

W. B. EASTON.

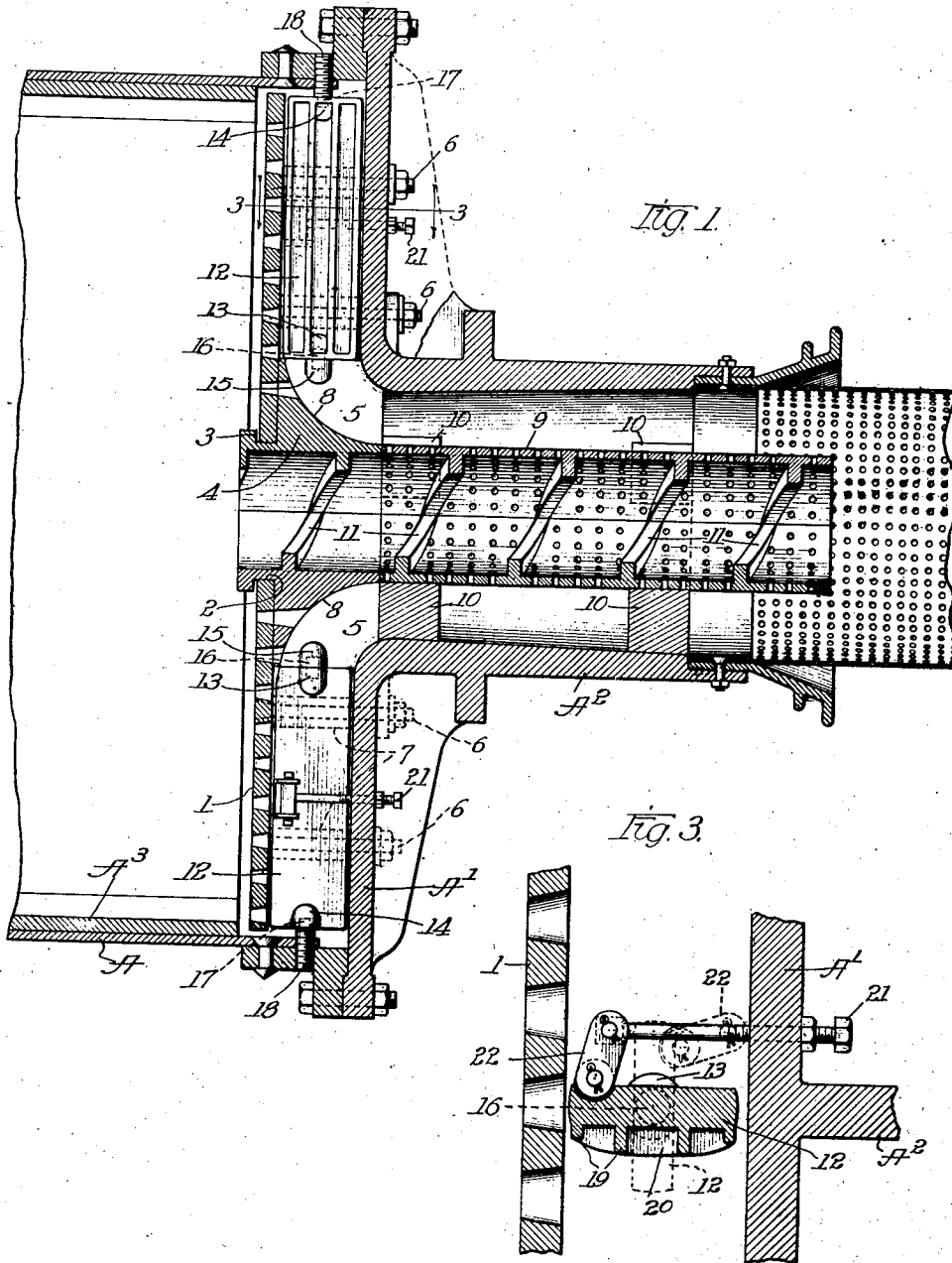
TUBE MILL.

APPLICATION FILED FEB. 21, 1913.

1,058,953.

Patented Apr. 15, 1913.

2 SHEETS—SHEET 1.



Witnesses:
Robert F. Weir
Arthur Carlson

Inventor:
William B. Easton,
by Geo. E. Waldo, atty.

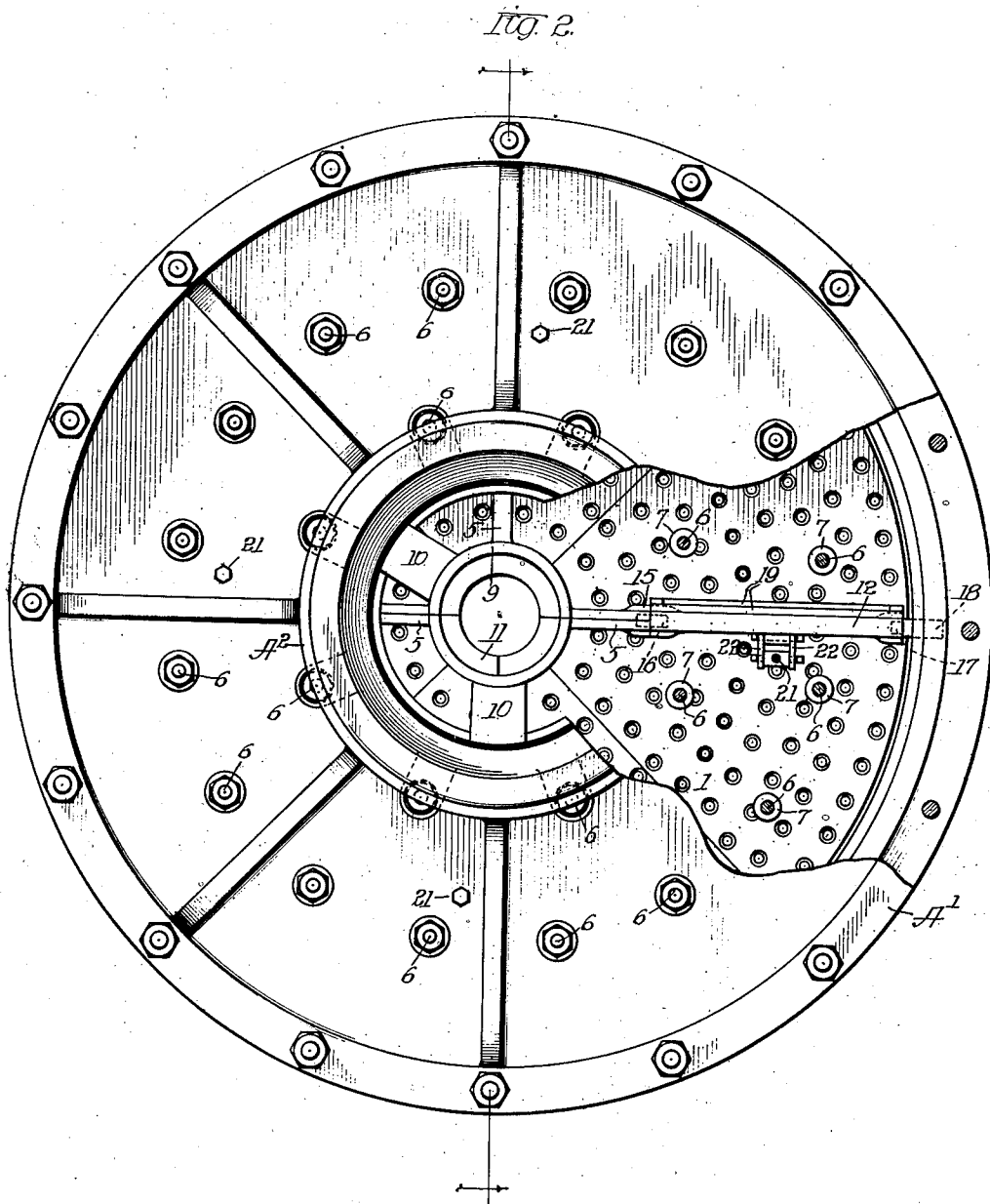
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UNITED STATES PATENT OFFICE.

WILLIAM B. EASTON, OF CHICAGO, ILLINOIS.

TUBE-MILL.

1,058,953.

Specification of Letters Patent.

Patented Apr. 15, 1913.

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To all whom it may concern:

Be it known that I, WILLIAM B. EASTON, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Tube-Mills, of which the following is a specification.

This invention relates to machines for crushing ore and other materials, and relates particularly to the type of crushers known as tube mills.

As is well known to persons familiar with the construction and operation of tube mills, said mills consist of a suitable metal shell rotatably mounted by means of trunnions through which the material to be treated, as the more or less finely comminuted ore from stamp mills or the like, is adapted to be fed as by a current of water introduced into said tube mill with the material to be treated therein. To provide for introducing material into said shell and discharging it therefrom, axial openings are formed through the supporting trunnion of said shell. As is also well known, the grinding, crushing, or pulverizing of the ore is effected by means of a mass of loose stones introduced into the shell of the tube mill so as to fill the same almost half full. Thus, as the shell of the tube mill rotates, said stones will be carried partly up the side of said shell in the direction of rotation, and falling back, will operate to crush ore particles caught between contacting surfaces of said stones.

One object of the invention is to increase the capacity of tube mills by providing means for delivering the treated ore or other material to the discharge opening of said mill after it has passed through said mill and has been subjected to the grinding or pulverizing action thereof.

A further object of the invention is to provide a construction for the discharge end of tube mills whereby the ore or other material undergoing treatment therein can escape from the further action of the grinding or pulverizing agencies of the tube mill when said material reaches the discharge end of said tube mill, thus preventing long-continued action of the grinding or pulverizing devices on the ore at the discharge end of

the mill, and resulting in a much more uniform product and a much smaller percentage of ore crushed finer than desired.

Still a further object of the invention is to provide means at the discharge end of the tube mill for regulating the time required for the ore undergoing treatment to pass through the crushing or pulverizing devices of said mill proper, that is, the time during which the ore passing through the mill will be subjected to the action of the grinding devices, or in other words, to provide means for regulating the sizes of the particles of ore produced by the mill.

To effect the foregoing ends, a tube mill of my invention comprises the various features, combinations of features and details of construction hereinafter described and claimed.

In the accompanying drawing, in which my invention is illustrated,—Figure 1 is a central sectional view of the discharge end of a tube mill embodying my invention; Fig. 2 is an end view of that part of the machine shown in Fig. 1, the head of the shell being broken away to expose the perforated plate through which the treated material is carried by the current of water; and Fig. 3 is a fragmentary sectional plan view taken on the line 3—3 of Fig. 2, on an enlarged scale.

As my improvement relates only to the discharge end of the tube mill, and, as the general construction of such mills is generally well known to persons familiar with the art, I have, in the drawings, shown only the discharge end of the mill, and will limit my description thereto.

Referring now to the drawing, A designates the shell of the tube mill, A¹ the head which closes the discharge end of said shell, formed on which is a trunnion A² adapted to be mounted in a suitable fixed bearing, not shown, in a familiar manner. The shell A is provided with a lining A³ of suitable refractory material, said lining being so constructed and arranged that it may be readily removed and replaced when worn out, thus providing for extending the life of the tube mill indefinitely.

Supported upon and at a distance from the head A¹ is a perforated plate 1, the periphery of which extends into close prox-

imity to the shell A and which is provided with a central opening 2, the edges of which engage a groove 3 formed in a boss at the inner end of a ring 4 supported by means of a suitable connection with the head A¹ of the tube mill substantially concentric with the trunnion A². As shown, said ring 4 is supported by means of webs 5 formed integral with said ring and with said head A¹.

To provide for assembling the plate 1, said plate is preferably made in segments, each of which is supported by means of independent connection with the head A¹, consisting, as shown, of bolts 6, which extend through said perforated plate 1 and head A¹, inserted over which are spacing sleeves 7 which define the width of the space or chamber between said plate 1 and head A¹.

For reasons presently apparent, the ring 4 is substantially conical, the sides thereof converging outwardly, preferably on curved lines, as shown at 8, and supported within the trunnion A² in such position that the bore thereof will register with the bore of the ring 4 is a perforated pipe 9. As shown, said pipe 9 is supported within the trunnion A² by means of wedge blocks 10 inserted between said pipe and trunnion.

To provide for inserting the stones into the tube mill and to permit chips and other light objects which will float and which are too large to pass through the perforations in the plate 1, to escape therefrom, the opening through the ring 4 and pipe 9 is left open, and, to prevent the stones from working out of the mill through said opening, a screw or spiral 11 is formed on the inner surface of said ring 4 and pipe 9, which forms in effect a screw conveyer, the pitch of which is such that rotation of the mill in the direction designed will operate to feed material through the opening in said ring 4 and pipe 9 into the shell A. Thus, the screw or spiral 11 being left-handed, the tube mill will rotate in a direction opposite to the movement of the hands of a clock.

Pivotally mounted in the space between the head A¹ and the perforated plate 1 are series of vanes 12, the width of said vanes being slightly less than the width of the space or chamber in which they are mounted, and the pivotal axes thereof extending substantially radially with reference to the axis of the tube mill. As shown, the pivot bearings for said vanes 12 are formed in bosses 13 and 14 formed on opposite ends of said vanes, and in corresponding bosses 15 formed on the webs 5 which connect the ring 4 with the head A¹ of the tube mill. Formed in said bosses 13, 14 and 15 are recessed bearings adapted to receive pivot pins 16 and 17, of which the pins 16 may be fitted to turn freely in the recesses in both the bosses 13 and 15, and the pivots 17 are

formed at the inner ends of pins 18 secured in suitable holes formed through the shell of the tube mill.

When turned into the same plane, the webs 5 and vanes 12 are practically continuous with each other.

With the described construction, it is obvious that, as the tube mill rotates the vanes 12 operate to carry up the water and ore particles which flow through the perforated plate 1 into the space between the perforated plate and the head A¹ and to raise the same, and that, as said vanes pass upward, the water and ore particles carried thereby will run off therefrom, and, falling upon the surface of the ring 4 and the webs 5, will be conducted into the discharge opening in the trunnion A², whence they will drain outwardly in the usual manner. In order to retain the water and ore particles on the vanes 12, the front sides of said vanes are preferably provided with longitudinal ribs 19 comprising marginal ribs and any desired number of intermediate ribs, and are also provided with transverse ribs formed substantially at their inner ends, and, if desired, at spaced points lengthwise thereof. Said ribs will operate, in an obvious manner, to retain the water on said vanes until said vanes are raised above a horizontal position. With the described construction, it is also obvious that the feed of the vanes 12 may be varied by changing their pivotal adjustment, varying from a designed maximum when said vanes are in radial planes to practically nothing when they are turned into planes at right angles thereto. To provide for thus varying the feed of the vanes 12 which will regulate the rate of flow and thus the current of water through the tube mill, means are preferably provided for adjusting said vanes 12 pivotally. As shown, said means consist of bolts 21 threaded through the head A¹ of the tube mill, one for each vane 12, the inner ends of which are connected by links 22 with the vanes 12, said links being pivotally connected to said bolts 21 and to said vanes 12, whereby turning said bolts 21 in or out will operate, in an obvious manner, to swing said vanes 12 pivotally in the manner desired. Said vanes are adapted to be locked in desired pivotal adjustment by means of lock nuts threaded to the bolts 21 and adapted to frictionally engage the head A¹.

A particular advantage of the adjusting means shown is that it is accessible for operation from the outside of the shell. And, while I consider the means shown as being preferable, I do not desire to limit myself thereto, as other means will suggest themselves to others skilled in the art.

I do not desire to limit myself to the specific perforated plate shown, as my in-

vention contemplates the use of any desired form of plate which will define a space or chamber at the discharge end of the tube mill for the vanes 12, constructed and arranged to permit drainage into said chamber as by leaving a space between the periphery of said plate and the shell of the tube mill. Neither do I desire to limit myself to the particular means shown for supporting and adjusting the vanes, as my invention contemplates the use of any means for this purpose.

I claim:—

1. In a tube mill, the combination with a shell and trunnions which rotatably support said shell, one provided with an admission opening, and the other with a discharge opening, of a perforated plate secured in said shell and which forms a chamber at the discharge end of said tube mill, vanes pivotally mounted in said chamber, means for adjusting said vanes pivotally, and means for delivering the water and material raised by said vanes into the discharge opening from said tube mill, substantially as described.

2. In a tube mill, the combination with a shell and trunnions which rotatably support said shell, one provided with an admission opening and the other with a discharge opening, of a perforated plate secured in said shell and which forms a chamber at the discharge end of said tube mill, vanes adjustably mounted in said chamber, means accessible for operation outside of the tube mill for adjusting said vanes, and means for delivering the water and material raised by said vanes into the discharge opening from said tube mill, substantially as described.

3. In a tube mill, the combination with a shell and trunnions which rotatably support said shell, one provided with an admission opening and the other with a discharge opening, of a perforated plate secured in said shell and which defines a chamber at the discharge end of said tube mill, vanes pivotally mounted in said chamber, ribs on the front sides of said vanes, means for adjusting said vanes pivotally, and means for delivering the water and material raised by said vanes into the discharge opening from said tube mill, substantially as described.

4. In a tube mill, the combination with a shell and trunnions which rotatably support said shell, one provided with an admission opening and the other with a discharge opening, of a perforated plate secured in said shell and which defines a chamber at the discharge end of said tube mill, vanes pivotally mounted in said chamber, longitudinal and transverse ribs on the front sides of said vanes, means for adjusting said vanes

pivotally, and means for delivering the water and material raised by said vanes into the discharge opening from said tube mill, substantially as described.

5. In a tube mill, the combination with a shell and trunnions which rotatably support said shell, one provided with an admission opening and the other with a discharge opening, of a perforated plate secured in said shell and which forms a chamber at the discharge end of said tube mill, vanes pivotally mounted in said chamber, means for adjusting said vanes pivotally comprising screws threaded through the head of said shell, and links pivotally connected to said screws and to said vanes, and means for delivering the water and material raised by said vanes into the discharge opening from said tube mill, substantially as described.

6. In a tube mill, the combination with a shell and trunnions which rotatably support said shell, one provided with an admission opening and the other with a discharge opening, of a perforated plate secured in said shell and which forms a chamber at the discharge end of said tube mill, vanes pivotally mounted in said chamber, means for adjusting said vanes pivotally, and means for delivering the water and material raised by said vanes into the discharge opening from said tube mill, said means comprising a substantially cone-shaped ring, webs which connect said ring with the head of the tube mill at the discharge end thereof, said webs forming a fixed continuation of said pivoted vanes, the inclined surface of said ring converging outwardly into the mouth of the discharge opening of the tube mill, substantially as described.

7. In a tube mill, the combination with a shell and trunnions which rotatably support said shell, one provided with an admission opening and the other with a discharge opening, a plate secured in said shell and which forms a chamber at the discharge end of said tube mill, said plate being constructed and arranged to permit drainage into the chamber at the discharge end of said mill, vanes adjustably mounted in said chamber, means for adjusting said vanes, and means for delivering the water and material raised by said vanes into the discharge opening from said tube mill, substantially as described.

In testimony that I claim the foregoing as my invention, I affix my signature in the presence of two subscribing witnesses this 1st day of February, 1913.

WILLIAM B. EASTON.

Witnesses:

MARY H. BIXEL,
F. C. STOCKING.