July 3, 1928. 1,675,417

W. F. McMAHON

GRINDING MILL SCREEN

Filed April 25, 1927 2 Sheets-Sheet 1

Fig. 1.

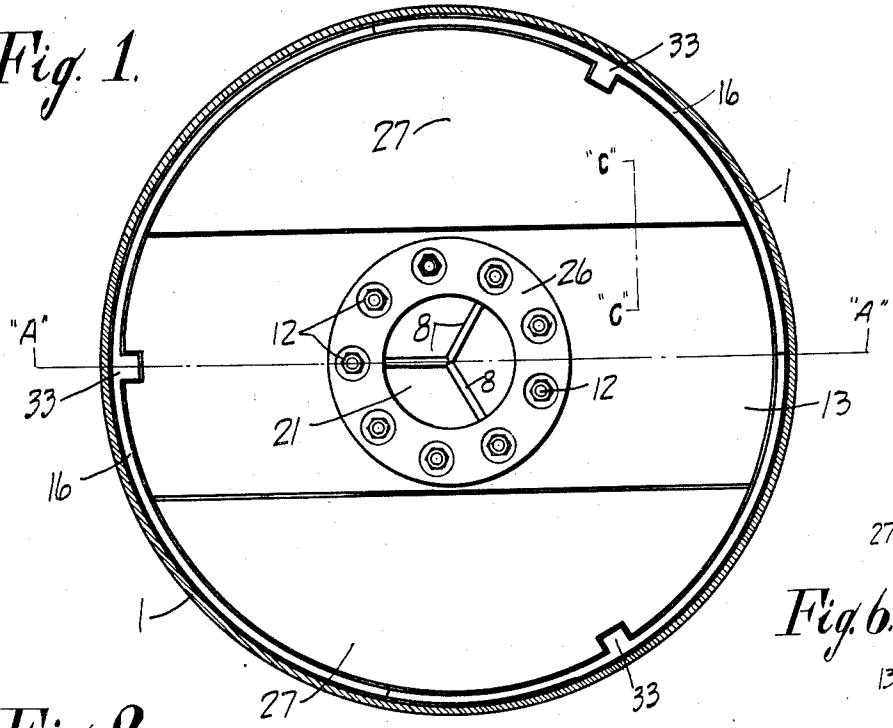
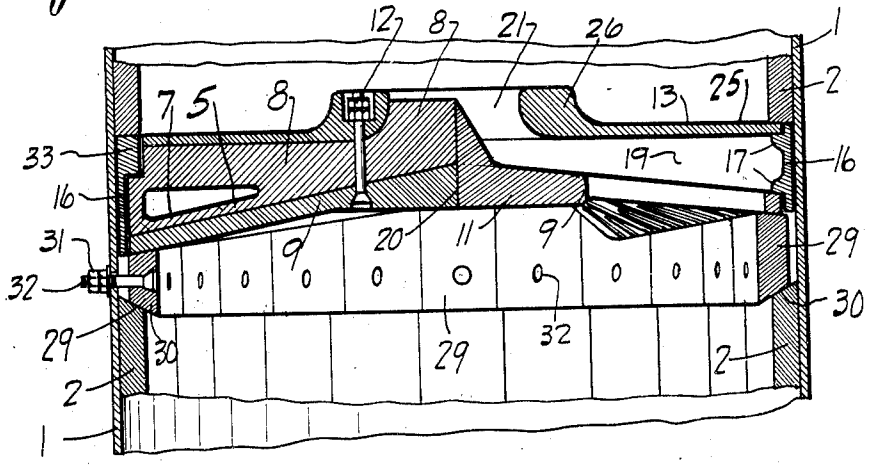


Fig. 6.



Fig. 2.



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Fig. 3.

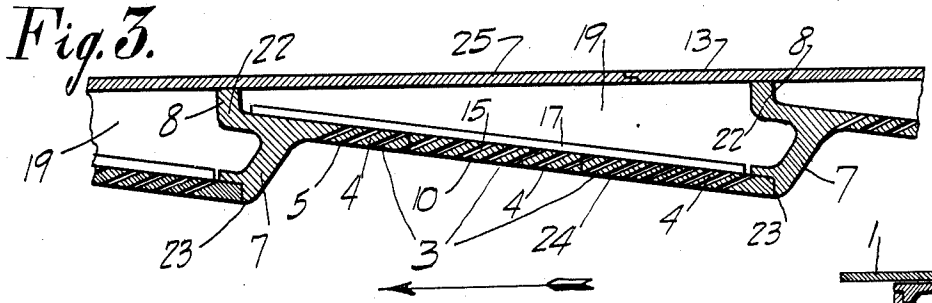


Fig. 5.

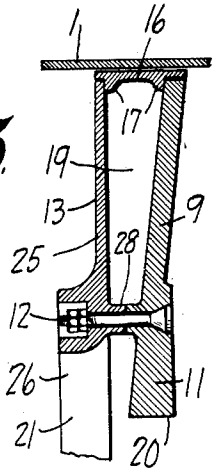
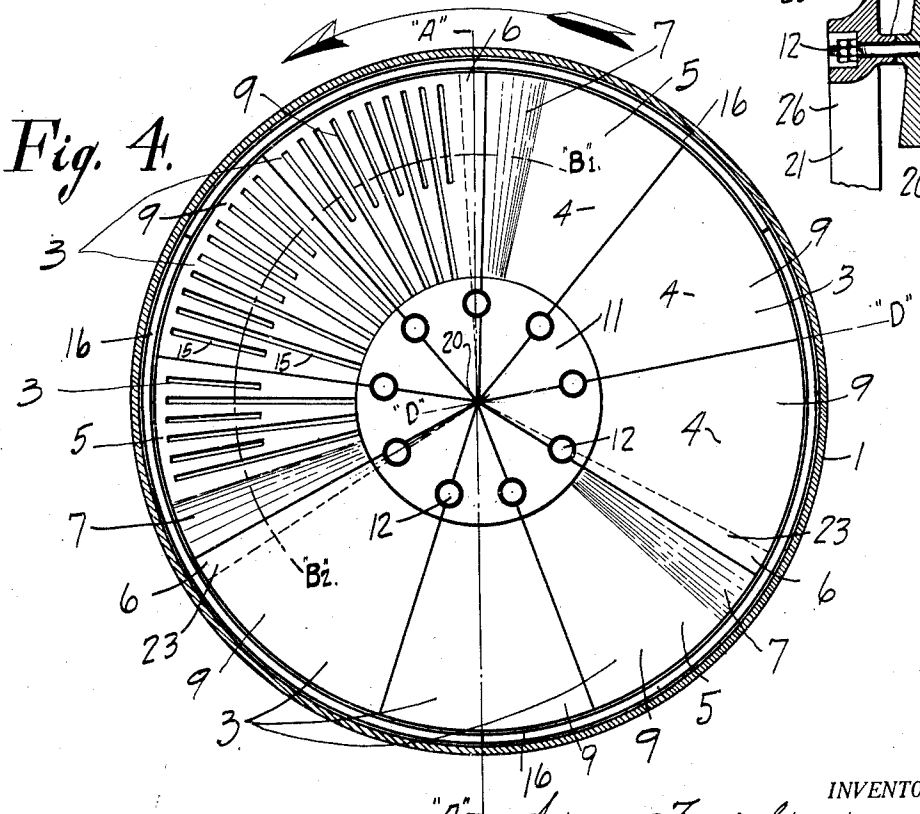


Fig. 4.



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Patented July 3, 1928. 1,675,417

UNITED STATES PATENT OFFICE.

WILLIAM FREDERICK McMAHON, OF RIVERSIDE, CALIFORNIA.

GRINDING-MILL SCREEN.

Application filed April 25, 1927. Serial No. 186,505.

This invention relates in general to a grinding mill division head and relates more specifically to a novel screening mechanism applicable to grinding mills and the like.

An object of the invention is to provide a simple efficient means for utilizing the rotary movement of the grinding mill to propel material through the separating screens of the division head in the said grinding mill, increasing thereby the capacity of grinding mills and screening devices therefor.

Another object is to provide a separating screen that will automatically clean itself and prevent clogging.

In the present type of grinding mills employing separating screens, the weight of the mass of the material ground forces the said material through the perforations in the screen. It has been found that these screens are always congested and wear out rapidly. This congestion reduces the capacity of such mills per horsepower hour. My present invention provides a simple, efficient and automatically functioning means for propelling all material in the mill being ground, that comes in contact with it, through the perforations in the screen, thereby eliminating the objectionable congestion of material and a large percentage of the wear on the screens.

Some of the novel features, disclosed but not specifically claimed herein, form the subject of copending applications for Letters Patent, filed Nov. 4th, 1926 and March 14, 1927 and bearing Serial Numbers 146,262 and 175,280 respectively.

A clear conception of an embodiment of the invention and of the operation of devices constructed in accordance therewith, may be had by referring to the drawing accompanying and forming a part of this specification in which like reference characters designate the same or similar parts in the several views.

Figure 1, is a plan view of the nonperforated wearing plate of the division head, showing a typical 7′ dia. mill head, made up of three plates the center plate acting as a main support member for the entire division head.

Figure 2, is a section taken at "A—A" of Fig. 1, and Fig. 4, showing also the wedging adjusting liner that permits adjustment of the screens, in the division head, outside of the mill.

Figure 3, is a section taken at "B^1—B^2" of Fig. 4, showing the propeller arrangement of the separating screens and the rearwardly inclined perforations, also the novel constructed perforated screen that functions as a supporting means.

Figure 4, is a plan view of the separating screens of a typical 7′ dia. division head, showing a three screen series arrangement, also the novel arrangement of the perforations in the screen castings. Perforations are shown in one sector, other sectors will be similar.

Figure 5, is a section taken at "D—D" of Fig. 4, showing the method of fastening the separating screen segments with the nonperforated wearing plate of the division head, also the one piece casting formation of the separating screen segments.

Figure 6 is a section taken at "C—C" of Fig. 1, showing the lap joint connections between the nonperforated wearing plates.

Referring in detail to the characters of reference marked upon the drawings, 1 represents the shell of the grinding mill that encases the shell liners 2 which are provided for wearing plates for the grinding media in the mill. As the construction and operating principle of a grinding mill is well known I will only describe the parts pertaining to my improvement as all other description would be superfluous. These grinding mills may contain several division heads and while I have shown a single division head it should be noted that the shown division head may be applied to any type of rotary grinding mills either singly or in duplicate and used to equally good advantage. As before stated my novel construction propels material through the perforations in the separating screens by a positive delivery movement given to the material by a series of screens having a propelling arrangement, also I reduce the replacement costs of the grinding mill screens by having fewer parts than any of the well known screens.

To accomplish the above said objects and more specifically the new screen result or propelling action, in a seven foot diameter grinding mill for instance, I provide three inclined screens, each of the said inclined screens are similar in construction consisting of three sectors. It should be noted that each of the three inclined screens 3 can be made in one piece, but in replacing the screens in a mill the space in the manhole provided for the

shipping of the various parts within the mill is limited, so in order to facilitate the shipment of my screen 3 through the manhole in the mill I make each inclined separating screen 3 into three sectors 4, two of the said sectors will be substantially similar while the other 5 will be constructed in the shape of a sector of a circle, one of the radii 6 being formed a supporting arm 7 which acts also as a lifter 8.

The said similar sectors 9 are formed on its plane surface 10 a part of a circle comprehended between two radii and the included arc. By referring to Fig. 4, it will be seen that each sector 9 has a central solid hub 11 in which is located the holding bolts 12 that fasten and hold the separating screens 3 with the central nonperforated wearing plate 13, from the outer diameter 14 of the central solid hub 11 each separating screen sector containing a series of radially disposed perforations 15 which are inclined rearwardly so that any material held in the perforation 15 will be forced out or through the said perforation upon the return sweep of the screen. It should be noted at this time that by the incorporation of the rearwardly inclined perforation any material that has passed through can not react upon the material on the opposite side of the said perforation.

Between the mill shell 1 and the outer diameter of the separating screens 3 I have provided a reinforcing ring 16 that contains annular seats 17 for the separating screens 3 and the partition plates 13 and 18. The reinforcing ring supports and acts as a separator between the separating screens 3 and the partition plates 13 and 18 making a discharge channel 19 for the material that has passed through the screens 3. This reinforcing ring 16 extends completely around the entire division head and is made up of sections to facilitate shipping same through the said mill manhole, in this case I have shown this ring 16 in three sections.

By referring to Figs. Nos. 2, 4, and 5 it will be seen that by the one piece formation of each separating screen sector 4 which extends from a central axis 20, each said sector 4 will bear upon each other at a central hub 11 and as this hub 11 is made of a large depth longitudinally, it will be seen that this construction is very rigid, coupled with the fact that the entire separating screen is held, to the central plate 13 which extends clear across the diameter of the mill, by the bolts 12.

The perforated screen 5 serves to support the entire screen sector 3 in an inclined formation by means of supporting arm 7 which is cast integral with the lifter means 8 and the said screen 5.

In this particular mill there will be three of these special screens 5 hence there will be three lifter arms 8 for the entire division head. The lifters 8 are provided to actuate all material that has passed through the perforated screens into the channel 19 and move said material through the discharge opening 21 in the central supporting plate 13. This lifter 8 will extend into the discharge opening 21 as shown in Fig. No. 2, and it serves as a connecting member between the screen arm 7 and the partition plate 13 as best shown in Fig. No. 3, supporting thereby the special perforated screen 5 which in turn serves to support one radii of a complete inclined screen sector 3.

It should be noted that each of the three inclined screen sectors 3 have their plane surface formed a part of a circle comprehended between two radii and the included arc, one of the radii 22 is substantially vertical with respect to the central axis 20, while the other radii 23 is substantially inclined outwardly from the said central axis 20, making the lateral surface 24 between the two radii inclined. (See Fig. No. 3). It is from this said inclined lateral surface 24, with the rearwardly inclined perforations 15 that I derive my propeller blade action upon all material that comes into contact with the surface 24, which is inclined toward the direction of rotation of the mill shell 1, this direction of rotation is indicated by the arrows in Figures 3 and 4 of the appended drawing.

As the entire screen is revolved it will be noted that each radially disposed perforation 15 will positively grip all material coming in contact with same, and as the said perforation 15 is inclined rearwardly, all the material that was gripped by the perforation in one revolution of the entire screen will be forced through the perforation on the next revolution of the screen by the duplicate gripping action of the perforation upon the body of material adapted to be screened. It suffices to say that this substantially radially disposed perforation being extended obliquely in a rearward direction relative to the respective faces of the separating screen, may obviously be used in a conical or cone shaped screen or in a flat screen or any shaped separating screen and used to equally good advantage.

The partition plate or head 25 of the division head proper is made up of three plates, two of the solid plates 27 having a segmental formation and being located to either side of a central plate 13 that comprises a central outwardly disposed hub 26 in which is the discharge opening 21, and countersunk holes for the bolts and nuts 12.

By referring to Figure Number 1 it will be noted that this central plate extends across the entire diameter of the mill, this novel construction affords an ideal stiffening support for the several screen sectors 4 which have connection to same by means of lugs 28

which are cast integral with the said screens 4 and the central solid plate 13, and are held centrally with the plate 13 by the bolts 12.

The partition plates 13 and 27 are held onto the annular seats 17 of the ring 16 by the shell liners 2, in fact the entire division head is held in place in the mill from longitudinal movement in this direction by the said shell liners 2, and from movement in the opposite longitudinal direction by adjusting liners 29 that cooperate with the shell liners 2 on this side of the division head.

The adjusting liners 29 serve to hold the several screen sectors 4 onto the annular seat 17 of the ring 16, and are made up in a wedge shape, one end portion of the liner 29 being shaped or formed to suit the shape of the respective screens 4 and the other end portion 30 being of a conical formation coacting with a conical surface on the shell liner 2. By this wedging liner 29 I am enabled to insure a tight fit of the entire division head and its various units in the grinding mill at all times. Any wear or looseness being taken up outside of the mill shell 1 by tightening of the nuts 31 on the adjusting liner bolts 32, this is also a new and novel feature of my specific construction. The said adjusting liner 29 is made up in several sections to facilitate assembling of the same in the mill, each section will contain an adjusting bolt 32.

It should be noted that in the event if this screen is to be located adjacent the discharge head of a mill the plates 13 and 27 may be eliminated if so desired.

Keys 33 are cast integral with the ring 16 and serve to hold the various units of the division head in relation with each other.

It should be understood that it is not desired to limit the invention to the exact details of construction herein shown and described for obvious modifications may occur to persons skilled in the art.

Having thus described my invention, what I claim is:

1. In a grinding mill, the combination with a rotary shell, of a division head comprising a series of separating screens having a lateral inclined plane arrangement, each series formed a part of a circle comprehended between two radii and the included arc and comprising a series of radially disposed perforations inclined rearwardly and being substantially in alignment with the direction of rotation of the rotary shell.

2. In a grinding mill, the combination with a rotary shell, of a division head comprising a plurality of separating screens, each screen formed a part of a circle comprehended between the radii and the included arc and having a lateral inclined plane arrangement and comprising a series of rearwardly inclined perforations and being substantially in alignment with the direction of rotation of the rotary shell to insure a positive delivery movement of the ground material through the separating screens.

3. In a grinding mill, the combination with a rotary shell, of a division head comprising a series of separating screens having a lateral inclined plane arrangement and comprising a series of rearwardly inclined perforations and being substantially in alignment with the direction of rotation of the rotary shell to insure a positive delivery movement of the ground material through the separating screens, a transverse wall member having a central discharge opening, a plurality of substantially radial lifter arms forming a part of the separating screens, an outer ring adapted to support and separate the separating screens from the said transverse wall, and means adapted to be adjusted outside of the mill shell for adjusting the separating screens in place.

4. In a grinding mill, the combination with a rotary shell, of a division head comprising a series of separating screens having a lateral inclined plane arrangement and comprising a series of radially disposed perforations inclined rearwardly and being substantially in alignment with the direction of rotation of the rotary shell to insure a positive delivery movement of the ground material through the separating screens, each series of separating screens forming a part of a circle comprehended between two radii and the included arc, a supporting arm made integral and formed a part of the separating screens for inclining the lateral surface of each said series of separating screens between the two said radii.

5. In a grinding mill, the combination with a rotary shell, of a division head comprising a series of separating screens having an inclined arrangement, each series of separating screens formed a part of a circle comprehended between two radii and the included arc, each series of separating screens having a plurality of substantially radial disposed perforations and the said perforations inclining rearwardly to insure a positive delivery movement of the ground material through the separating screens.

6. In a grinding mill, the combination with a rotary shell, of a division head comprising a series of separating screens having a lateral inclined plane arrangement to insure a positive delivery movement of the ground material through the separating screens, each series of separating screens formed a part of a circle comprehended between two radii and the included arc, means formed integral to one radii of one series of separating screens for supporting the opposite radii of the adjacent separating screens.

7. In a grinding mill, the combination

with a rotary shell of a division head comprising a series of separating screens having perforations inclined rearwardly and said perforations being substantially in alignment with the direction of rotation with the rotary shell to insure no reaction of material on one side of the separating screens with material on the opposite side of said separating screens.

8. In a grinding mill, the combination with a rotary shell, of a divison head comprising a series of separating screens having perforations extending obliquely in a rearward direction relative to the respective faces of the said separating screen and being so formed as to prevent the reaction of material on one end portion of the perforations with material on the opposite end portion of the said perforations when the said division head is rotating.

9. In a grinding mill, a divison head separating screen, a series of shell liners, an adjusting shell liner adapted to hold the said separating screen in place, an inclined plane surface between the said shell liners and the adjusting shell liner and means for moving said adjusting shell liner along said inclined plane surface whereby, the said adjusting shell liner is moved in a longitudinal direction.

In testimony whereof, I affix my signature.

WILLIAM FREDERICK McMAHON.