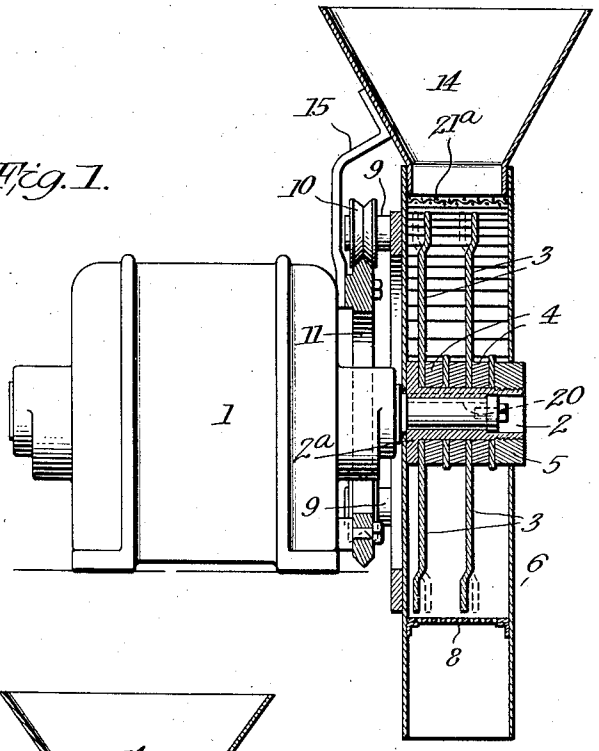
Feb. 18, 1930. F. J. BULLOCK 1,748,046

PULVERIZING MILL

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Fig. 1.



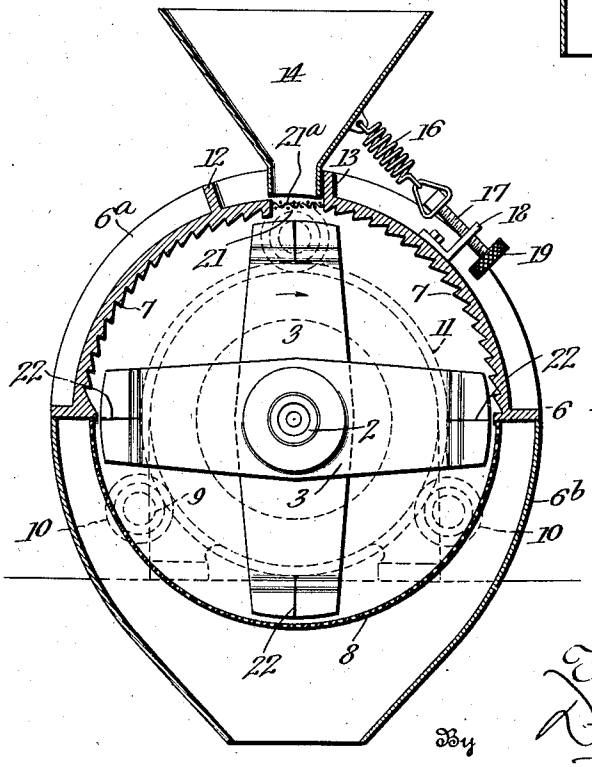


Fig. 2.

Inventor:

Fred J. Bullock,

By Dodge & Sons.

Attorneys

Feb. 18, 1930.

F. J. BULLOCK

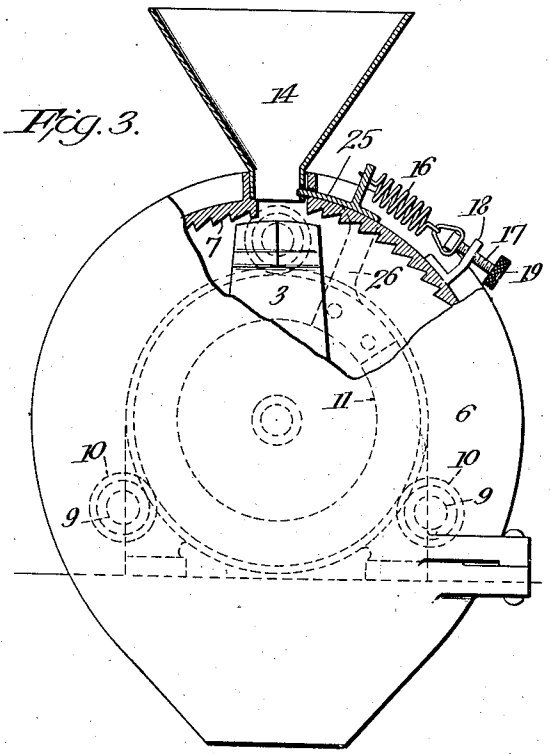
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Fig. 3.



Inventor:

Fred J. Bullock,

By Dodge & Sons,

Attorneys.

Patented Feb. 18, 1930 1,748,046

UNITED STATES PATENT OFFICE

FRED J. BULLOCK, OF SHORTSVILLE, NEW YORK, ASSIGNOR TO PAPEC MACHINE COMPANY, OF SHORTSVILLE, NEW YORK, A CORPORATION OF NEW YORK

PULVERIZING MILL

Application filed July 5, 1928. Serial No. 290,621.

This invention pertains to pulverizing mills or machines of the hammer type, and the improvements comprise automatic means for controlling and regulating the infeed of material to the mill; a novel type of hammers or beaters; and other features and details hereinafter more fully set forth.

A preferred embodiment of the invention is illustrated in the accompanying drawings, wherein an electric motor is shown for giving motion to the hammers or beaters carried directly by the armature shaft, and the body or shell of the mill is supported by the motor frame through connections permitting a limited rocking motion or oscillation of said casing relatively to the motor. In these drawings:

Figure 1 is a side elevation of the machine, showing the motor in outline and the mill proper in vertical section in the plane of the axis of the motor;

Fig. 2 is a face elevation of the mill with its shell or casing, hopper, and screen cut in a vertical plane at right angles to the motor axis;

Fig. 3 is a similar face elevation of the mill in a slightly modified form, with the shell or casing partially broken away and in section;

In these drawings, 1 indicates a motor of any suitable type, here conventionally indicated as an electric motor, the armature shaft of which is extended to receive a sleeve or hub 2 of cylindrical form with a radial flange 2^a at its inner end and circumferentially threaded at its outer extremity. Upon this hub or sleeve are strung in alternation, flat hammer bars 3 of the general form shown in Figs. 1, 2, 3 and 4, each comprising two hammer members. The bars 3 are each provided with a hole at its midlength, of a size to fit snugly upon the hub 2, and are spaced apart by interposed collars 4. The bars and collars are pressed toward and clamped against the flange 2^a of hub 2 by a nut 5 screwed upon the threaded outer end of said hub (see Fig. 1).

The shell 6 of the mill may vary in construction but is preferably of the character shown in Figs. 1 and 2, comprising an upper semicircular portion 6^a and a lower section 6^b which may be of light cast iron or built up of sheet steel or iron in the hopper form shown. The inner face of the upper section 6^a of the shell is provided with serrations 7, and may conveniently be of iron cast in a chill mold to give to the serrations the requisite hardness. A semicircular screen 8 is suspended from the upper sections 6^a, as shown in Fig. 2, the inner face of said screen being set a short distance from the hammer heads which latter are advisably curved to a radius struck from the same center as are the screen and the upper section of the shell. The shell or casing so constructed is provided on its face next the motor with a series of stud axles 9, three being shown in the drawings and regarded as the preferable number. Each of said axles is provided with a grooved pulley or roller 10, the groove of which corresponds to the peripheral V form of a ring or annulus 11, secured by bolts or otherwise to the proximate end of the motor frame or shell.

This mode of mounting the shell or casing 6 permits it to oscillate about the supporting ring 11 a distance determined and limited by two radial ribs 12 and 13 extending across the upper portion 6^a of the shell, and between which extends the lower end of a hopper 14 with which the ribs 12 and 13 make contact as the casing is rocked in one or the other direction. The hopper is supported by an arm or bracket 15 bolted or otherwise made fast to ring 11, and is hence stationary. The rib 13 is normally held in contact with the discharge end of the hopper through the pull of a spring 16, one end of which is attached to the hopper while the other end has a swiveling connection with an adjusting screw 17 passing through a threaded supporting post 18, and furnished with a milled head 19 by which it may be turned to adjust and regulate the tension or pull of spring 16. The hub or sleeve 2 is prevented by a spline or feather 20, indicated by dotted lines in Fig. 1, from rotating independently of the armature shaft.

With the mill constructed generally as above described, it will be seen that upon being supplied with current the armature shaft will be caused to turn rapidly, and its rota-

tion will be in the direction indicated by the arrows in Fig. 2. When the motor has attained a considerable speed, the material to be treated is delivered into the feed hopper 14 and descends through the bottom thereof into the shell 6 through an opening 21 therein, which opening, with the shell or casing in the normal position indicated, will register with the outlet opening of the hopper. In the event that the material is fed more rapidly than the hammers can pulverize it, or for any cause tends to clog or slow down the rotation of the hammers, it will tend to lodge between the ends of the hammers and the corrugated inner surface of shell section 6^a. The friction or drag incident to such lodgement of materal will cause a slight movement of the shell or casing 6 about the motor shaft or arbor, in the direction of rotation of the hammer arms. This in turn will carry that portion of upper shell section 6^a to the left of the inlet opening 21, beneath the delivery end or outlet of hopper 14, reducing the effective area of such outlet to an extent directly proportionate to the drag, or to the accumulation of material which produces the drag, upon the shell or casing. As soon as the excess is removed by the hammers, the casing will be rocked in the reverse direction through the stress of spring 16, causing a full opening of passage 21, and restoring the mill to its normal adjustment.

The reduction of feed will take place in immediate response to any undue accumulation of material, or any indication of overfeeding, and before any considerable departure from normal feed occurs, hence there will be but little movement of the shell or casing at any time, and very slight variation in the feed. In other words, the response to the first indication of clogging is so prompt, that the excess is taken care of and removed before it reaches a serious amount. In this way, by very simple means, requiring little or no attention, an exceptionally uniform feed and uniform product are secured.

Various of the materials, grains, etc., which these machines are designed to handle, carry or contain more or less hard and gritty particles, as clay, sand, and the like, coming from the soil, and it not unfrequently happens that pebbles, bits of metal, and other foreign substances, enter such mills with the grain. To intercept the larger and more solid bodies, a reasonably coarse screen 21^a may be placed across the inlet opening 21.

A slightly modified construction of the mill is illustrated in Fig. 3, where a cut-off gate or plate 25 is carried by an arm or bracket 26 made fast to the ring 11 on which shell or casing 6 is mounted to oscillate. The gate 25 projects through a slot or opening in the shell or casing and into or below the delivery mouth of the hopper 14, so that if the feed becomes excessive and causes a swinging of shell or casing 6 to the right, or in the direction of the arrow in Fig. 3, the hopper will move toward and over the gate 25 which will consequently lessen the effective area of said outlet opening, proportionately. The shell or casing will, however, be normally held in the adjustment shown in said figure by means of a spring 16 and adjusting screw 17 as in the previously described construction, unless the material fed be of a character to flow very freely, in which case the spring may be adjusted to hold the shell in a slightly rocked or tipped position.

It is desirable to cause the hammers to act in succession, since the resistance to their travel will be thereby lessened as compared with simultaneous action, and any tendency of particles to lodge between proximate hammers or hammer bars will be avoided. The hammer bars are hence placed in different angular relation to the axis of rotation, causing their outer extremities to constitute a spiral or screw-like series. The angular spacing of the bars will, however, advisably be made uniform throughout the circle or series.

The construction set forth, both that in Figs. 1 and 2 and in Fig. 3, begets when the mill is in operation, a constant though slight oscillating movement of the shell or casing, which tends to keep free or clear the meshes of the screen 21^a when such screen is employed.

The operation of the structure will be readily understood. Grain or other material is delivered to the hopper 14 in any convenient way, and falls with greater or less freedom, according to its nature, through the delivery end of the hopper to the screen 21^a, if present, and through opening 21 into the casing 6, encountering at the top of the casing the rapidly moving hammer bars 3, the impact of which against the falling material tends to break up or tear apart said material which is thrown against and moved over the serrated face of the upper section 6^a of the casing. From this serrated portion the now comminuted material is carried to or falls upon the screen 8, which is preferably of perforated sheet metal. In moving over the inner surface of this screen the material is further reduced, and the finer particles are caused to pass through the perforations into the hopper-like section 6^b of the casing, from which they pass to any suitable receptacle, as a conveyor trough, or are delivered directly upon the floor. Such particles as will not pass through the meshes of the screen are picked up by the rapidly rotating beater arms, again thrown against the serrated surfaces, and returned to the screen surface, this action continuing until all particles are reduced sufficiently to pass through the screen and are hence delivered from the mill.

It is obvious that a weight or like equivalent of spring 16 may be substituted therefor; that

a feed pipe is the equivalent of the hopper 14; and that various details of the mechanism, such as the mounting of the shell, the manner of supporting the motor, and the like, may be varied within reasonable limits without departing from the spirit of my invention.

If for any reason it be desirable to introduce gearing between the motor shaft or arbor and the sleeve or hub 2, said hub and also the shell or casing will of course be coaxial with the shaft or arbor driven by such gearing.

Practical use of the mill embodying the features and principles above set forth, has shown it to be of high efficiency and to require minimum attention.

What is claimed is:—

1. A pulverizing mill comprising a rotatable shaft; hammer bars carried by said shaft; an oscillatable casing encompassing said hammer bars and having a feed inlet; a feed device for delivering material to the feed inlet; and a cut-off for varying the effective area of the feed device through oscillation of the casing and consequent variation of the effective area of the feed inlet.

2. In a pulverizing mill, the combination of a motor; hammer bars carried by and rotatable with the shaft of said motor; a casing mounted to permit oscillation and having an inlet opening; a feed device having a delivery mouth above said inlet opening; and means for varying the effective area of the outlet opening of the feed device in direct proportion to and by reason of, oscillation of the casing.

3. In combination with a motor of suitable character, hammer bars carried by and rotatable with the motor shaft; a casing for enclosing and co-operating with said hammer bars, and provided with an inlet opening; a circular support on the motor for the casing and upon which said casing may oscillate; a stationary feed device having its delivery mouth located above the inlet opening; and a cut-off positioned in proximity to the delivery mouth of the feed device and serving when the casing is oscillated, to vary the effective area of said delivery mouth in direct proportion to the amplitude and direction of such oscillation.

4. A pulverizing mill comprising a rotatable shaft; hammer bars carried by said shaft; an oscillatable casing encompassing said hammer bars and having a feed inlet; means for delivering material to the feed inlet; a cut-off for varying the effective area of the feed inlet through oscillation of the casing; and means for yieldingly holding the casing against oscillation.

5. A pulverizing mill comprising a rotatable shaft; hammer bars carried by said shaft; an oscillatable casing encompassing said hammer bars and having a feed inlet; means for delivering material to the feed inlet; a cut-off for varying the effective area of the feed inlet through oscillation of the casing; and adjustable means for yieldingly holding the casing against oscillation.

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

FRED J. BULLOCK.