

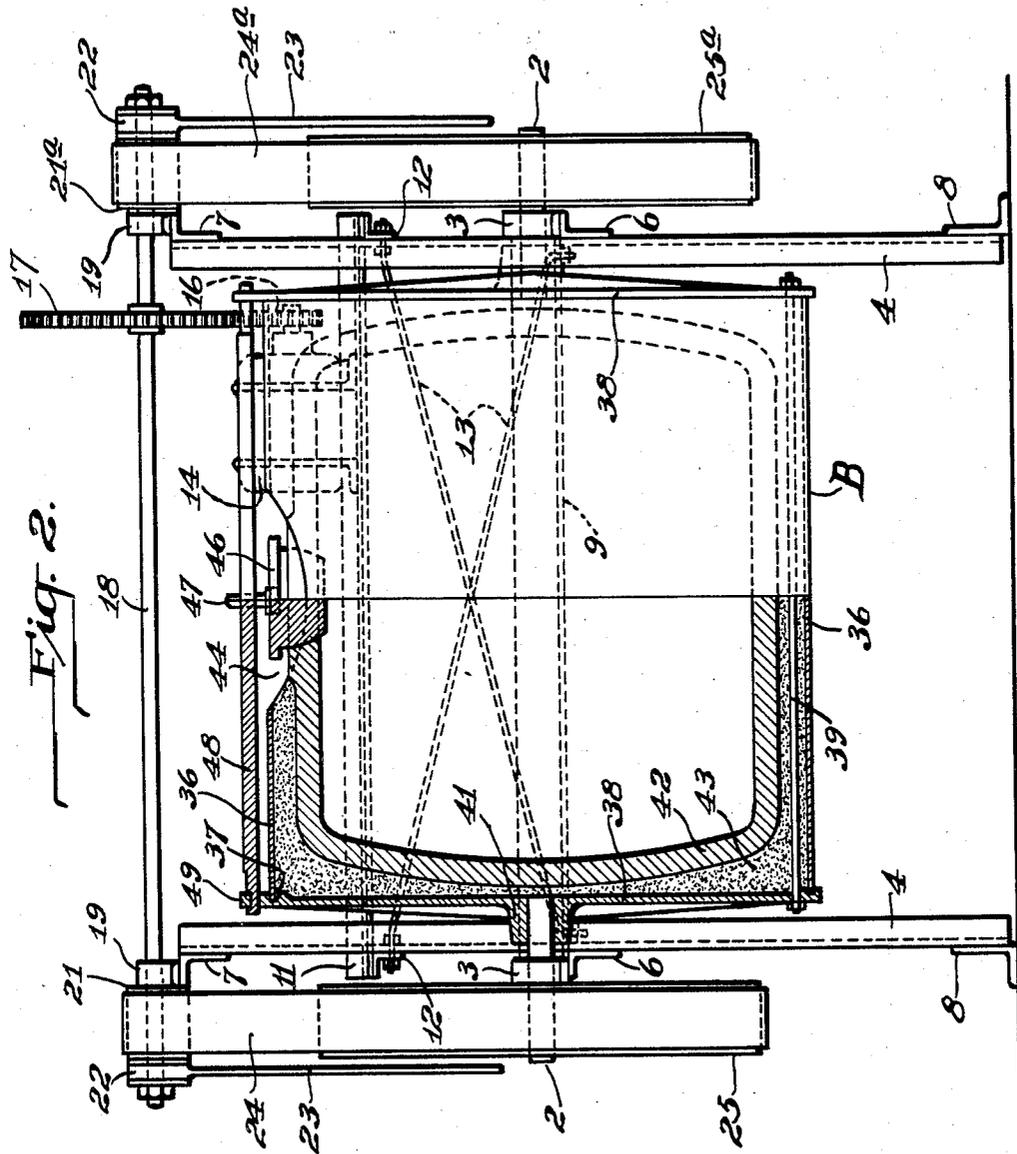
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MOUNTING OF BALL MILLS

2,022,553

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3 Sheets-Sheet 2



WITNESSES

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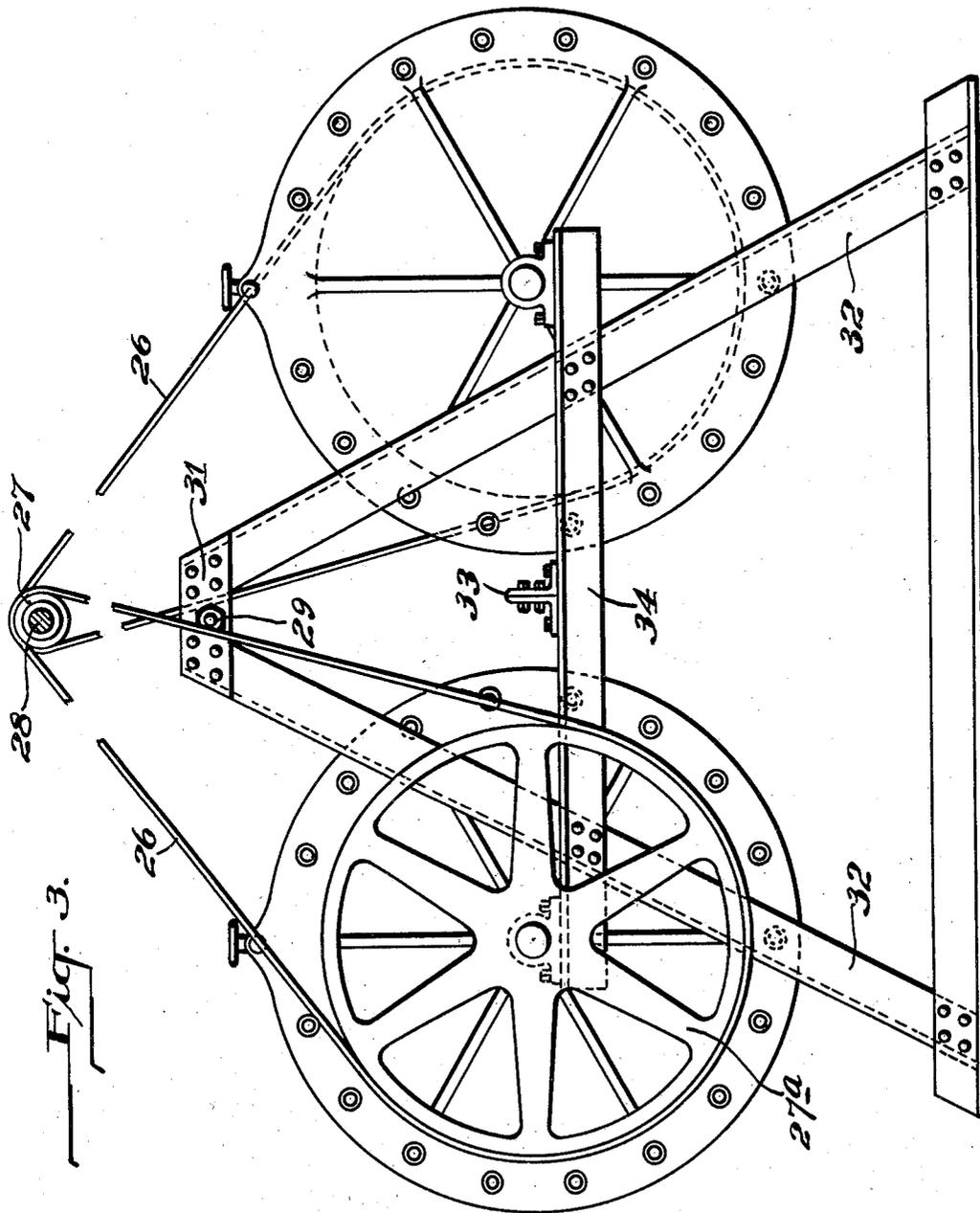


Fig. 3.

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MOUNTING OF BALL MILLS

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3 Claims. (Cl. 83—9)

This invention relates to ball mills, and more especially to frames for ball mills used for preparing glazes, enamels and the like.

It is among the objects of this invention to provide a ball mill structure in which two ball mills are mounted in a single supporting framework which is rigid, strong and of simple and inexpensive construction; which requires relatively little floor space as compared with prior modes of mounting such mills; and in which unobstructed access is given to the mills for removing their contents.

It is a further object to provide a structure of the foregoing type in which both mills are driven by a single electric motor mounted in the framework with them, and in which the starting torque of the motor need be great enough only to start one mill, whereby to afford economies in power factor and consumption.

In accordance with the invention, a ball mill structure is provided in which a pair of ball mills are journaled side by side in bearings carried by two spaced end frames which are rigidly connected by longitudinal bracing means disposed between and above the bottoms of the mills. The width of each frame is most suitably such that it does not extend outwardly beyond the sides of the mills. The space between the frames below the mills is left free of tie rods or other obstructions which would interfere with the placing of discharge pans beneath the mills.

The invention may be described in the accompanying drawings, of which Fig. 1 is an end view of the framework of one embodiment, showing the ends of two ball mills journaled therein; Fig. 2 a side view of the structure shown in Fig. 1; and Fig. 3 an end view of a modified embodiment.

Referring to Figs. 1 and 2 of the drawings, a pair of ball mills A and B are shown disposed side by side with stub shafts 2 projecting from their ends rotatably mounted in bearing members 3. Bearings 3 are carried by a framework formed of a pair of A-frames each of which includes two inclined side members 4 and a horizontal cross bar 6 attached thereto a substantial distance above the base of the frame. The side members are rigidly connected, for example at the top by a short angle iron 7, and at the bottom by a long angle iron 8. An A-frame is preferred as an end frame because it combines compactness and simplicity with strength and rigidity.

As it is desirable, in the interests of economy, that the framework occupy no more floor space than necessary, the width of the end frames is

most suitably such that it does not extend beyond the outermost sides of the mills. This is readily accomplished by the use of A-frames and by extending the horizontal cross bars 6 of the frames outward beyond the side members and mounting the bearings, in which the mills are journaled, on those projecting ends. The lower ends of the side members of each frame can thus be positioned more closely together than if the axes of the mills were disposed between the side members. Such an arrangement is also advantageous in that the mills are supported out in the open where there is little framework adjacent them, thereby making them readily accessible for repairs, inspection and the like.

A transverse brace 9, such as a T-bar, or a pair of angles placed back to back, is fastened at its ends to the horizontal cross bars 6 between the ball mills, to hold the side frames in proper position and render the structure rigid. The framework is further strengthened by a stiffening plate 11 connected at its ends to cross bars 12 which are attached at their ends to the upper portions of the inclined side members, as shown in Fig. 1. Additional rigidity is given to the framework by diagonally disposed tie rods 13 connecting cross bar 12 of one end frame to the horizontal cross bar 6 of the other frame. It will be observed from this construction that all of the transverse bracing members of the framework are disposed above the bottoms of and between the ball mills. Consequently, the space between the A-frames below the mills is left unobstructed by anything which would interfere with the placing of receptacles under the mills for receiving their contents.

In the embodiment shown in Figs. 1 and 2 the mills are rotated by a single electric motor 14 mounted on plate 11. A pinion 16 mounted on the motor shaft drives a gear 17 splined on a drive shaft 18 journaled in bearings 19 carried by the end frames, e. g., on the top flanges of angle irons 7. The outer ends of drive shaft 18 are provided with drive pulleys 21 and 21a which rotate with shaft 18 or stand idle, depending upon the manipulation of suitable clutch mechanisms 22 operated by levers 23. Pulley 21 is connected to ball mill A by a belt 24 passing around a pulley 25 keyed on stub shaft 2, and mill B is similarly driven from pulley 21a through a belt 24a and pulley wheel 25a. If desired, a chain and a gear sprocket drive can be substituted for the belts and pulleys. It is apparent that, due to the two clutches 22, either one or both of the mills can

be connected to or disconnected from the driving mechanism at will.

This construction is particularly advantageous because it reduces power requirements. It requires three or four times as much power to start ball mills, at least in the larger sizes, as it does to keep them rotating, but by driving two mills from a single motor having a clutch connection between it and each mill, it is possible to use a motor which has only sufficient starting torque to start and run one mill. This is because one mill can be started rotating, and after it is in full rotation the clutch of the other mill can be thrown in to start the second mill, without exceeding the peak load of the motor, by the power of the motor combined with the inertia of the first mill which acts like a fly-wheel. In this way a less expensive motor can be used, and there is reduction in the charge of power factor and current consumption, than where a separate motor is used for each mill.

The structure just described may be used also for driving the mills from a line shaft. In such case a pulley driven from the line shaft is substituted for spur wheel 17 on countershaft 13, motor 14 and its associated driving elements being eliminated.

Also, either or both mills may be driven directly from a line shaft through pulleys attached to the driving trunnions of each mill, i. e. to stub shaft 2. In that case countershaft 13, motor 14 and their associated driving elements are unnecessary and are not used. This embodiment is illustrated in Fig. 3, which shows the mills driven by belts 26 passing around wheel pulleys 27a, preferably of the tight and loose type, mounted on the stub shafts of the mills. Belts 25 are driven from pulleys 27 keyed to a line shaft 28, each mill being driven independently, as in the preceding embodiment. A chain and sprocket drive can be substituted for such a belt and pulley drive, if desired. In this construction the previously described drive shaft, motor and gearing are omitted from the framework, and the tops of the A-frames are connected by a tension rod 29 secured at its ends in gusset plates 31 which connect the tops of side members 32 of the end frames. Rigidity is obtained by a transverse bracing member 33 attached at its ends to the horizontal cross bars 34.

The type of framework contemplated by this invention supports two ball mills, and if a motor drive is used the entire structure is self-contained because the driving means is also mounted in the framework with the mills. In spite of this, the invention provides a compact and satisfactorily strong and rigid structure which requires little floor space as compared with former types of ball mill structures, and which in fact affords substantial saving in floor space over the single mill mounting used heretofore. Furthermore, it is a relatively simple and inexpensive structure to build, ship and set up. Moreover, in the preferred embodiment the A-frames leave the mills largely exposed, for ready access.

Although the invention has been described with particular reference to end frames built up from steel structural sections, it will be recognized that the end frames may assume a unitary form, e. g., being cast, as these embody also the essence of the invention. That is cast A-frames, for example, may be used to support two mills, particularly with their axes of rotation lying outside of the frame, as shown and described herein.

With the transverse bracing members between

the frames disposed above the bottoms of the mills, unobstructed access is given to the placing of collecting receptacles beneath the mills for receiving the ground batch discharged therefrom, as may be seen from Fig. 2. In prior types of construction it has been necessary to reinforce the framework by longitudinal members disposed at the bottom, so that collecting means, such as pans, could not be run far enough under the mill to safely gather the ground product when the mill was dumped. With the construction shown, collecting devices may be inserted from either side of the mill and be extended as far as need be for reception of the mill contents without spilling, and, if desired, such collecting means may take wheeled forms.

A ball mill which is especially suitable for use in the practice of this invention is shown in detail in Fig. 2. It consists of a cylindrical shell 36, formed from sheet metal, whose ends enter annular grooves 37 in the inside faces of a pair of circular end plates 38. These plates are held tightly against the ends of the cylindrical shell by tie rods 39 which project through them. Each end plate has a trunnion 41 projecting from its outer face in which the inner end of stub shaft 2 is anchored.

In order to prevent foreign matter from contaminating the material being pulverized in the ball mill, and to prolong the life of the liner, the liner is a seamless monolithic ceramic-ware jar 42. Jar 42 is held rigidly in position in the shell by cementitious material 43, such as Portland cement, which completely surrounds the jar and spaces it from shell 36. The mill is charged through an opening 44 which extends through the shell, cement and jar; a ceramic plug 46 acting as a closure for the opening in the jar. Pressure is applied to the plug by its handle 47 which threadably engages cross bar 48 fastened at its ends in lugs 49 extending radially from the edges of the end plates 38. No claim is made herein to this monolithic ball mill liner structure, which is the subject of my copending application Serial No. 650,816, filed January 9, 1933.

The practice of this invention is not limited to the use of the monolithic lining just described, although such a structure is particularly desirable, especially for large mills, whose liners can not well be molded for technical reasons and therefore are commonly made from shapes laid up in mortar.

According to the provisions of the patent statutes, I have explained the construction and mode of use of my invention, and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A ball mill structure comprising a pair of horizontally-spaced upright A-frames each including inclined side members crossed centrally by a horizontal member which extends outward beyond them, bearing members mounted on the projecting ends of said horizontal members, a ball mill journaled in said bearings at each end of the horizontal members, transverse bracing members rigidly connecting the upper portions of the frames, driving means mounted in the top portion of the framework, and means operably connecting the driving means to each of said mills for rotating it.

2. A ball mill structure comprising a pair of horizontally-spaced upright A-frames each including inclined side members crossed centrally by a horizontal member which extends outward beyond them, bearing members mounted on the projecting ends of said horizontal members, a ball mill journaled in said bearings at each end of the horizontal members, transverse bracing members rigidly connecting the top portions of the frames, a motor mounted on said bracing members, means operably connecting the motor to each of said ball mills for rotating it, and means for disconnecting either or both of said mills from the motor.

3. A ball mill structure comprising a pair of horizontally-spaced upright A-frames each in-

cluding inclined side members crossed centrally by a horizontal member which extends outward beyond them, bearing members mounted on the projecting ends of said horizontal members, a ball mill journaled in said bearings at each end of the horizontal members, means rigidly connecting the top portions of the frames, a motor mounted on said means, means operably connecting the motor to each of said ball mills for rotating it, clutch means for disconnecting either or both of said mills from the motor, and a transverse bracing member attached at its ends to said horizontal members between the ball mills to thereby leave the space between the frames below the mills free of obstructions.

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