

June 30, 1936.

W. J. ARMSTRONG

2,045,690

REDUCING MACHINE

Filed March 15, 1932

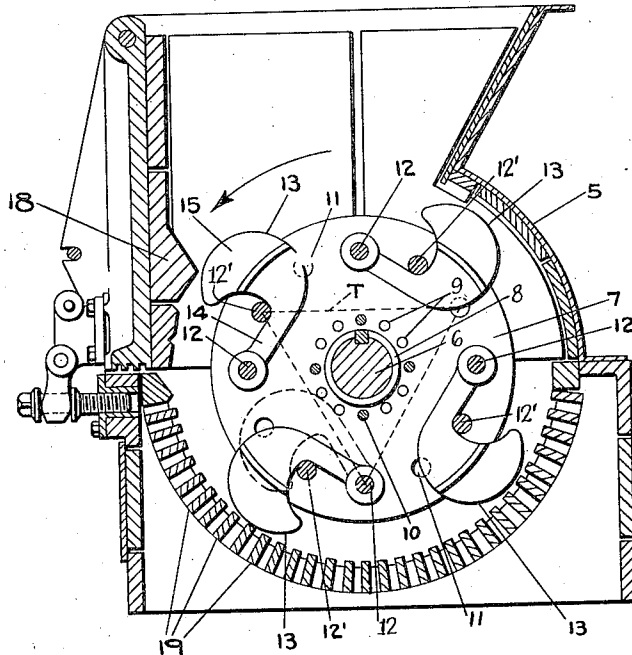


Fig. 1

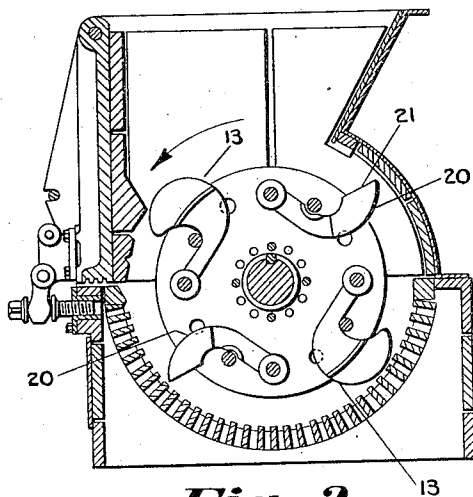


Fig. 3

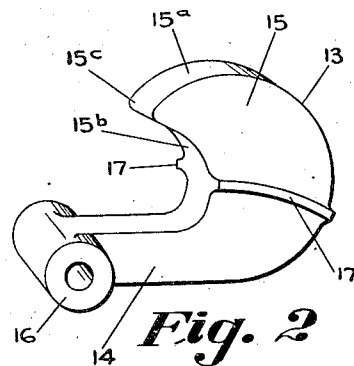


Fig. 2

INVENTOR
Walter J. Armstrong
BY
Cushman, Dwyer, & Dwyer
ATTYS.

UNITED STATES PATENT OFFICE

2,045,690

REDUCING MACHINE

Walter J. Armstrong, Columbus, Ohio, assignor
to The Jeffrey Manufacturing Company, a cor-
poration of Ohio

Application March 15, 1932, Serial No. 599,028

2 Claims. (Cl. 83-11)

The present invention relates to rotary reducing machines, and particularly to such machines as applied to the reduction of friable material. More particularly, the invention relates to a rotor construction for such machines involving a new form of hammer and hammer combination.

The invention is particularly applicable to the type of machine broadly covered in U. S. Patent 1,761,083, granted to William K. Liggett, June 3, 1930, wherein the rotor includes centrifugally projectible beaters whose projection is limited by abutment means on the rotor, the beaters being movable inwardly of the rotor to an ineffective or inoperative position upon cessation or counteraction of centrifugal force. In his U. S. application Serial No. 362,951, filed May 14, 1929, Nils D. Levin has described a machine in which the Liggett development is carried further to the end that, through the use of comparatively heavy hammers of considerable length, a relatively low speed machine is made practical.

According to the present invention, beaters having relatively great inertia, as taught by Levin, are preferably employed, a novel form of beater head being provided whereby the production of an undesirable amount of fines is avoided. The particular beater or hammer contemplated has a round head which presents a working face convexly curved from its leading to its trailing end. Beaters of this type will strike a blow and sledge or shatter material rather than cut through it as is the tendency of beaters having relatively plane working faces with sharp edges. The machine may be entirely equipped with the round head type of beater for reduction of materials which break up readily and where no difficulty is encountered in discharging the finished product. On the other hand, the machine may be partly equipped with round head beaters and partly with the plane faced type, the particular arrangement depending upon a number of factors, such as the fineness of the product required, capacity (when time is not an important factor), and the nature of the material whether wet, sticky or dry. When quantity feed or feed of relatively large material is desirable, it may be necessary to use a few plane faced beaters in conjunction with the round head beaters. Where a screening medium, such as the well known screen bars, is present, the matter of discharge therethrough is an important consideration since with some materials the round head hammer will have a tendency to force unfinished material into the finished product, making it

necessary to employ a closer spacing of the screen bars. However, the use of a few plane faced hammers will ordinarily overcome this difficulty, since they will tend to cut through the material in the screen section, reducing it sufficiently for passage therethrough without forcing. In explanation of the above, and as will be apparent from the accompanying drawings, the round head beaters engage the material to be reduced with an outward forcing action, whereas the plane faced beaters have a substantially flat impact with the material.

The invention also includes a rotor body design intended to accommodate an odd or an even number of axial rows of beaters without destroying the rotor balance.

The invention also includes the other subsidiary improvements which will be mentioned in the following description and which will be pointed out in the claims.

In the drawing:

Figure 1 is a trans-axial section through a machine embodying the improvements of the present invention.

Figure 2 is a perspective view somewhat enlarged, of one of the new beaters as shown in Figure 1, and

Figure 3 is a view similar to that of Figure 1 showing a modified beater arrangement.

The general form of machine shown in Figure 1 is well known in the art and is specifically described in Reissue Patent No. 17,334, William K. Liggett, June 25, 1929. The machine comprises generally a casing 5 in which is revolvably mounted a shaft 6 on which are keyed a number of disks as at 7 spaced axially of the shaft by means of collars as at 8. According to the present invention, the disks are provided outwardly of the collars with a series of apertures 9, twelve of these apertures being shown, and these being spaced at thirty-degree intervals. The apertures 9 of the various disks are in alignment and, as here shown, every third one of the concentric series has a tie-rod 10 passed therethrough.

Outwardly of the apertures 9 the disks are provided with another concentric series of somewhat larger apertures 11, each disk having twelve of these apertures as here shown with the centers thereof lying on the radii of shaft 6 passing through the centers of the apertures 9. It, of course, follows that apertures 11 are spaced 30° apart.

Pivot rods 12 are mounted in the apertures 11 intersected by the radii of shaft 6 passing through the apertures 9 which are occupied by the tie-

rods 10, and on the rods 12 are mounted beaters generally designated by the reference numeral 13, these beaters each comprising an arm portion 14 and an angularly extending head portion 15 at one end of the arm portion. In the apertures 11 next succeeding, in the clockwise direction, the apertures 11 occupied by the rods 12, are mounted abutment rods 12', which cooperate with the beater arms adjacent the heads to limit the centrifugal projection of the latter. Upon cessation or counteraction of centrifugal force the beaters are movable inwardly of the rotor body into abutment with the collars 8, the position of the tie-rods 10 being so chosen that the latter are out of the path of inward movement of the beaters. The selective positioning of the tie-rods 10 is, of course, permitted by the excess number of apertures 9.

With the disks provided with apertures at 30° intervals for the reception of the pivot and abutment rods, considerable flexibility of design is permitted so that various results may be obtained. As shown in Figure 1, there are four axially extending series of beaters 13. If desired, opposite series may be removed without affecting the balance of the rotor and, if it is desired to lengthen the beater arms, the abutment rods may be placed in any appropriate apertures intermediate the pivot rods. On the other hand, if three axial series of beaters are desired, the pivot rods may be arranged as at the apices of the equi-lateral triangle shown in dotted lines in Figure 1 and designated at T. Broadly considered, the invention contemplates a number of apertures 11, which number is the common denominator of the integers 2 and 3. More specifically, the invention contemplates the provision of such apertures spaced 30° from each other. Whatever the number of pivot rods involved, the tie-rods may be correspondingly located so as not to interfere with the inward movement of the beaters.

Each beater arm 14 at its end opposite the head 15 is provided with a boss 16 pierced to receive a pivot rod 12, the boss being of a size to substantially fill the rod space between adjacent disks. The arm 14 and head 15 are of less thickness than the boss, although the head, as here shown, may be provided with lateral ribs 17 having a guided fit between adjacent disks so as to prevent chattering of the beater. The beater head projects substantially rectangularly from the arm and is of substantially the same length as the latter. The longitudinal boundary surface of the arm at the head end thereof and at the side opposite the head is curvilinearly continued throughout the outer portion of the head so that the head presents a convexly curved working face indicated at 15^a, Figure 2, the working face merging at the free end of the head with a re-entrant inner longitudinal boundary surface 15^b which merges with the other longitudinal boundary surface of the arm. As here shown, the surface 15^b is concavely curved substantially on an arc concentric with the pivotal axis of the beater. As shown in Figure 1, the abutment rods 12' are disposed close to the surface 15^b, the latter being shaped, as described, in order not to interfere with the rods while still giving the free end of the beater as much of a rearward overhang as possible. The surfaces 15^a and 15^b merge in a substantially tapered point 15^c which is directed toward the opposite end of the arm 14. The reducing action takes place principally on that portion of face 15^a adjacent point 15^c,

this area of the face being directed more or less toward the boss 16.

In order that the beater may offer a considerable resistance to inward movement when the rotor is rotating, head 15 preferably has a considerably greater mass than arm 14, this being secured by forming it with a considerably greater breadth than the arm.

As in the reissue patent, above referred to, a restricted reducing zone is defined in conjunction with the rotor by an abutment bar or breaker plate 18 and screen bars 19. The distance between the pivot rods and abutment rods is less than the distance between the pivot rods and the breaker plate 18 and screen bars 19 or other outer reduction zone defining means, so that in case a beater arm breaks at any point between the pivot and abutment rods, the pivoted portion cannot be projected sufficiently to engage any of the outer zone defining means so as to cause damage thereto. The distance between the pivotal axis of any beater and its abutment means is preferably no greater than the distance from the pivotal axis to the maximum circle described by the beater when fully projected.

In Figure 3 the casing and rotor body are the same as in Figure 1. The rotor body, however, supports two opposite axially extending series of round head beaters 13 and two opposite axially extending series of plane faced beaters 20. Other relative arrangements of the two types of beaters are, of course, possible, but in any event care must be taken to see that the distribution is such that rotor balance is maintained. The beaters 20 have flat substantially square working faces 21 inclined somewhat rearwardly relative to radial planes of the rotor and, as above described, have rather a cutting action as contrasted to the round head beaters.

It will be understood that while I have gone into some detail in the description of the invention in order that the same may be readily understood and practiced, I do not limit myself except as in the following claims.

I claim:

1. In a machine of the class described, a rotor body, a beater, said beater having an arm portion and a head portion projecting angularly from the arm portion at one end of the latter, the arm portion being pivoted at its other end to the rotor body with the head portion in trailing relation as regards the direction of rotor rotation, said head portion having a convexly curved working surface extending generally in the longitudinal direction of said arm portion and merging at its end toward the pivoted end of said arm portion with a re-entrant boundary surface which merges with said arm portion whereby a substantially hook-shaped beater is provided, said last named surface being curved substantially on an arc having a center substantially at the pivoting axis of said arm portion, and an abutment on the rotor for cooperation with said arm portion and disposed adjacent said arcuate surface, the beater arm portion engaging said abutment upon rotor rotation and being held by the latter within the periphery of the rotor body in parallel relation to a diameter of said body with the head centrifugally projected from the body, said surfaces forming a point at their leading ends, said point being outside of the rotor periphery and being closer to the rotor axis than the medial portion of said working surface when the head is fully projected, the head being movable within the periphery of the rotor body upon counteraction of centrifugal force.

2. In a machine of the class described, a rotor body comprising a rotary shaft, axially spaced plates fixed to said shaft, and rods extending through apertures in said plates in parallel relation to said shaft, a beater between two adjacent ones of said plates comprising an arm portion and a head portion projecting angularly from the arm portion at one end of the latter, the other end of said arm portion having an apertured boss formed thereon adapted to be strung on one of said rods, said head portion having a convexly curved working surface extending generally in the longitudinal direction of said arm portion and merging at its end toward the pivoted end of said arm portion with a re-entrant boundary surface which merges with said arm portion whereby a substantially hook-shaped beater is provided, said last-named surface being curved substantially on an arc having a center substantially at the pivoting axis of said arm portion, and an abutment on the rotor for cooperation with said arm portion and disposed adjacent said arcuate surface, the

beater arm portion engaging said abutment upon rotor rotation and being held by the latter within the periphery of the rotory body in parallel relation to a diameter of said body with the head centrifugally projected from the body, said surfaces forming a point at their leading ends, said point being outside of the rotor periphery and being closer to the rotor axis than the medial portion of said working surface when the head is fully projected, the head being movable within the periphery of the rotor body upon counteraction of centrifugal force, said boss being of greater thickness than the arm portion and than the head portion proper, the head portion having laterally projecting ribs thereon to provide a transverse dimension substantially equal to the spacing of the two adjacent plates, said ribs being spaced inwardly from the working face of said head portion so as to be always between said adjacent plates in guided relation thereto.

WALTER J. ARMSTRONG.