W. K. LIGGETT & W. J. ARMSTRONG.

PULVERIZER.

APPLICATION FILED FEB. 3, 1910.

1,044,401.

Patented Nov. 12, 1912.

3 SHEETS—SHEET 1.

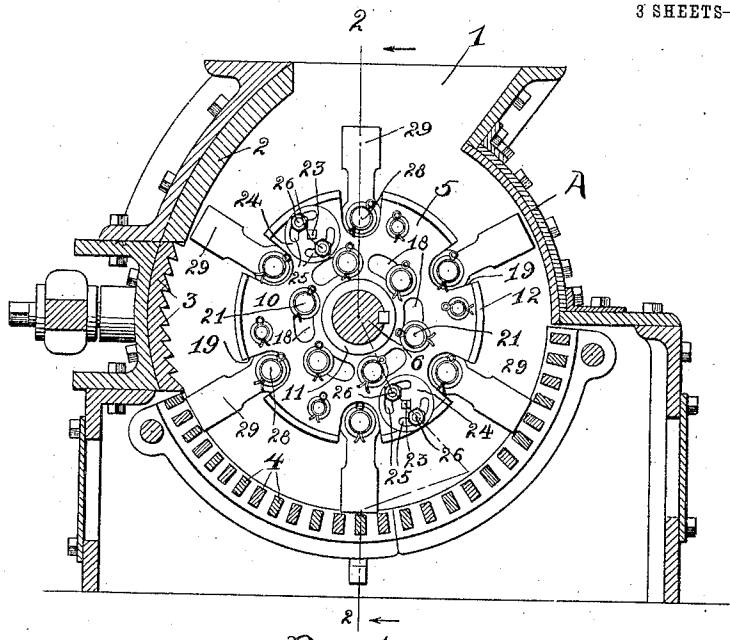

Fig. 1.

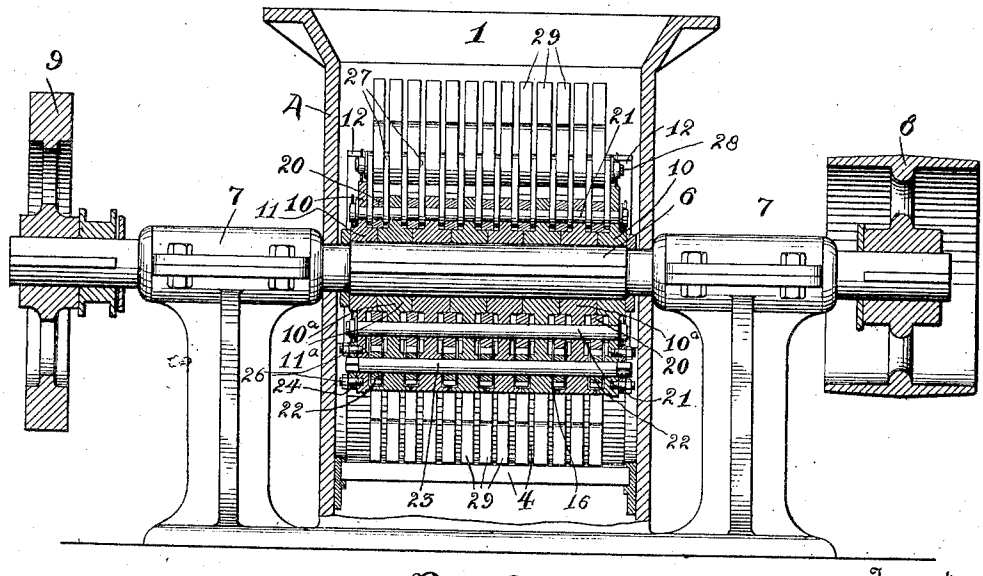

Fig. 2.

Witnesses

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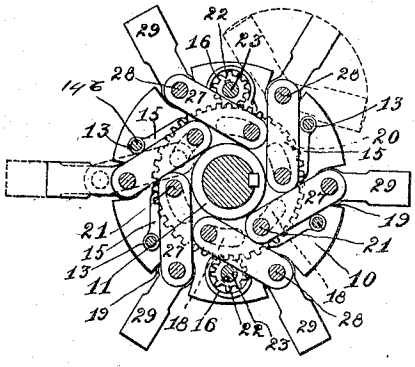

Fig. 3.

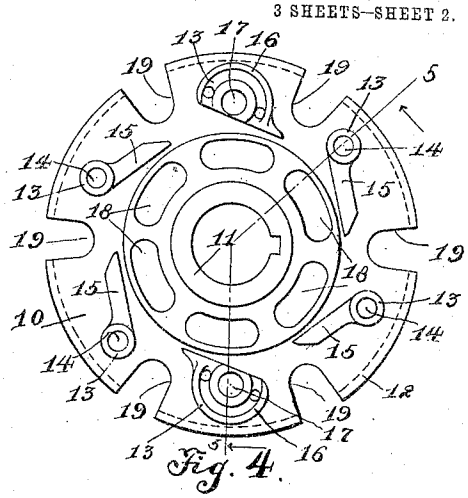

Fig. 4.

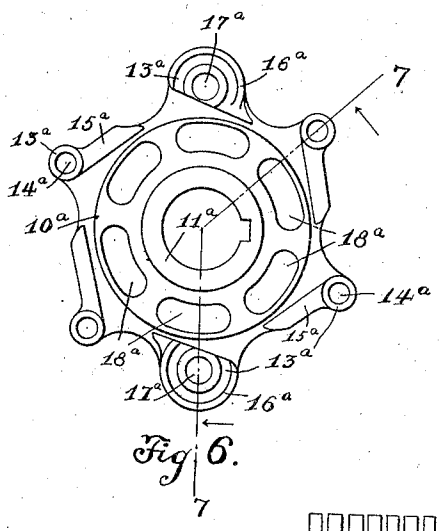

Fig. 6.

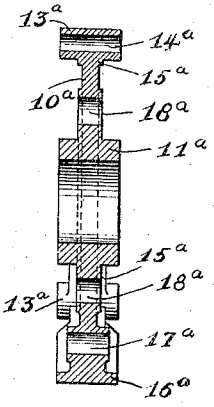

Fig. 7.

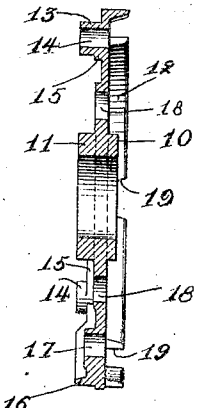

Fig. 5.

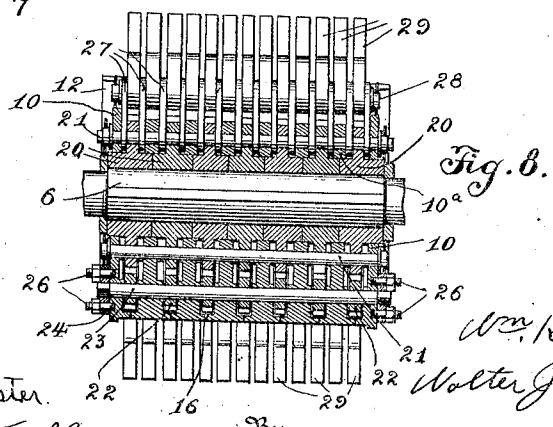

Fig. 8.

Witnesses

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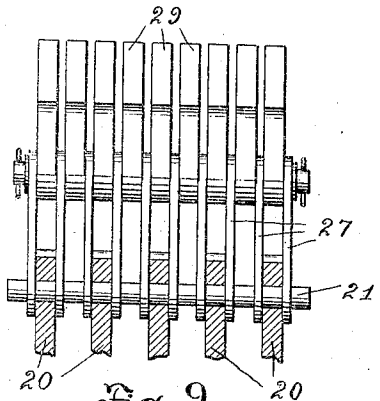

Fig. 9.

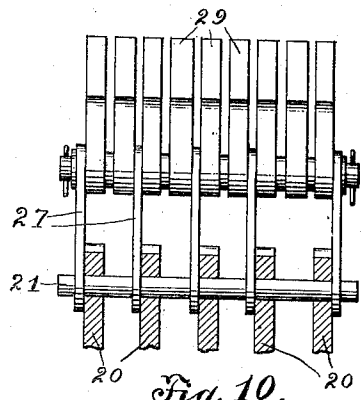

Fig. 10.

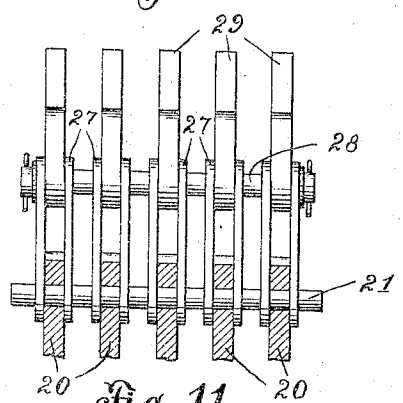

Fig. 11.

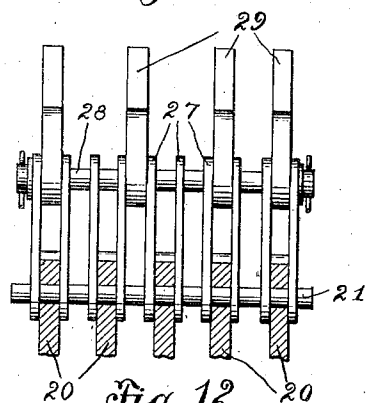

Fig. 12.

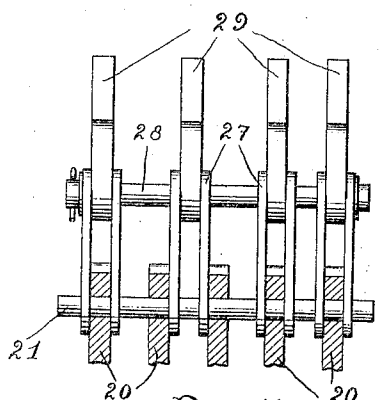

Fig. 13.

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UNITED STATES PATENT OFFICE.

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PULVERIZER.

1,044,401. Specification of Letters Patent. Patented Nov. 12, 1912.

Application filed February 3, 1910. Serial No. 541,753.

To all whom it may concern:

Be it known that we, WILLIAM K. LIGGETT and WALTER J. ARMSTRONG, citizens of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Pulverizers, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to improvements in pulverizing machines of the swing hammer type. In pulverizers of this class it is well known that the hammers wear off rapidly at their outer or working ends and render the machine less effective by increasing the power necessary to drive it and by reducing the fineness of the pulverized product. The hammers work most satisfactorily when they barely clear the grinding surface and screen bars, and it has been found by experience that when the hammers are shortened a thin layer of material in the process of pulverization lies between the screen and the ends of the hammers. It thus becomes necessary for the hammers to force their way through this thin layer of material and much energy is thus needlessly expended.

The object of this invention, therefore, is to provide a hammer carrying mechanism by means of which hammers may be readily adjusted to off-set the reduction in their length due to wear.

In the drawings we have shown the construction which we at present prefer, but we desire it to be understood that our construction is not limited to the exact construction shown and that various changes may be made.

Of the drawings, Figure 1 is a cross sectional elevation of a pulverizer embodying our invention. Fig. 2 is a cross sectional elevation along the line 2—2 of Fig. 1. Fig. 3 is a cross sectional view of the rotor of the hammer mechanism. Fig. 4 is a detail view of one of the end rotor disks. Fig. 5 is a cross sectional view taken along the line 5—5 of Fig. 4. Fig. 6 is a detail view of one of the intermediate rotor disks. Fig. 7 is a cross sectional view taken along the line 7—7 of Fig. 6. Fig. 8 is a longitudinal cross sectional view showing a modified form of rotor or hammer mechanism. Figs. 9 to 13 are fragmentary cross sectional views showing various arrangements of hammers and supporting links for which our invention is adapted.

The framework and casing which we have shown in the drawings is similar in many respects to that shown and described in the pending application of Wm. K. Liggett, Ser. No. 357,072, and it will not therefore be necessary to give a detailed description. Briefly described the pulverizer consists of the casing A having a feed opening 1 and provided with a pulverizing surface which consists of the breaking plate 2, the teeth 3 and the screen bars or grating 4. The rotor 5 is secured to the shaft 6, which is mounted in the bearings 7, 7. The shaft is driven by the belt pulley 8 and carries the fly wheel 9.

Material is fed in through the feed opening 1 and is struck by the hammers and driven against the breaking plate 2. It then passes the teeth 3 and is ground against and between the screen bars 4 by the continued action of the hammers.

In the drawings we have shown the pulverizer provided with six rows of hammers; but it will, of course, be understood that any suitable number may be used and that the number six, as used in the following specification, simply serves to indicate a correspondence between the number of hammers and the number of the parts described.

In the preferred form of our invention, as shown in Figs. 1 to 7, 10, 10 and 10^a, 10^a are plates or disks keyed to the shaft 6 and provided with laterally extending flanges 11 and 11^a which contact with each other to form a continuous hub extending throughout the length of the rotor. The end disks 10, 10 are preferably substantially circular in outline and are provided with the flanges 12. 13 and 13^a are bosses formed on the disks and uniformly spaced concentrically. Four of the six bosses 13 and 13^a of each plate are provided with circular axial apertures 14 and 14^a. Pins or rods 14^b pass through the apertures 14 and 14^a of the bosses. These rods are of such a length that they extend through all of the disks and serve not only to tie the disks together but also to strengthen the bosses 13 and 13^a. Tangent to each of the bosses is a stop or ledge 15 having its inner wall perpendicular to the plane of the disks. The purpose of these stops or ledges will be fully set forth hereinafter. The two bosses of each disk

which are not provided with the axial apertures are made larger than the others, and are provided with approximately semi-circular gear casings 16 and 16ª. Concentric within the gear casings are apertures 17 and 17ª for a purpose to be hereinafter set forth. Each of the disks is provided with six curved slots 18 and 18ª. The disks 10, 10 are provided with six notches 19 uniformly distributed about the circumference. Between each pair of adjacent disks and rotatably mounted on the hubs thereof is a gear wheel 20. Each of these gear wheels is provided with six equally spaced holes through which extend the pins 21. The pins 21 pass through the slots 18 and 18ª of the disks and are secured against longitudinal movement by means of washers and cotter pins at their ends.

22, 22 are spur pinions located within the gear casings formed on the disks and meshing with the gears 20. The pinions are keyed to the shafts 23, 23, which extend through the apertures 17 and 17ª of the disks. The ends of the shafts 23, 23 are each square and pass through square apertures in the locking plates 24. The plates 24 are provided with curved slots 25, through which pass the studs 26. By means of nuts on the studs these plates may be locked in any desired position. The square ends of the shaft 23 are preferably extended far enough beyond the plates 24 to permit the attachment of a crank having a square socket.

27, 27 are links each pivotally attached at its inner end to one of the rods 21. At their outer ends the links 27 carry the rods 28, upon which are pivotally mounted the swing hammers 29. When the parts are in the position shown in Fig. 3 each link bears against one of the stops or ledges 15. The ledges thus serve to give an extended bearing surface for each link.

When it is desired to adjust the position of the hammers the nuts on the studs 26 are loosened and a crank attached to any one of the four ends of the shafts 23. One of the shafts is thus rotated by means of the crank and with it are rotated one set of pinions 22, which in turn rotate the gears 20 and the other set of pinions. The gears 20 carry with the rods 21 which move through the slots 18 and 18ª. The rods 21 carry with them the links 27 which slide upon the bosses 13 and 13ª. In this way the rods 28 and the hammers 29 are moved outward. In Fig. 3 we have shown in dotted lines one of the hammers moved to its extreme outward position. When the hammers have been adjusted to proper working position the nuts on the studs 26 are tightened and the whole mechanism is locked ready for use.

It will be noted that the links 27 are held in contact with the bosses 13 and 13ª entirely by centrifugal force. It will be further noted by a reference to Fig. 1 that the tendency of material thrown into the machine is to move the hammers backward and thus force the links still more firmly into engagement with the bosses.

In Fig. 8 we have shown a modification of our invention. The construction shown differs from that shown in Figs. 1 to 7 in that the gears 20 are provided with hubs or flanges and are keyed to the shaft 6. The disks 10, 10 and 10ª, 10ª are rotatably mounted on the hubs of the gears. The relative adjustment of the gears and of the disks is accomplished in the same manner as in the other construction and further description will therefore be unnecessary.

In Figs. 9 to 13 we have shown a number of different hammer and link arrangements which may be used without modifying in any way the construction of the disks and gears. Fig. 9 shows an arrangement such as is shown in Fig. 2. Fig. 10 shows an arrangement having the same number of hammers but in which some of the links are omitted. Fig. 11 shows the same number of links as Fig. 9, but every second hammer is omitted. Fig. 12 shows a construction with still more hammers omitted. Fig. 13 shows the same number of hammers as Fig. 12 but some of the links are omitted.

What we claim is,

1. In a pulverizing machine, the combination with a casing provided with a suitable grinding surface, of a rotary hammer mechanism comprising two groups of disks, the disks of one of said groups being angularly adjustable relatively to those of the other, a plurality of hammers each in alinement with a disk, and hammer supporting devices to which the hammers are pivotally attached, each of the said supporting devices being pivotally connected at its inner end to a disk of one group and each slidably engaging a disk of the other group at a point outside of the pivotal connection with the first disk, whereby the adjustment of the elements will move the hammers radially inward or outward, substantially as set forth.

2. In a pulverizing machine, the combination with a casing provided with a suitable grinding surface, of a rotary hammer carrying mechanism comprising two groups of disks, the disks of the two groups being alternately arranged relative to each other and the disks of one of said groups being angularly adjustable relatively to those of the other, links pivotally connected to the disks of one group and engaging the disks of the other group, and swing hammers pivotally connected to the links and adapted to cooperate with the grinding surface, substantially as set forth.

3. In a pulverizing machine, the combination with a casing provided with a suitable

grinding surface, of a rotary hammer mechanism comprising a shaft, two groups of disks, the disks of one group being rigidly connected to the shaft and provided with laterally extending hubs and the disks of the other group being adjustably mounted on the hubs of the first group, means for adjusting the position of the disks of the second group relative to those of the first and for locking them in position, hammer supporting devices engaging the disks of each group, and having a part adapted to be moved radially inward or outward by the relative movement of the disks, and hammers mounted upon the hammer supporting devices whereby they may be moved radially inward or outward, substantially as set forth.

4. In a pulverizing machine, the combination with a casing provided with a suitable grinding surface, of a hammer mechanism comprising a shaft, a plurality of swing hammers, rods parallel to the shaft upon which the hammers are mounted, links connected at their outer ends to the rods, supporting means for the links intermediate their ends, said supporting means being rigidly connected to the shaft and adapted to slidably engage the links, disks angularly adjustable relatively to the supporting means, and positioned one immediately adjacent each link, and means for pivotally connecting the inner end of each link with the immediately adjacent disk, substantially as set forth.

5. In a pulverizing machine, the combination with a casing having a suitable grinding surface, of a rotary hammer mechanism comprising a series of rotating disks, a series of gears mounted alternately between the disks and rotatable relative thereto, a series of pinions mounted on the disks and meshing with the gears, means for rotating the pinions to adjust the relative positions of the disks and the gears, a plurality of links pivotally attached to the gears and engaging the disks, and a plurality of hammers pivotally attached to the links, substantially as set forth.

6. In a pulverizing machine, the combination with a casing having a suitable grinding surface, of a rotating hammer mechanism comprising a series of parallel disks, a series of gears mounted between the disks and rotatable relative thereto, a series of pinions adapted to mesh with the gears, a shaft on which the pinions are mounted, said shaft being connected to the disks, means for locking the shaft against rotation, a plurality of groups of links, a plurality of rods connected to the gears, the inner ends of the links of each group being pivotally connected to one of the rods and all of the links engaging intermediate their ends with the disks, a plurality of rods to each of which are connected the outer ends of the links of one group, and swing hammers pivotally mounted on said rods, substantially as set forth.

7. In a pulverizing machine, the combination with a casing having a suitable grinding surface, of a rotary hammer mechanism comprising two elements angularly adjustable relative to each other, a plurality of hammer supporting devices engaging the said two elements and adapted to move the hammers radially inward or outward as the relative positions of the said elements are changed, gear teeth on one of the elements, and a rotatable pinion on the other element adapted to engage the said gear teeth to move one element relative to the other, substantially as set forth.

8. In a pulverizing machine, the combination with a casing provided with a suitable grinding surface, of a rotary hammer mechanism comprising two groups of disks, the disks of the two groups being arranged alternately relative to each other, and the disks of one of the said groups being angularly adjustable relative to those of the other, links pivotally connected to the disks of one group, each link being located between a pair of adjacent disks of the said group, and each link engaging the disks of the other group to be moved by the relative adjustment of the disks of the two groups, and swing hammers pivotally connected to the links and adapted to coöperate with the grinding surface, substantially as set forth.

9. In a pulverizing machine, the combination of a casing provided with a suitable grinding surface, of a hammer mechanism comprising a plurality of apertured rotatably mounted parallel disks, arranged with spaces between them, rods parallel to the axis of rotation of the disks and passing through the apertures thereof, links connected at their inner ends to the rods, each link being immediately adjacent to one of the disks, rods connected to the outer ends of the links, swing hammers mounted on the said rods, and adjustable means for engaging the links intermediate their ends to support them against movement relative to the disks, substantially as set forth.

In testimony whereof we affix our signatures, in presence of two witnesses.

WILLIAM K. LIGGETT.
WALTER J. ARMSTRONG.

Witnesses:
H. B. ALEXANDER,
RALPH CLOSE.