

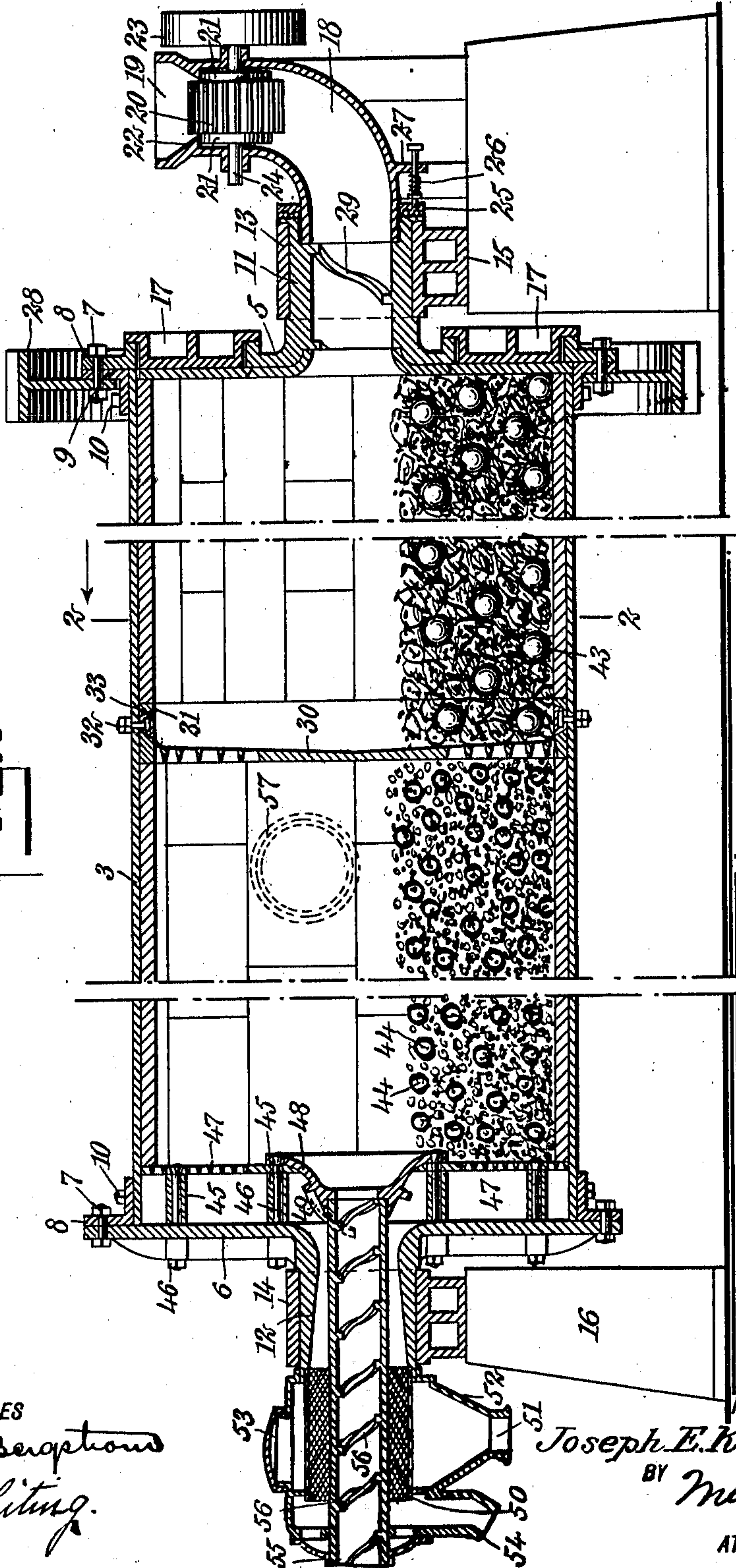
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J. E. KENNEDY.  
COMBINED BALL AND TUBE MILL.  
APPLICATION FILED MAR. 27, 1909.

Patented Mar. 29, 1910.

2 SHEETS—SHEET 1.

Fig. 1



WITNESSES

*John A. Bampton*  
*H. Whiting.*

INVENTOR

*Joseph E. Kennedy*

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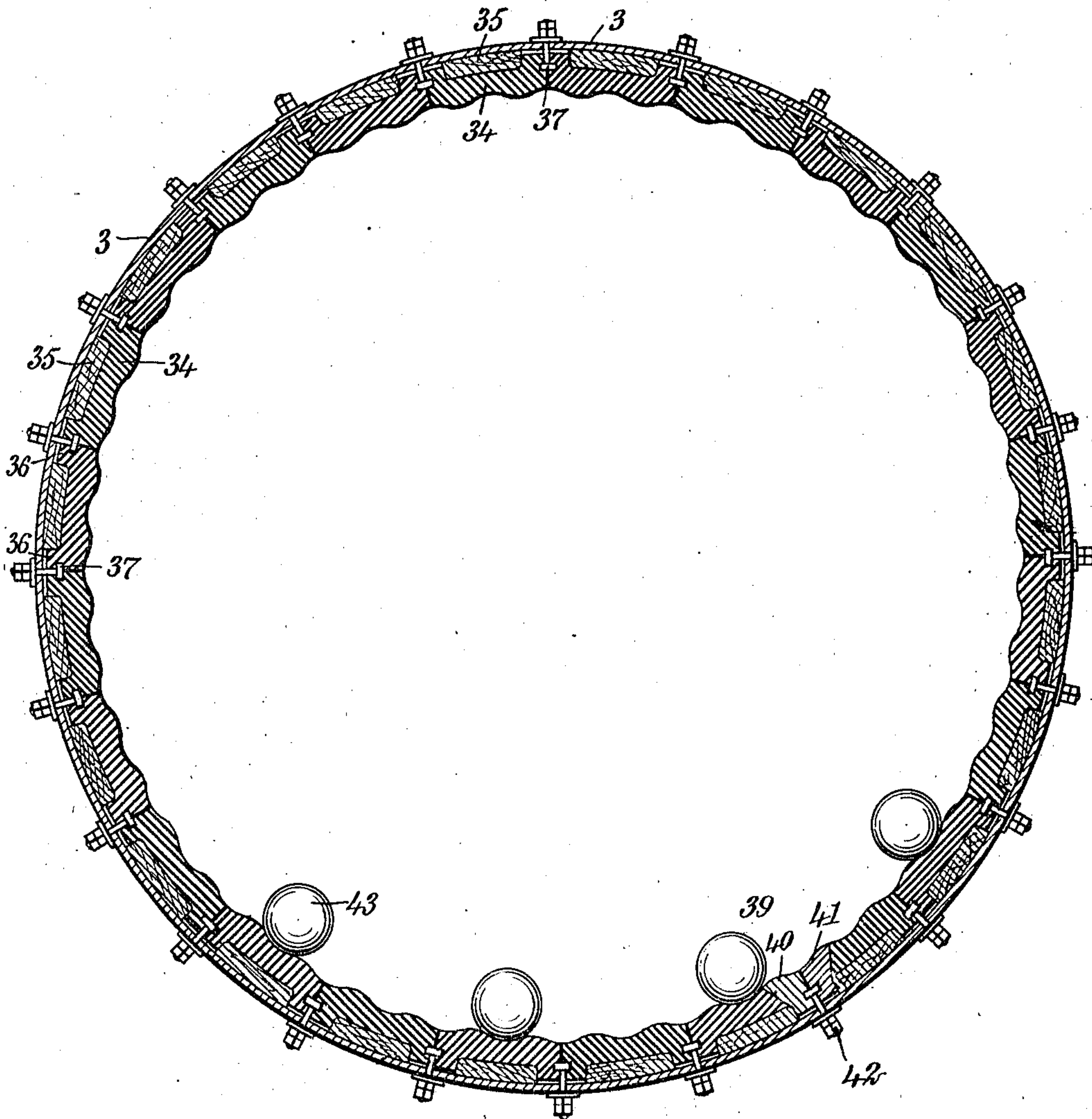


Fig. 2

WITNESSES

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# UNITED STATES PATENT OFFICE.

JOSEPH E. KENNEDY, OF NEW YORK, N. Y.

COMBINED BALL AND TUBE MILL.

953,092.

Specification of Letters Patent. Patented Mar. 29, 1910.

Application filed March 27, 1909. Serial No. 486,092.

*To all whom it may concern:*

Be it known that I, JOSEPH E. KENNEDY, a citizen of the United States, and a resident of the city of New York, borough of Manhattan, in the county and State of New York, have invented a new and Improved Combined Ball and Tube Mill, of which the following is a full, clear, and exact description.

This invention relates to a tube mill adapted to comminute ore, cement or the like from a comparatively large size to a fine powder.

The device is adapted to be used in either wet or dry crushing, and it consists primarily in a tube-chamber in which the crushing is done in two stages.

One object of the invention is to provide a simple construction which will perform in one machine that which has formerly taken two separate machines to accomplish.

Another object of the invention is to provide means whereby the tube mill may be fed from either end without stopping the rotation thereof.

A still further object is to provide a lining for the tube mill, which will be easily removed and will form an efficient grinding surface.

These and other objects will be more fully described hereinafter and particularly pointed out in the claims.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in both views, and in which—

Figure 1 is a longitudinal section through the center of my device; and Fig. 2 is a transverse section on the line 2—2 in Fig. 1, showing the method of attaching the lining to the casing.

Formerly, when it was desired to comminute ore, cement or the like, it was necessary to first subject the material to a ball mill crushing and then to the grinding action of flint pebbles in a tube mill. By my device, I perform these operations in one machine. The device has an outer casing 3, which is in the form of a tube, and is preferably made of some suitable metal such as sheet-iron. This casing is open at each end, and is adapted to be closed at the head end by a head 5, and at the tail end by a head 6, which are adapted to be secured in any suitable manner, as by means of bolts 7, to circular angle-bars 8 and 9, which are

in turn secured in any suitable manner, as by means of bolts 10, to the ends of the casing 3. The heads have outwardly-extending hollow trunnions 11 and 12, which are adapted to rotate in bearings 13 and 14 on upright supports 15 and 16, which are supported in any suitable manner on the foundation. The head 5 has a number of openings therein, which serve to permit access into the interior of the casing without removing the head, and are closed by means of covers 17.

Connected to the trunnion 11, and having a close fit therewith, is a feed pipe 18, which is fed from a hopper 19 by means of a feed wheel 20, which may be of any suitable form, but is preferably a cylindrical body having radiating flanges between which the material to be fed to the mill is adapted to settle and be carried around by the rotation of the wheel into the feed-pipe 18 below. The feed wheel 20 has bosses 21 on each side thereof, which are adapted to be engaged by flanges 22 on the hopper 19, which prevent the material from passing down by the sides of the feed wheel. The feed wheel is driven by any suitable motor means, which may be connected up to the means used to rotate the tube mill proper, and is shown here in the form of a pulley belt 23, which is fastened to a shaft 24, to which the feed wheel 20 is also fastened.

In order to prevent the water from leaking out at the joint between the feed pipe and the trunnion 11 of the tube mill proper, there is provided a number of packing washers 25, which are held snugly up against the end of the trunnion 11 by any suitable means, such as a spring 26, which is placed between the washers 25 and a projecting lug 27.

The tube mill is adapted to be rotated by means of a gear 28, which is secured in any suitable manner to the casing 3, and by its rotation, the material fed from the hopper 19 is drawn into the casing 3 by means of a spiral flange 29 on the inner surface of the hollow trunnion 11. The tube 3 is divided into two parts by means of a screen partition 30, which is in the form of a cylindrical disk, tapering from its center out to its periphery, and has perforations from one surface to the other, to permit ore to pass from one side of the partition to the other.

Extending from the outer periphery of



the partition 30 in the direction of the head end, is a cylindrical flange 31, which is adapted to conform to the inner surface of the casing 3 and has openings therein, through which are adapted to pass fastening bolts 32, the heads of which within the casing are covered by protecting pieces 33.

The division of the casing toward the head end is to be used for the ball-grinding, and has a lining similar to that shown in Fig. 2, which preferably consists of corrugated plates 34 of hardened metal, such as manganese steel.

Between the wear-plates 34 and the casing 3 are longitudinal beams 35, which serve as cushions. The lining plates 34 have flanges 36, which engage the sides of the beams 35, and these flanges have grooves in their outer edges which are adapted to receive the heads of bolts 37, which fasten the lining plates to the casing. The junction between the lining plates, and shown in Fig. 2 as being directly over the center of the bolts 37, may be placed to one side or the other thereof, if desired. One of these junctions, as shown at 39, is formed of two wedge-shaped parts 40 and 41, having a junction directly over the center of a fastening bolt 42, the head of which extends into grooves in the facing sides of the wedge-shaped parts 40 and 41. The purpose of these wedge-shaped parts 40 and 41 is to permit the last lining plate to be inserted, so that the bolt-heads will fit within the grooves in the lining. It will thus be seen that the lining may be readily removed and be replaced by a new one.

The head end division is adapted to receive the large particles of ore from the feed hopper 19, and is adapted to have therein a number of hardened steel crushing balls 43, which are adapted to grind and crush the ore to a size sufficient to permit it to pass through the perforations in the dividing screen 30 into the lower part of the casing 3, which is for the purpose of further crushing the ore and contains a large quantity of flint pebbles or the like, which are indicated by the numeral 44. The lining of this portion of the casing is preferably made of silica, hard quartz or the like, built up in sections somewhat similar to the sections in the ball mill portion of the tube.

Spaced from the tail head 6 of the tube mill by means of spacing pieces 45 which surround tie bolts 46, are radially-extending partitions, to which are adapted to be secured in any suitable manner, segmental screens 47. The partitions and the segmental screens 47 extend from the inner surface of the casing to a conical feed-head 48, which is secured to the tail head of the mill by means of some of the tie bolts 46. This feed head 48 has on its outer surface a plurality of spiral flanges 49, which are adapted to engage the upper surface of the ore which

is passed through the screens, and force it into the hollow trunnion 12, where it falls down the incline formed by the diverging of the surface of the hollow trunnion onto the trommel screen 50, where the under-size passes through the screen into the hopper 51 of the casing 52. The casing 52 has at the top thereof a manhole 53 which permits access to the screen, to clean the screen and watch its operation. The over-size from the screen 50, which contains pebbles and ore which have not been sufficiently ground, passes out through a pipe 54. Extending from the feed-head 48 through the screen 50 and out beyond the pipe 54 is a hollow feed-pipe 55, which has a spiral internal flange 56, having a pitch opposite to that of the flange 29 provided in the trunnion 11. This pipe 55 is for the purpose of feeding into the pebble-mill portion of the casing, large lumps of ore or quantities of flint pebbles. On the lower end of the tube-mill, access is provided to the interior of the casing, to allow for the insertion of lining, by means of a manhole, which is indicated by the dotted lines 57.

In the operation of the device, the upper or head end of the tube mill is provided with a quantity of steel balls, and the ore is fed to the hopper 19, which in turn feeds it gradually, by means of the feed wheel 20, to the interior of the ball-mill. Here, after the ore has been subjected to the action of the balls for a time sufficient to grind it to such a size that it will pass through the openings in the dividing screen 30, it comes into a lower section of the tube-mill, where it is subjected to the pebble grinding. The pebbles and large chunks of ore are fed into the lower half of the casing by means of the feed pipe 55. The large chunks of ore take the place of the flint pebbles to a certain extent. The ore is held subjected to the grinding action of the flint pebbles until it is reduced sufficiently to pass through the screens 47, where it is subjected, when a sufficient amount has passed through, to the action of the external spiral flanges 49, which force it into the hollow trunnion 12, from whence it slides into the screen 50, the under-size going through the screen and down into a suitable receptacle, and the over-size passing out through the pipe 54. The tube-mill is continuously rotated by means of the gear 28, which is driven at a speed suitable to the material to be ground. The means for driving the gear 28 may be also connected up to the means for driving the feed roller 20, so as to make the machine self-contained.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:—

1. In a device of the class described, the combination with a casing, of means for dividing said casing into two parts, said



means having communicating openings therein, separate feeding means for both parts of said casing, and means concentric with one of said feeding means for discharging one part of said casing.

2. The combination with a tube mill formed of a single integral tube, of means for gradually feeding ore to the interior of said tube, a partition having communicating openings therein adapted to divide said tube into two parts, means for subjecting ore to a coarse grinding action in one of said parts, means for subjecting ore to a fine grinding action in the other of said parts, means for separating said finely ground ore from said grinding means, means for removing said finely ground ore from the tube mill, said means comprising spiral flanges connected to the interior of said tube mill, a screen for separating said finely ground ore, and means for feeding the grinding means to the interior of the tube mill.

3. In a device of the class described, the combination with a casing open at both ends, of a head closing the head end of said casing, said head having a hollow trunnion connected thereto, means for supporting said trunnion, a flange on the interior of said trunnion adapted to draw ore within

the casing, a head for the other opening of said casing, a hollow trunnion connected to said last-mentioned head, a bearing adapted to support said trunnion, a screen for dividing said casing into two parts, a screen for separating one of said parts from the head, means for feeding ore to both ends of said casing, and means for discharging ore from one end of said casing.

4. In a device of the class described, the combination with a casing, of a partition having communicating openings therein adapted to divide said casing into two parts, a cylindrical flange on said partition, means for fastening said flange to the casing, and means for protecting said fastening means.

5. In a device of the class described, the combination with a casing, of means for feeding said casing at one end, and means for feeding and discharging the casing at the other end, comprising a member having internal and external spiral flanges.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOSEPH E. KENNEDY.

Witnesses:

M. O. FAHNESTOCK,  
HORATIO WHITING.