyed through the duct separately from material discharging through another predetermined portion of the screen.

4. In a hammer mill, a casing embodying a material receiving opening and a discharge duct, a corrugated cylindrical element embodying perforations mounted in the casing, a grinding rotor within and cooperating with said element for grinding material and discharging the same through separate predetermined portions of the element into the casing, and a partition in a portion of the casing substantially concentric with and in curvilinear relation to the screen and casing for dividing the discharge duct of the casing into concentric channels whereby material discharging through a predetermined portion of the screen will be conveyed through the duct separately from material discharging through another predetermined portion of the screen.

5. In a hammer mill, a casing embodying a material receiving opening and a discharge duct, a cylindrical screen mounted in the casing, rotatable grinding means within the screen and adapted to cooperate with the latter in grinding

material, and a partition in a portion of the casing substantially concentric with and in curvilinear relation to said screen and casing for dividing the duct into a plurality of channels whereby material discharging into the casing from different predetermined portions of the screen will be conveyed separately and circumferentially through said channels and become commingled when discharged tangentially beyond the outer end of the partition.

6. In a hammer mill, a casing having side walls and a rim, a grinding screen mounted in the casing to form a volute channel between the rim and a portion of the screen, a partition in a portion of the casing substantially concentric with and in curvilinear relation to said screen and the casing forming a continuation of said channel through the casing and also forming a channel around a portion of the screen, and a grinding rotor in the screen adapted to cooperate with the latter for grinding material and discharging the same through the different predetermined portions of the screen to be conveyed separately through the channels and discharged tangentially from the casing.

7. In a hammer mill, a casing including a discharge duct and an outlet, a grinding screen in the casing spaced therefrom to form a channel extending partly through the casing, rotating hammers within the screen and cooperating therewith for grinding material and discharging the same through the screen, and a partition circumferentially positioned in the casing at the end of the channel forming a continuation thereof and spaced from a portion of the screen to form another channel whereby material will be conveyed separately from different portions of the screen.

8. In a hammer mill, a casing embodying walls, a rim and an outlet, cylindrical grinding means in the casing positioned at one side thereof in close proximity to the outlet, said rim gradually receding from the screen to form a circumferential channel in a portion of the casing, a partition in the casing gradually receding from a portion of the grinding means to form another circumferential channel in the casing, and a rotatable grinder in the casing cooperating with the cylindrical grinding means for pulverizing material and discharging the same through different parts of the cylindrical means into said channels whereby ground material is conveyed from the casing in separate portions.

9. In a hammer mill, a casing, a perforated grinding element in the casing, a partition between the casing and grinding element forming a plurality of circumferential channels in concentric relation to said element for receiving material from different portions of the latter, and a grinding rotor within the element cooperating therewith for pulverizing material and discharging the same through different portions of the element into said channels to be conveyed tangentially from the casing.

10. In a hammer mill, a material receiving and discharging casing having a tangential discharge outlet, a perforated grinding element in the casing, a partition between the casing and grinding element forming a plurality of circumferential channels in concentric relation to said element for receiving material from different predetermined portions of the latter, and rotary grinding means within the grinding element and cooperating with the latter for pulverizing material and discharging the same through different portions of the grinding element into said channels and by the latter conveyed from said casing.

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