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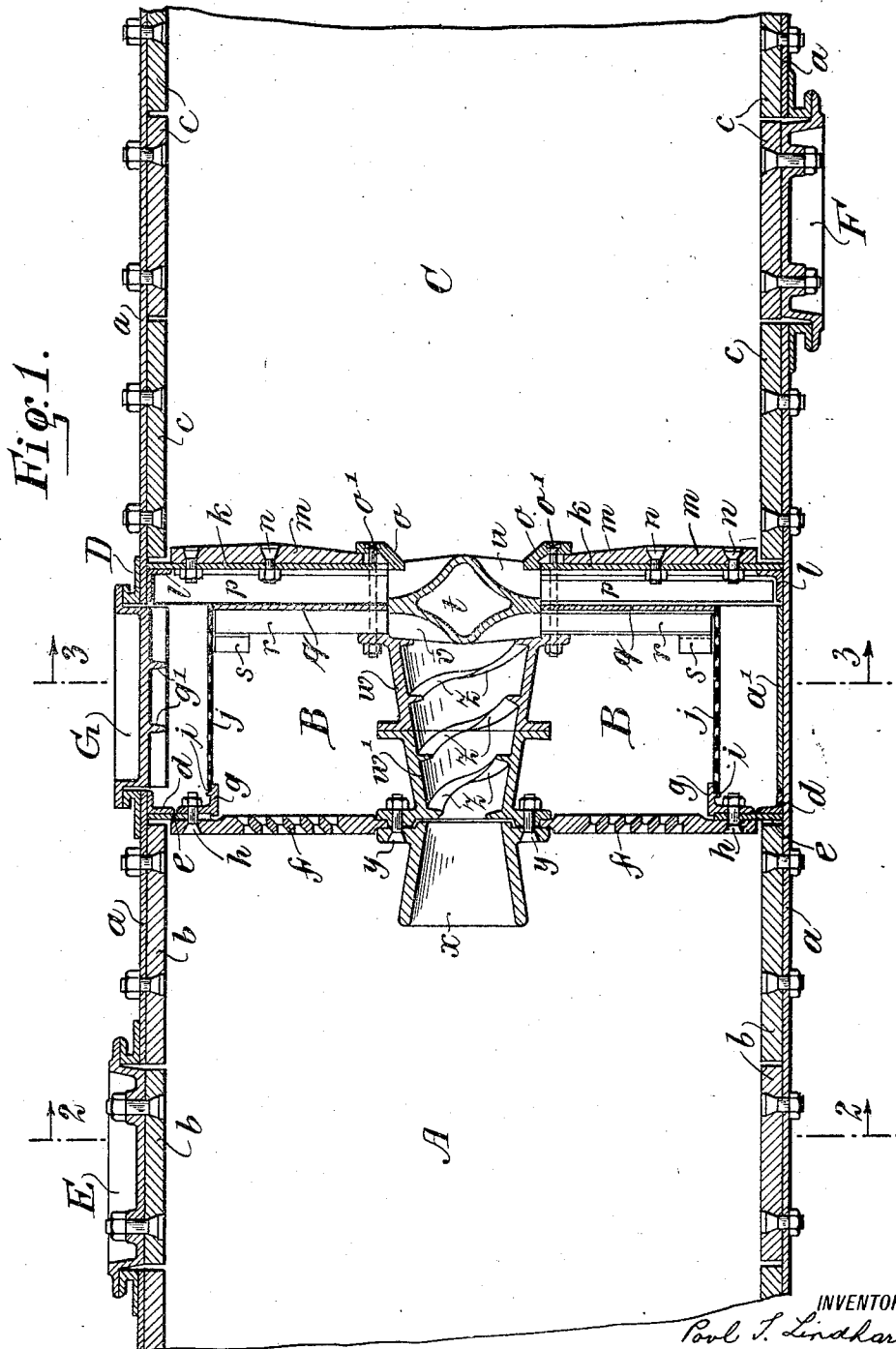
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BALL MILL

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BALL MILL.

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This invention relates particularly to ball mills in which a separating compartment is introduced between the preliminary grinding compartment and the secondary grinding compartment, the tailings from the separating compartment being continuously returned to the preliminary grinding compartment for regrinding and the material which passes through the separator being delivered to the secondary grinding compartment. The object of the invention is to improve such mills in various structural features for the purpose of increasing efficiency, facilitating the assembling of parts and the substitution of screens of different mesh and size according to the nature of the materials operated upon, reducing wear on nuts which must be removed in such substitution, reducing cost of manufacture, and generally improving construction. In the improved mill the screen in the separating compartment is substantially cylindrical and concentric with the shell of the mill; the material from the preliminary grinding compartment passes upon the screen at one end, the fines pass through the screen and are carried on to the secondary grinding compartment, and the tailings pass from the screen at the further end and are then returned to the preliminary grinding compartment. The full area of the screen thus becomes effective and is not limited by the arrangement of the means for returning the tailings or for passing on the fines. The construction is such, moreover, that the screens can be removed from the outside of the mill readily and other screens substituted as may be desired. Various details of construction will be more fully particularly referred to hereinafter with reference to the accompanying drawings in which the invention is illustrated as embodied in a convenient and practical form and in which:

Figure 1 is a partial longitudinal section of a mill of the character referred to, showing a portion of the preliminary grinding compartment, the separating compartment, and the adjacent portion of the secondary grinding compartment.

Figures 2 and 3 are views in transverse section on the planes indicated by the broken lines 2—2 and 3—3, respectively, of Figure 1.

The shell *a* of the mill may be constructed as usual and is shown as continuous and as

provided in the preliminary grinding compartment A with liners *b*, and in the secondary grinding compartment C with liners *c*. In the separating compartment the shell is shown as having a liner *a'*. The preliminary grinding compartment is shown as having a single manhole provided with a cover E, while the secondary grinding compartment C, is shown also as having a single manhole provided with a cover F. The separating compartment, however, is shown as having several manholes or handholes, to facilitate the removal and replacement of the screens, each manhole or handhole having a cover G, which is supported by and secured to a suitable frame D, which is made sufficiently heavy to compensate for the possible weakening of the shell by the several manholes or handholes. All of the details of construction thus far referred to may be of any usual or suitable character.

Secured to the shell *a* within the same at a suitable point is an angle iron ring *d*, to the inwardly projecting flange of which is secured, as hereinafter described, an annular plate *e* which in turn has secured thereto the outer ends of the several perforated or slotted plates *f*, through which the fines from the preliminary grinding compartment pass into the separating compartment. Also secured to the annular plate *e* is an angle iron ring *g*, the plates *f* and the ring *g* being conveniently secured to the annular plate *e* by bolts *h* which have their heads countersunk in the plates *f* and receive their nuts within the separating compartment where they are less exposed to wear and are readily accessible through the handholes. The plates *f* are further secured at their inner ends as described hereinafter.

The horizontal flange of the ring *g* is formed at *i* with a seat to receive and support the corresponding end of the cylindrical or slightly conical screen *j* which, in the construction shown, is formed of sections connected by clamps *j'* and hinges *j''* to facilitate the removal and replacement of the screen through the handholes *g*. At its other end the cylindrical screen *j* is supported on the periphery of a plate *g* to be referred to.

At the other side of the space set apart for the separating compartment there is secured to the inside of the shell *a*, an angle iron ring *l*, to the vertical flange of which

is secured an annular plate k which extends well toward the axis of the shell. Liners m are preferably secured, as by bolts n , to the face of the plate k toward the secondary grinding compartment C, the heads of the bolts being countersunk in the liners and the nuts being on the other face of the plate where they are readily accessible and less exposed to wear. The inner ends of the liners m , may also be received within an undercut ring o held by bolts o' .

To the plate k , on its face next the separating compartment, are secured channels p , by which the fines which have passed from the intermediate portion of the separating compartment through the screen j , and into the annular space between the same and the shell a , are conducted toward the secondary grinding compartment c , while the tailings, rejected by the screen j , are conducted by channels r , provided with flights s , and secured to the separating side of the plate q , above mentioned, toward the central conveying tube w .

Centrally in the mill is disposed a double deflecting cone t , with radial ribs u and v , by which the fines received from the channels p , are directed into the secondary grinding compartment C, and the tailings received from the channels r , are directed into the conveyor tube by which they are returned to the preliminary grinding compartment A. In the construction shown the conveyor tube is conical, made up of several sections w , w' , and x , and is provided interiorly with flights z , by which the return of the tailings to the preliminary grinding compartment A is effected. In the construction shown bolts o' , above mentioned, with nuts exposed in the separating compartment, serve to secure together the liners m , the plate k , the ring o , the channels p and r , the double deflecting cone t , and the section w of the conveyor tube, while the sections w' and x of the conveyor tube receive between them the inner ends of the perforated or slotted plates f , and are secured together by bolts y , and also have their nuts within the separating compartment. The section x , of the conveyor tube forms an extension with the preliminary grinding compartment by means of which the tailings are carried somewhat within the preliminary grinding compartment so that they are subjected to a further grinding action before they are again presented to the plates f .

The movement of the fines in the annular space between the screen j and the shell a , toward the channels p and the secondary grinding compartment C, is facilitated by flights g' , on the inner faces of the handhole covers G, so that such flights are removed with the covers and do not form an obstruction to the introduction of the screen, the shell a and its liner a' , within the sepa-

rating compartment, being left without flights between the handholes.

It will be understood that various changes in details of construction and arrangement can be made to suit different conditions of use without departing from the spirit of the invention.

I claim as my invention:

1. In a ball mill, the combination of a shell, partitions forming a preliminary grinding compartment, a separating compartment and a secondary compartment, the partition between the preliminary grinding compartment and the separating compartment being perforated, a substantially cylindrical screen in the separating compartment and concentric with the shell, means to direct the fines from one end of the screen to the secondary grinding compartment, means to return the tailings from the screen to the preliminary grinding compartment, the shell having a handhole for communication with the separating compartment, a cover for the handhole, and conveyor flights on the inner face of the cover to promote movement of the fines toward the secondary grinding compartment.

2. In a ball mill, the combination of a shell, partitions forming a preliminary grinding compartment, a separating compartment and a secondary grinding compartment, the partition between the preliminary grinding compartment and the separating compartment being perforated in its intermediate portion, a substantially cylindrical screen supported between the partitions concentric with the shell and forming an annular space between itself and the shell, means to direct the fines from said annular space to the secondary grinding compartment, and means to direct the tailings to the preliminary grinding compartment.

3. In a ball mill, the combination of a shell, partitions forming a preliminary grinding compartment, a separating compartment and a secondary grinding compartment, the partition between the preliminary grinding compartment and separating compartment being perforated, a substantially cylindrical screen supported between the partitions concentric with the shell, a double cone deflector mounted centrally with respect to the partition between the separating compartment and the secondary grinding compartment, channels to direct the fines from one side of the screen to one side of said deflector, channels to direct the tailings from the other side of the screen to the other side of said deflector, and a conveyor to conduct the tailings to the preliminary grinding compartment.

4. In a ball mill the combination of a shell, an angle iron ring secured to the inside of the shell, an annular plate secured to the

vertical flange of said ring, and perforated plates, forming a partition, secured to said annular plate.

5 5. In a ball mill, the combination of a shell, an angle iron ring secured to the inside of the shell, an annular plate secured to the vertical flange of said ring, a substantially cylindrical screen supported at one end on the horizontal flange of said ring, and means
10 to support the other end of said cylindrical screen.

6. In a ball mill, the combination of a shell, an angle iron ring secured to the inside of the shell, an annular plate secured to the vertical flange of said ring, perforated
15 plates forming a partition secured to said annular plate, a substantially cylindrical screen supported at one end by the horizontal flange of said ring, and means to support the other end of said screen.

7. In a ball mill, the combination of a shell, a perforated partition, an angle iron ring secured to the inside of the shell, a plate secured to the vertical flange of said ring and extending well toward the axis of the shell and forming a partition, said partitions forming a preliminary grinding compartment, a separating compartment and a secondary grinding compartment, a substantially cylindrical screen between the two partitions, channels supported by said plate to direct the fines toward the secondary compartment, a third annular plate between said channels and the separating compartment, and other channels to direct the tailings toward the preliminary grinding compartment.
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8. In a ball mill, the combination of a shell, a perforated partition, an angle iron

ring secured to the inside of the shell, a plate secured to the vertical flange of said ring and extending well toward the axis of the shell and forming a partition, said partitions forming a preliminary grinding compartment, a separating compartment and a secondary grinding compartment, a substantially cylindrical screen between the two partitions, channels supported by said plate to direct the fines toward the secondary compartment, a third annular plate between said channels and the separating compartment, and a double cone deflector to deflect the fines from the first mentioned channels to the secondary grinding compartment and to direct the tailings from the second named channels toward the preliminary grinding compartment.

9. In a ball mill, the combination of a shell, a perforated partition, an angle iron ring secured to the inside of the shell, a plate secured to the vertical flange of said ring and extending well toward the axis of the shell and forming a partition, said partitions forming a preliminary grinding compartment, a separating compartment and a secondary grinding compartment, a substantially cylindrical screen between the two partitions, channels supported by said plate to direct the fines toward the secondary compartment, a third annular plate between said channels and the separating compartment, and a central conveyor tube to conduct the tailings into the preliminary grinding compartment.

This specification signed this 12th day of August A. D. 1925.

POVL T. LINDHARD.