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PULVERIZING MILL

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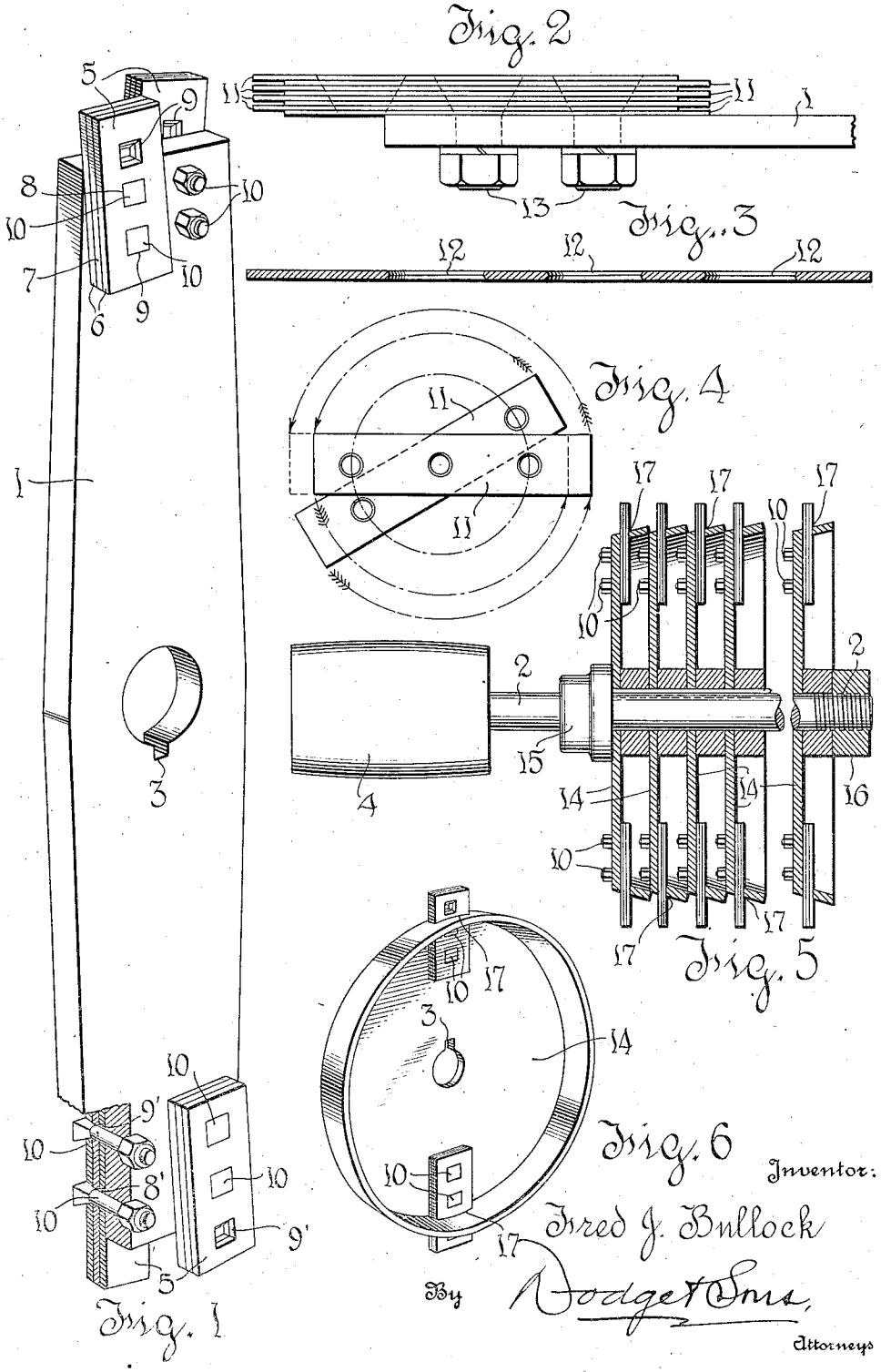

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PULVERIZING MILL

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This invention pertains to pulverizers of the type commonly known as impact or hammer mills because consisting mainly of a series of metal bars carried by and radiating from a rotatable shaft, and constituting, or armed with, heads or hammers which, moving through a falling mass of grain, vegetable, animal, or mineral matter, deliver sharp blows thereto which pulverize, cut, shred, or reduce the matter treated, to a finely divided condition.

The invention of the present application is in part disclosed in a prior application filed in my name on the 5th day of July, 1928, and bearing Serial No. 290,621, and to the extent of such prior disclosure is a continuation in part thereof. As to certain modifications and details herein set forth and claimed, the present application embodies new matter, not claimed or present in the parent case.

The invention sought to be protected by this application has for its objects, first, the better or more complete utilization of those parts of the mill which, owing to the service they perform, are subjected to the greatest wear; and second, the ready reconditioning of the mill through adjustments rendered possible by the novel construction and mode of mounting the hammer heads or blocks, or the bars or members by which they are carried.

The accompanying drawings illustrate slightly variant embodiments of my invention, all of which carry out the basic idea thereof. In these drawings:

Figure 1 is a perspective view of a single hammer bar suitable for use in an impact or hammer mill or pulverizer, provided with reversible hammer heads or blocks formed of laminated steel or other suitable metal or alloy;

Figure 2 illustrates a hammer head composed of separate thin metal plates, capable of joint and of independent reversal facewise and endwise, to permit utilization of the front and rear edges of each end of each plate;

Figure 3 is a longitudinal sectional view of one of the plates shown grouped in Fig. 2, enlarged to show the double beveling of its bolt holes;

Figure 4 is a face view illustrating the mode and effect of reversing the plates end for end;

Figure 5 is a sectional view illustrating a modified embodiment of the invention, wherein flanged circular disks are substituted for hammer bars such as shown in Fig. 1, and are assembled to produce a closed drum or cylinder;

Figure 6 is a perspective view of a single disk such as above referred to.

In pulverizers of the character here referred to, hammer bars 1 such as shown in Fig. 1, are usually assembled upon a main shaft 2, and held against rotation independently of the shaft by a spline or feather extending from the shaft into a seat 3 formed in the eye of the hammer bar. The shaft 2 is journaled in bearings in a suitable frame, and carries a belt pulley 4 to which rotary motion is imparted by belt from any convenient prime mover. The hammer bars or their equivalent, later described, may be arranged in direct alinement with and on the shaft 2, or at different angular positions relative thereto, thus forming a spiral series and causing the hammers to go into and out of action in succession instead of simultaneously. It is, however, deemed preferable, ordinarily, to employ two series of double-ended hammer bars, those of one series crossing the other at a right angle. It is likewise preferable, usually, to hold the hammer bars in their proper relative positions through frictional contact and facewise pressure, produced by nuts screwed upon threaded portions of the shaft, and pressing facewise against the outermost hammer bars of the series. In such case the key-seat 3 may be omitted.

The hammer carriers, of whatever form used, are according to my invention, furnished with hammer heads or blocks 5, secured to the carrier by bolts, and arranged to project beyond the outer boundaries or extremities of the carrier, as shown in the several figures of the drawing. Each hammer head or block 5 is formed of several laminæ

6 and 7, preferably three, though more or fewer may be employed, and these may be of steel, iron, or of other suitable metal or alloy. The separate laminæ may be of like material and temper or hardness, or of different material, or of different temper or hardness, as desired. When of different temper or hardness, the laminæ are preferably, though not necessarily, brazed, riveted, welded, or otherwise permanently joined face to face, with hard and soft laminæ 6 and 7 alternating, and the edges of the laminæ arranged to constitute the leading or impact face of the head or block when in action. When alternate hard and soft laminæ are employed, the outermost laminæ should be hard as compared with the intermediate lamina or laminæ, since the harder laminæ are best adapted to give and to withstand impact, and the softer ones wear away somewhat rapidly to a material depth or degree, leaving the edges of the harder ones exposed and prominent.

This idea of a laminate hammer head or block presenting the edges of the laminæ to the material to be pulverized or reduced, was fully set forth in my previous application above noted, and is claimed herein, as is also the mode of mounting, reversing, and thereby prolonging the life and usefulness of the hammer heads.

Figs. 1, 5 and 6 show hammer heads or blocks of the type above described, and when this type is employed the edges of the several laminæ are usually flush initially owing to the fact that the laminæ are usualy welded together in large sheets from which the smaller heads or blocks are subsequently cut or stamped. If made up of separate or independent plates, the softer or intermediate members may be of the same form as, but somewhat smaller than the outer plates. When so made, and secured by through bolts or the like, the edges of the softer plates will initially be set back, or inward from the corresponding edges of adjacent harder plates; but if the plates be cut from welded sheets, the more rapid wear of the softer plates will produce a like effect, and the harder edges will in a short time, stand out in advance of the softer ones.

Where welded laminate hammer heads are employed, each head is provided with a bolt hole 8 at its midlength, and two others, 9, one on either side of and equidistant from the first. Two similar bolt holes 8′ and 9′ are formed in the outer extremity of the carrying bar or member 1, extending through the same from face to face, and spaced apart to register with the intermediate hole 8 and one of the holes 9 of the head or block. If the forward or impact face of a hammer head or block thus constructed and mounted becomes worn, the head or block can be freed by removal of the inner bolt 10 swinging the head or block 5 about bolt 10 as a pivot, through an arc of 180 degrees, and replacing said bolt. To further utilize the head or block 5, it may be turned over facewise, thereby bringing to the front or leading position that edge and portion of head or block 5 which previously was the rear or trailing edge, and projected beyond the end of the bar.

By such endwise and facewise reversals of each hammer head or block, each affords four distinct, fresh or unused portions, or four times the wear available with the integral hammer heads formed upon the carrier bars. The time required to make such reversals is much shorter than that required for complete renewal or replacement of the hammer block or head, and no other expense or loss attends such reversals.

In Figs. 2, 3 and 4 I have shown a construction in which the several laminæ in the form of thin metal plates or strips 11 may, and preferably will, be formed of like material and of equal hardness or like temper, though this is not essential either as to material or hardness. Each plate or lamina is provided with three holes 12, but unlike the holes 8, 9, etc., of Fig. 1, the intermediate hole 12 is set slightly nearer one than the other end of the plate or strip. The other holes 12 are, however, equally spaced from the intermediate one. If, now, alternate plates or strips 11 be turned in reverse directions, the several plates or strips will bear the relation illustrated in Fig. 2, leaving alternate strips projecting beyond the intermediate ones, and exposing the sharp edges of the projecting ends to act upon the material to be pulverized or reduced. The plates or strips thus arranged are preferably secured to the carrier bars by conical or taper-headed bolts 13, which pass through the plates or strips 11, the holes in which are of progressively smaller diameter from the outermost plate to the innermost, to produce seats for the bolt heads, closely corresponding thereto.

Under this construction and arrangement the group of plates 11 may be swung about the bolt 13 occupying the intermediate holes of the plates, and thus reversed end for end, the innermost bolt being removed preparatory to, and replaced after, such reversal. By removing both bolts 13 each plate 11 will be made free for facewise reversal, thereby bringing the previously rear face to the front or advancing side of the composite hammer or block, but care must be taken to maintain the original order or sequence of the plates because of the progressive reduction in the size of the seats for the bolt heads, throughout the group or series of plates. Obviously, polygonal bolt heads of tapering form may be used instead of truly conical; but in each such case the bolt holes should be beveled each way from the plane midway between the two faces of each plate as shown in Fig. 3, so that they may snugly fit the bolt heads

throughout one-half the thickness of each plate, whichever face be turned outward. While the tapered bolt heads are preferred, any usual form of bolt may be employed, in which case, however, a relatively thin or flat head may advantageously be adopted to minimize projection beyond the face of the hammer head.

The dotted lines and arrows of Fig. 4 illustrate the end for end reversal of the plates.

In Figs. 5 and 6 I have illustrated a modified form of carrier for the hammer heads or blocks, each consisting of a circular disk 14, with a slightly flaring circumferential flange, provided with one or more openings, each to receive a laminate hammer head of either of the types above described. The flare of the flanges is just sufficient to permit each to overlap slightly or permit the seating within it of the smaller diameter of a proximate disk. In other words, each disk in its preferred construction, is a shallow, frusto-conical, pan-like disk, capable of slightly nesting with a like proximate disk, so that when placed upon a central shaft or arbor 2 they shall constitute a closed circular drum, which may be of any desired axial measurement.

To force and bind together the series of disks, the shaft or arbor 2 is formed or furnished near one end with a fixed boss or collar 15, against which one disk is pressed, and successive disks being added and slightly nested, the entire group is pressed together and against the collar 15 by a heavy nut 16 applied to the threaded end of the shaft or arbor 2 distant from said collar. Such pressure ensures centering and inter-engagement of the disks, and produces a very strong and solid structure The drum prevents the matter treated from falling directly downward to and past the shaft or arbor, and tends to hold it longer in the path of the hammer heads or blocks. It also eliminates the separate hammer bars, and encases the major portion of the hammer heads, thereby greatly reducing the air friction and resistance incident to rapid movement of exposed hammer bars through the air and through the material treated.

As shown in Figs. 5 and 6, the flange of each disk has one or more holes or openings 17, to permit a hammer head or block of either described type to be passed through it and bolted to the radial body of the disk, in the same way that said heads or blocks are secured to the bar 1 of Fig. 1. The openings 17 can be extended sufficiently to permit endwise reversal of the hammer heads without removing the pivot bolt, but as it is deemed advisable to prevent entrance of material into the drum, I prefer to make the openings with only sufficient clearance to permit free insertion and removal of the hammer heads or blocks with the aid of simple tools.

While it is deemed preferable to nest slightly one disk within the other, because of the more certain centering of the several disks and the somewhat stiffer or stronger construction afforded, this is not essential, and it is within the purview of my invention to abut the edges of the disk flanges against the outer face of the proximate disk throughout the series.

Machines of this general type commonly comprise, in addition to the frame, shaft and belt pulley, a suitable casing, feed hopper or spout, and reticulate or perforate concave, to confine the material under treatment and aid in the work of pulverization, as also to retain particles of undue size until they are sufficiently reduced to pass through the meshes or perforations of the concave. Such parts being common and well known, and being fully shown and described in the parent application, are not here illustrated, but will or may be used.

The hammer bars 1, or the end portions thereof, may be made of the laminated material if desired, whether provided with additional hammer heads or not.

It is obvious that an ordinary nut of suitable dimensions may be substituted for the fixed boss or collar 15, and is in fact preferable thereto in that it permits equal adjustment of the disks or hammer bars from both ends of the shaft, and hence involves less shifting of the disks or other form of hammer bars from their initial position, when compressing the group of hammer carriers to secure requisite frictional contact. This is important where, as is sometimes done, the hammer heads co-operate with a grid or series of teeth fixed to the casing of the mill.

What is claimed is:—

1. In a pulverizing mill of the character described, hammers formed of laminated metal, the outer laminæ being relatively hard and the intermediate lamina or laminæ being relatively soft, said hammers being arranged to operate through travel in the plane of lamination.

2. In a pulverizing mill, a series of hammers of laminated metal, each comprising at least three layers, the outer layers being relatively hard and the intermediate layers being relatively soft, said layers being presented edgewise to the material to be reduced.

3. A hammer or impact member for pulverizing machines of the impact type, consisting of metallic laminæ arranged face to face with laminæ of relatively softer quality interposed between others of harder quality.

4. A hammer or impact element for pulverizing mills of the impact type, said hammers comprising a plurality of relatively thin metallic laminæ superposed facewise one upon another, some of the laminæ projecting in advance of or beyond others on the lead-

ing face, whereby sharp angular edges are exposed on said leading face.

5. In a pulverizing mill, the combination of a hammer or impact block comprising a series of metallic laminæ superposed facewise one upon another, and collectively and individually reversible facewise to present first one and then the other edge of each laminæ forward as related to the direction of travel of the hammer; and a carrier for said hammer.

6. In a pulverizing mill, the combination of a hammer or impact block comprising a series of metallic laminæ superposed facewise one upon another; and a carrier for the hammer, said hammer being reversible end for end to present first one and then the other edge face of the laminæ forward as related to the travel of the hammer when in operation.

7. In a pulverizing mill, the combination of a hammer or impact block comprising a series of metallic laminæ superposed facewise one upon another; and a carrier for the hammer, said hammer being reversible end for end and facewise to present first one and then the other edge face of the laminæ forward as related to the travel of the hammer when in operation; whereby four distinct working faces of the hammer are made available.

8. A laminated hammer for pulverizing or reducing substances, the same consisting of metallic plates placed face to face and mounted to move through the substance to be reduced, edgewise of the individual plates or laminæ; a carrier for said hammer; and bolts passing through the plates and carrier and each having its head tapered from its outer extremity to the threaded stem of the bolt, to fit corresponding seats in the hammer head.

9. In a pulverizing mill of the impact type, a hammer carrier provided near its outer extremity with two bolt holes; a hammer head secured to said carrier by two bolts, one passing through the intermediate hole of the hammer head and through the carrier, and serving as a pivot about which to reverse or adjust said head, and the other bolt passing through one of the remaining holes of the hammer and through the carrier, and serving with the pivot bolt, to secure the hammer to the carrier.

10. In a pulverizing mill of the impact type, a main supporting shaft; a series of flanged disks secured to and carried by said shaft, said disks being arranged with the outer edge of each in supporting relation to the body of the proximate disk; hammers carried by said disks and projecting radially beyond their flanges; and means carried by said shaft for frictionally holding the disks against rotation independently of the shaft or of one another.

11. In a pulverizing mill of the impact type, a main supporting shaft; a series of frusto-conical disks secured to and carried by said shaft, said disks being nested slightly one within another, to center them and to secure a bracing effect, hammers carried by said disks and projecting radially beyond their conic faces; and means carried by the shaft and serving to apply facewise pressure to both ends of the series of disks.

In testimony whereof I have signed my name to this specification.

FRED J. BULLOCK.