No. 648,488. Patented May 1, 1900.

G. S. EMERICK.

PULVERIZING MACHINE.

(Application filed Aug. 6, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

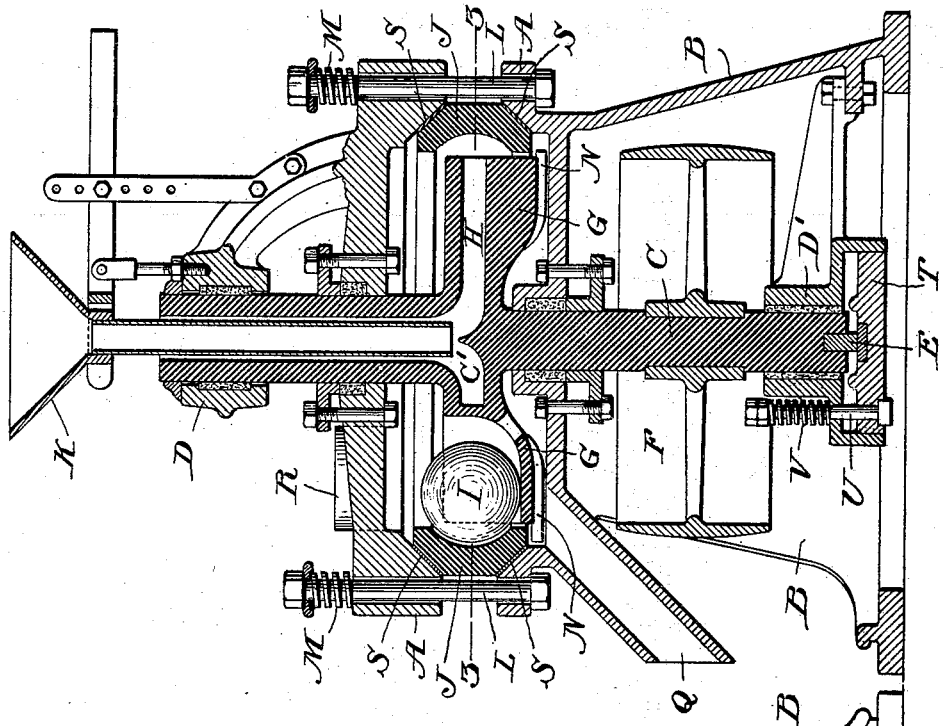

Fig. 2.

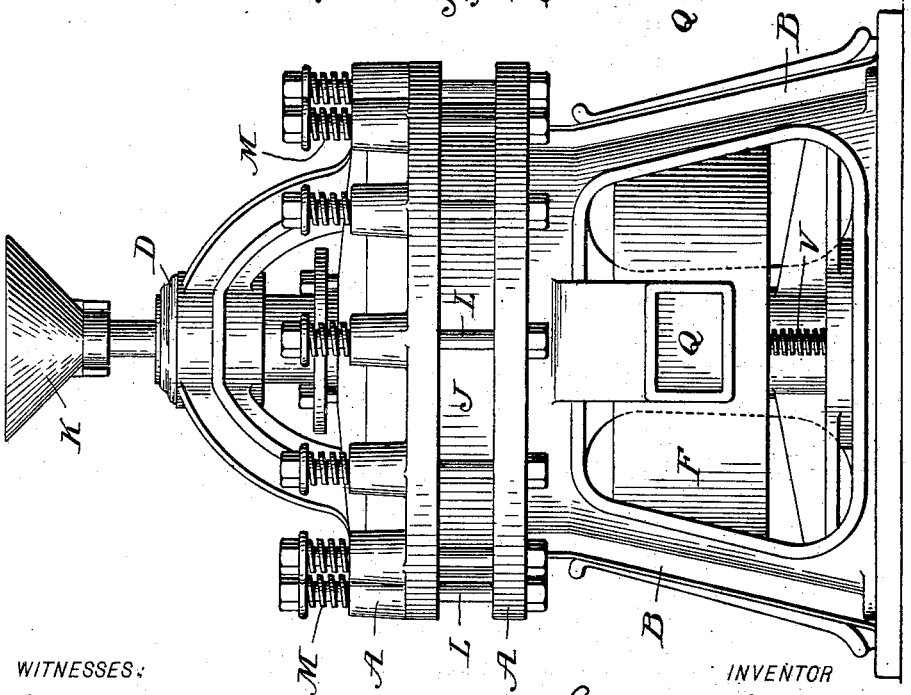

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Fig. 3.

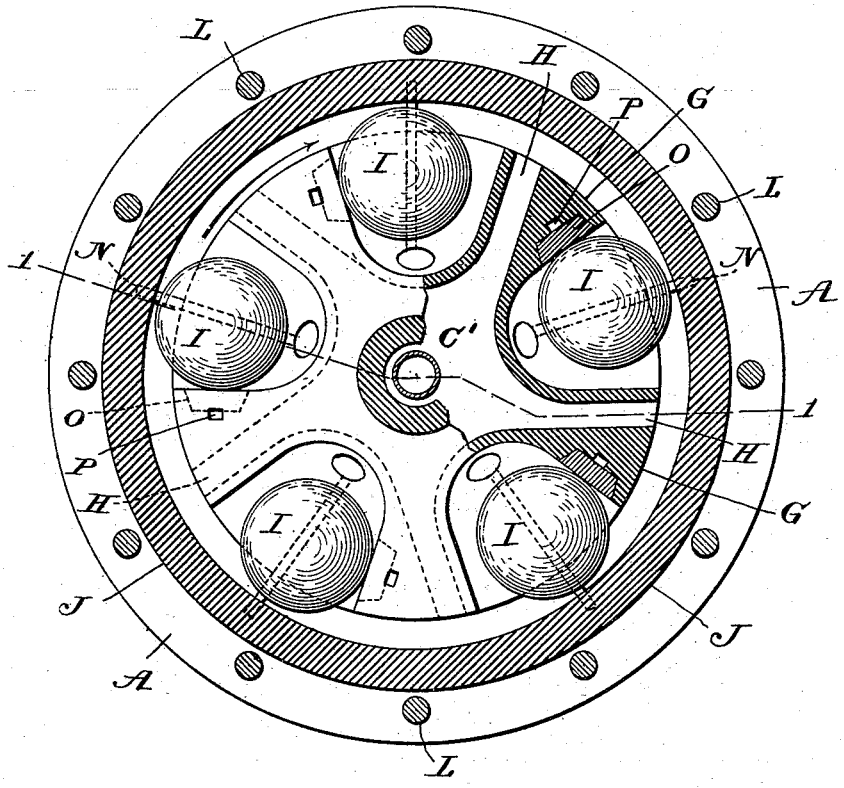
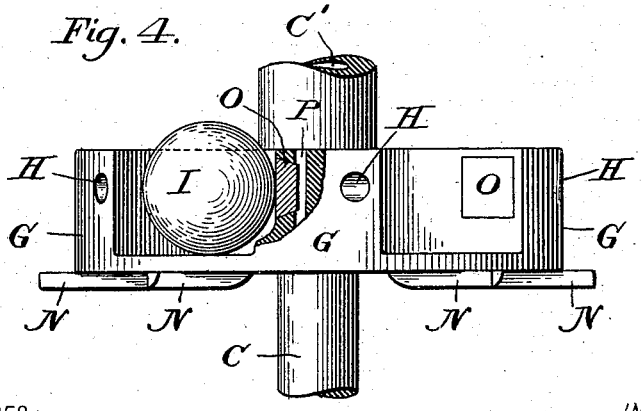


Fig. 4.



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GEORGE S. EMERICK, OF PHILADELPHIA, PENNSYLVANIA.

PULVERIZING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 648,488, dated May 1, 1900.

Application filed August 6, 1898. Serial No. 688,008. (No model.)

To all whom it may concern:

Be it known that I, GEORGE S. EMERICK, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented a new and useful Pulverizing-Machine, of which the following is a specification.

My invention relates to improvements in pulverizing-machines in which balls driven by rotating arms traversing within a cylindrical casing operate to grind or comminute the substances desired; and one object of my improvement is to impart greater strength and efficiency to such machines by combining the driving-arm and feed-conduit in such manner that the material to be pulverized is fed directly against the face of the grinding-ring without passing around the balls or into the ball-sockets.

A further object of my improvement is to do away with the wear upon the face of the driving-arm at its point of contact with the ball, and, lastly, to obviate the strain upon the upper portion of the cylindrical casing due to the expansion of the grinding-ring when heated by the operation of grinding or pulverizing.

I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section of the entire machine upon the line 1 1, Fig. 3; Fig. 2, a view in side elevation of the entire machine; Fig. 3, a horizontal section or plan of the machine on the line 3 3, Fig. 1, the upper plate or cap of the cylindrical casing being removed; Fig. 4, a view in side elevation of the combined driving-arm and feed-conduit with the scrapers and with the ball in place.

In Fig. 1 the casing A A, with its supports B B, constitutes the framework of the machine. The lower supporting portion of the frame is provided with an annular beveled face adapted to receive a grinding-ring, and the upper covering portion of the frame is also provided with an annular beveled face to engage such a ring. These frame portions are provided with apertures through which bolts, as L L, are passed, springs M M being interposed between the nuts on the upper ends of the said bolts and the top of the upper frame portion, as clearly seen in Figs. 1 and 2 of the drawings. This holds the frame portions together with a yielding pressure and enables them to give when the parts (more particularly the grinding-ring) become heated. The grinding-ring J forms an important feature of my invention, and is provided with an inner concaved grinding-face and outer annular beveled faces which are adapted to coincide with and bear upon the annular beveled faces of the upper and lower frame portions. It will be seen from the drawings, especially Fig. 1, that the grinding-ring J wedges the upper and lower frame portions apart, thus forming the side walls of the grinding-chamber of the machine. The action of the spring-carrying bolts L L therefore has a tendency to so draw the frame portions together as to properly center the grinding-ring between them.

C is a shaft with a partly-hollow portion C′ with bearing boxes or collars D D′, supported by and revolving upon the pintle E.

F is a pulley-wheel attached to and revolving the shaft C. The shaft C is provided about centrally of its length with a horizontally-arranged disk or cylindrical portion which is provided with a series of recesses or sockets to receive the grinding-balls I I. The bottoms of the said sockets are closed by suitable ball-supporting floors which carry the balls around in the operation of the device.

G G are driving-arms, of which there may be any number from two upward, each containing the feed-conduit H, which opens into the hollow portion C′ of the shaft C.

In setting forth the operative portion of the machine, as shown in Fig. 1, it should be borne in mind that the right-hand half of the vertical section there shown passes through the driving-arm on a line running through the center of the feed-conduit H, while the left-hand half passes through the axis of the most nearly opposite socket between two of the driving-arms, as shown by the line 1 1, Fig. 3.

I is a ball in place in the socket between the driving-arms.

K is a hopper with its pipe communicating with the hollow portion C′ of the shaft C.

N N are scrapers attached radially to the bottoms of the driving-arms G G.

S S are rubber rings between the outer faces of the grinding-ring and the upper and lower portions of the cylindrical casing.

R, Fig. 1, is a capped opening, of which there are three, through the top of the casing A A. These allow access to the interior of the pulverizer for purposes of adjustment and repair and also to pass off the heat generated in grinding.

In Fig. 3, O O are what I term "driving-blocks," inserted in the face of each driving-arm. P P are channels passing through each driving-arm back of the driving-blocks to facilitate the removal of the driving-blocks when worn.

The operation of the pulverizing-machine is as follows: The shaft C being driven with great velocity by any suitable means, the material to be pulverized is fed from the hopper into the mouth of the hollow shaft and is thence drawn or driven by centrifugal or other force through the feed-conduits H H, Fig. 3, in the driving-arms, striking the inner face of the grinding-ring J, Fig. 1. Where the arrangement of the feed-conduits is such that the material is fed in back of the balls, or, in other words, where it is fed either into the socket carrying the ball or into the space between the driving-arms where the ball is being driven, the socket or space is liable to become temporarily choked or obstructed, and the grinding is in some measure done between the ball and its surrounding socket instead of taking place between the face of the grinding-ring and the ball, as it should do. This develops great heat and unnecessary friction, with a consequent rapid wear of parts and an imperfectly and unevenly ground product. By the form and arrangement of the feed-conduits herein shown and described the material is fed directly to the concave face of the grinding-ring, where it is pulverized by the ball without coming in contact with the ball at the point at which it is being driven and without being obliged to pass around the ball or through the ball socket or chamber in order to reach the grinding-ring. The balls I I, Fig. 3, driven by the driving-arms in the direction indicated by the arrow, are thrown outward against the concave face of the grinding-ring and operate to crush the material in the course of their rotation. As the crushed product falls to the bottom of the casing it is carried by the scrapers N N, Fig. 1, to the outlet Q, through which it passes into proper receptacles.

The number of balls and driving-arms with their feed-conduits is immaterial, depending upon the size of the pulverizer and the character of the material to be pulverized. Cylinders or cones might also be used instead of balls, but balls are preferable.

Where the upper and lower portions of the casing inclosing the grinding-ring are bolted or secured together in the ordinary manner, or, in other words, rigidly connected, the expansion of the grinding-ring, due to the heat developed in the process of grinding, forces up the upper part of the casing and breaks loose any such rigid connecting means. To obviate this difficulty, the bolts or rods L L, Figs. 1 and 2, are furnished with the springs M M, which allow the upper part of the casing to yield to the pressure of the expanding grinding-ring, while at the same time holding the latter firmly in place. The rubber rings S S, Fig. 1, are interposed between the outer faces of the grinding-ring and the inclosing casing to take up the jar and lessen the crystallization of the adjacent parts caused by the vibration.

To take the wear of the driving-arm at the point of contact with the ball, the driving-block O above described is inserted in the driving-arm, as shown in Figs. 3 and 4. The channel P enables the driving-block to be drifted out or removed when worn by the insertion of a wedge or suitable tool. The driving-blocks may be of any suitable shape, either in the form of a truncated cone or as herein shown.

The step-plate T, Fig. 1, has a relatively-free vertical movement in the bearing D', moving in downwardly-extending flanges formed thereon. The step-plate is secured to the bearing by a suitable number of bolts, as shown at U. These bolts are furnished with springs, as shown at V. This arrangement gives the shaft C, with its driving-arms, a limited vertical play, and thus allows the driving-arms and balls to automatically adjust themselves to the center of the grinding-ring. By this means the balls bear uniformly against the concave face of the grinding-ring, and thus avoid the heating, wear, and friction due to the balls bearing unequally against either the top or bottom of the inner face of the ring.

What I claim as my invention, and desire to secure by Letters Patent, is—

A pulverizing-machine, comprising a lower supporting-frame, a grinding-ring mounted thereon, an upper frame resting on said grinding-ring, beveled engaging surfaces being arranged between the said frames and the upper and lower edges of the said ring, bolts and springs for holding the grinding-ring in place between the frames under a yielding pressure, grinding-balls engaging said grinding-ring, a disk having ball-sockets and driving-arms, a shaft carrying said disk, a step-block supporting said shaft in a yielding manner to correspond with the yielding action of the grinding-ring, substantially as described.

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