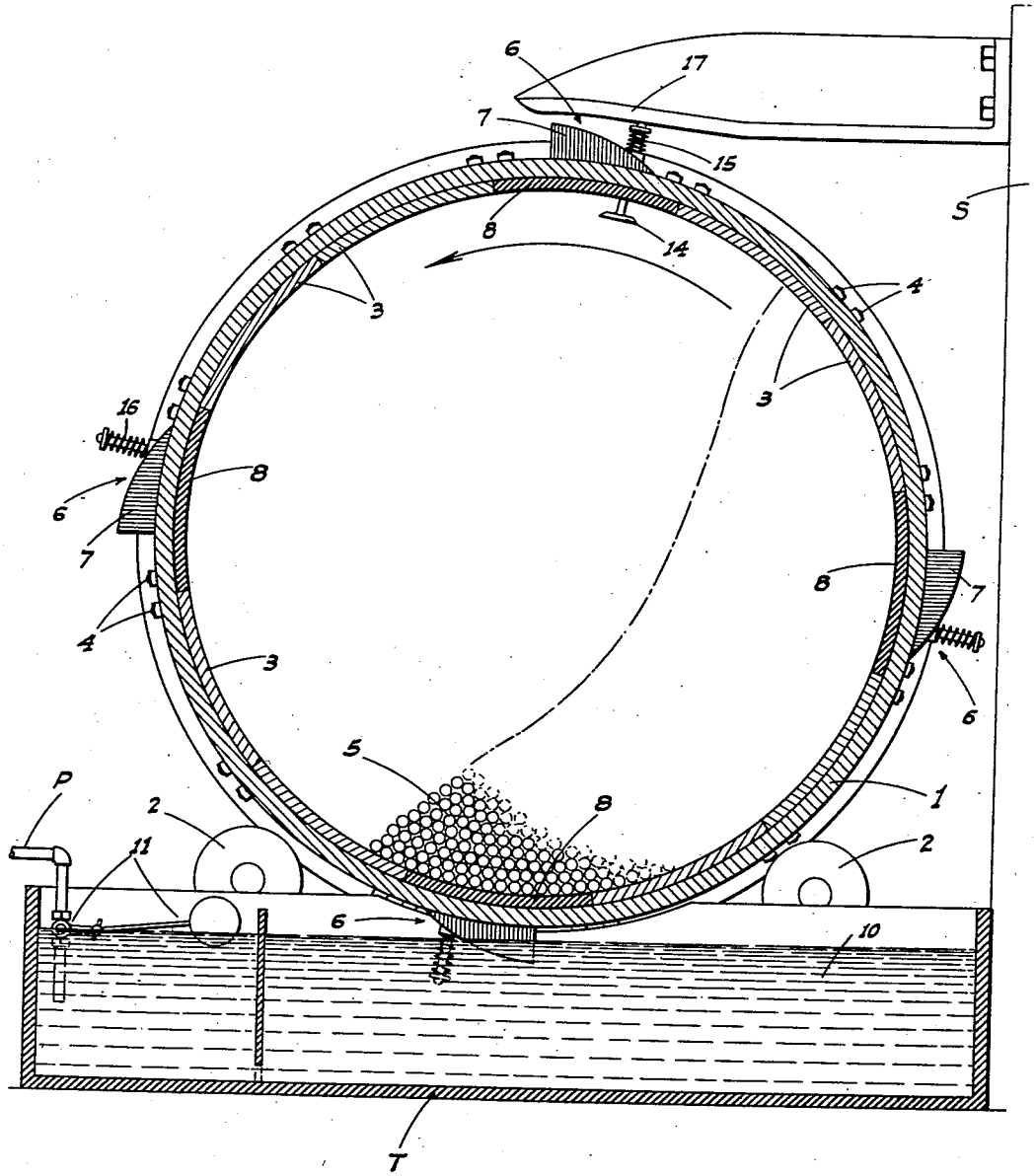
Sept. 10, 1957 S. C. PIERCE 2,805,827

DEVICE TO INTRODUCE A LIQUID IN METERED AMOUNTS INTO A GRINDING MILL

Filed Jan. 12, 1954

2 Sheets-Sheet 1

Fig. 1



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Fig. 2

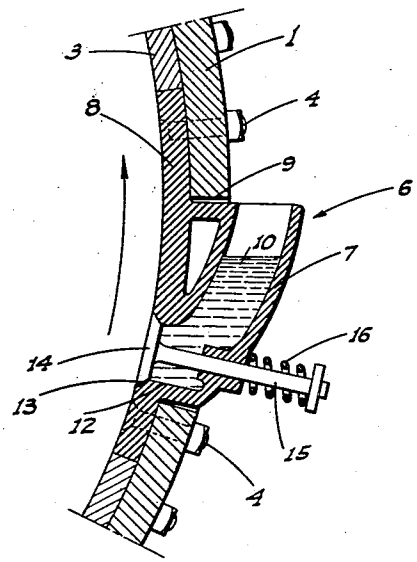


Fig. 4

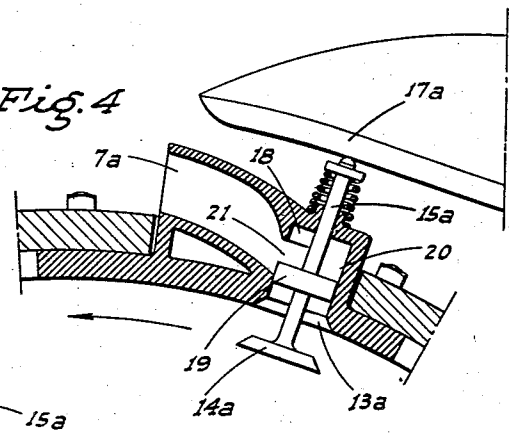
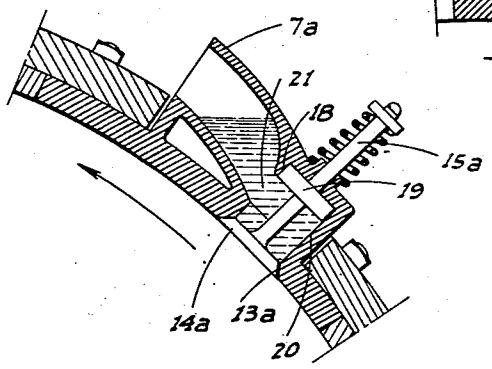


Fig. 3



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2,805,827

Patented Sept. 10, 1957

2,805,827

DEVICE TO INTRODUCE A LIQUID IN METERED AMOUNTS INTO A GRINDING MILL

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Application January 12, 1954, Serial No. 403,619

5 Claims. (Cl. 241—171)

This invention relates to a horizontal grinding mill, and particularly to one of the type used in grinding cement, and which includes a mass of grinding balls in the rotary cylinder.

For reasons set forth in my copending application for patent, Serial No. 303,414, filed August 8, 1952, now abandoned, it has been found advantageous to feed water in measured amounts into the mill at a predetermined point relative to the discharge end of the mill, and in order to obtain the best results this water should enter the mill at a point where it is clear of the mass of balls.

It is therefore the main object of my invention to not only discharge water in measured quantities into the mill as the latter rotates, but to prevent such discharge until the collected and measured amounts of water have in turn arrived at a point such that the water as discharged will enter the mill clear of the mass of balls and not into or under the same. By reason of this control of the liquid, better mixing results are obtained than when the liquid is allowed to enter the mill haphazardly or at indeterminate points.

While the device has been particularly designed for use with the metering and discharge of free-flowing water into a mill, for certain grinding and mixing operations it may be necessary to use a more viscous or slow flowing type of liquid.

It is therefore another object of my invention to provide a liquid metering and control device for the purpose which includes a means for aiding in the discharge of the liquid by positively forcing the same through the discharge opening faster than it would otherwise flow of itself.

Mills of the above general type include an outer shell, and segmental wear plates therein which are removable for replacement as they become worn by contact with the balls and the material being ground.

It is therefore a further object of my invention to provide liquid metering devices for the purpose, arranged to be mounted on the mill, and each of which includes a base plate adapted to take the place of one of the segmental wear plates, which is simply removed from the mill to enable said base plate to be substituted therefor.

The metering devices may therefore be installed on mills already in service or as built, without expensive remodeling being required; it being only necessary to cut an opening through the outer shell for the projecting scoop portion of the device.

Still another object is to provide a liquid metering and control device which is designed for ease and economy of manufacture.

It is also an object of the invention to provide a practical and reliable device to introduce a liquid in metered amounts into a grinding mill, and one which is exceedingly effective for the purpose for which it is designed.

These objects are accomplished by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings:

Fig. 1 is a somewhat diagrammatic transverse section of a grinding mill equipped with my improved liquid feed and metering units.

Fig. 2 is a fragmentary enlarged transverse section of the mill and one of the metering units, with the valve thereof closed.

Fig. 3 is a similar view, but showing a modified form of valve device, the latter being closed.

Fig. 4 is a view of the structure of Fig. 3, but showing the valve device open.

Referring now more particularly to the drawings, and to the characters of reference marked thereon, and particularly at present to the structure of Figs. 1 and 2, the shell 1 of a conventional cylindrical mill is mounted on rollers 2 and is rotated by suitable means in the customary manner.

The shell is lined with segmental wear plates 3 removably held in place by bolts 4 and which are engaged by the mass of grinding balls 5 disposed in the mill and which of course are tumbled about to effect the desired grinding operation as the mill rotates.

Liquid to be mixed with the cement or other material being ground, at any desired point intermediate the ends of the mill, is introduced into said mill by means of a number of metering units 6 spaced circumferentially about the mill. Since all the units are identical, a description of one will suffice for all, as will be obvious.

Each such unit therefore comprises a substantially tangential scoop 7 rigid with, and projecting outwardly from, a base plate 8 which is the same size and curvature as one of the liner or wear plates 3, and adapted to be mounted in the mill in place thereof, as shown in Fig. 1; being secured by the same bolts 4 as were used to hold the plate 3 in place. In order to allow the scoop to project from plate 8 to the outside of the shell 1, the latter is cut away for the passage of the scoop, as shown at 9.

The scoop is open at its outer end in facing relation to the direction of rotation of the mill, as shown, and at the bottom of the mill dips into a supply of liquid 10 maintained at a desired level in a tank T by means of any suitable form of adjustable-float valve unit 11 connected to the supply pipe P, as shown in Fig. 1.

The inner end of the scoop passage 12, which extends to the inner face of plate 8 and is there generally radially of the mill, is formed as a taper valve seat 13 normally engaged and closed by a poppet type valve 14 whose stem 15 is disposed substantially radially of the mill and projects through the outer wall of the scoop some distance and is engaged by a spring 16 acting to hold the valve closed.

Adjacent the top of the mill, a fixed cam 17 projects from a suitable rigid support S into the path of the various alined valve stems 15, substantially tangent to the mill, so as to successively depress the same and open the valves when the corresponding scoops arrive adjacent the top of the mill, as shown in Fig. 1.

By reason of the arrangement above described, it will be seen that liquid from tank 10 will be lifted by the scoops and held therein as the mill rotates until the scoops in succession reach a point adjacent the top of the mill and clear of the mass of grinding balls 5. At this point the valve 14 of each scoop, or liquid receptacle, is opened, allowing the liquid to instantly discharge—by gravity—from the scoop and into the mill, over rather than into the mass of balls. I have found this to give a far better distribution of the liquid, for mixing purposes, than when the liquid is allowed to enter the mill, as a sudden solid flow, under the mass of balls. Also, no interference with the free opening of the valve is had.

Since all the scoops are the same size, and the mill turns at a constant speed, the amount of liquid taken into the scoops will always be the same, and such amount will be determined by the depth to which the scoops dip into

the liquid, which in turn depends on the setting of the adjustable float unit.

Should the liquid being fed into the mill be of a somewhat viscous and slow flowing nature, the arrangement shown in Figs. 3 and 4, and which gives a boost to the portion of the liquid finally discharging from the scoop, may be used.

In this arrangement, the outer wall of each scoop **7***a*, directly opposite the inwardly opening valve **14***a*, is formed with a recess **18** in which a plunger or piston **19** is normally seated, as shown in Fig. 3. This plunger is mounted on the valve stem **15***a* and fits the wall of the scoop from the recess **18** to the valve seat **13***a*, except on the side facing the outer open end of the scoop. In other words, this portion of the scoop is formed as a cylinder **20** for the plunger, which cylinder is open to the throat **21** of the scoop. With this valve structure the cam **17***a* is formed so that the valve stem **15***a* will be moved sufficiently to not only open the valve, but to move the plunger from its initial position in recess **18** across the throat **21** to a position adjacent the valve seat **13***a*, as shown in Fig. 4.

With this arrangement, the initial opening of the valve enables the lower part of the liquid to discharge relatively fast due to the pressure of the mass of liquid behind. The advancing plunger then positively pushes the remaining liquid out past the valve and clear of the wall of the cylinder in which such remaining liquid has collected.

By reason of the fact that in either case, the base plate on which the scoop is mounted is designed to take the place of one of the conventional removable wear plates of the mill, the metering devices may be mounted in a standard mill without having to redesign or make over such mill; it being only necessary to cut the various openings **9** in the shell for the passage of the scoops therethrough.

From the foregoing description it will be readily seen that there has been produced such a device as will substantially fulfill the objects of the invention, as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described the invention, the following is claimed as new and useful, and upon which Letters Patent are desired:

1. In a grinding mill which includes a substantially horizontal rotary cylinder unit, and a mass of grinding balls in the unit; a liquid gathering and retaining scoop mounted on the unit generally tangent thereto and forming a passage open to the outside and inside of the unit, a liquid receptacle positioned to receive the scoop when the latter is at a bottom position on the unit whereby the scoop will pick up liquid upon rotation of the mill, a valve mounted in the scoop and normally closing the inner end of the passage, and means functioning upon rotation of the mill to open the valve when the scoop arrives at a position approaching the top of the mill.

2. In a grinding mill which includes a substantially horizontal rotary cylinder unit, and a mass of grinding balls in the unit; a liquid gathering and retaining scoop mounted on the unit generally tangent thereto and forming a passage open to the outside and inside of the unit, a liquid receptacle positioned to receive the scoop when the latter is at a bottom position on the unit whereby the scoop will pick up liquid upon rotation of the mill, a disc valve opening inwardly of the mill, disposed to normally close the inner end of the passage, said inner end being substantially radially of the mill, a stem on the valve projecting to the outside of the scoop and substantially radially of the mill, spring means acting on the valve to yieldably hold the same closed, and means disposed exteriorly of the mill to depress the stem and open the valve upon arrival of the scoop at a position approaching the top of the mill.

3. In a grinding mill which includes a substantially horizontal rotary cylinder unit, and a mass of grinding balls in the unit; a liquid gathering and retaining scoop mounted on the unit generally tangent thereto and forming a passage open to the outside and inside of the unit, a liquid receptacle positioned to receive the scoop when the latter is at a bottom position on the unit whereby the scoop will pick up liquid upon rotation of the mill, a valve mounted in the scoop and normally closing the inner end of the passage, and means functioning upon rotation of the mill to open the valve when the scoop arrives at a position approaching the top of the mill; the cylinder unit including an outer shell and segmental wear plates therein; with a relatively large base plate on which the scoop is secured and through which the scoop passage extends, said plate being curved to correspond to the curvature of the shell and forming a wear plate to aline with the first named wear plates, the shell having an opening, smaller than said base plate, through which the scoop projects.

4. In a grinding mill which includes a substantially horizontal rotary cylinder unit, and a mass of grinding balls in the unit; a liquid gathering and retaining scoop mounted on the unit generally tangent thereto and forming a passage open to the outside and inside of the unit, a liquid receptacle positioned to receive the scoop when the latter is at a bottom position on the unit whereby the scoop will pick up liquid upon rotation of the mill, a valve mounted in the scoop and normally closing the inner end of the passage, and means functioning upon rotation of the mill to open the valve when the scoop arrives at a position approaching the top of the mill; with means including an element mounted on the valve to positively discharge the liquid from the scoop as the valve is opened.

5. In a grinding mill which includes a substantially horizontal rotary cylinder unit, and a mass of grinding balls in the unit; a liquid gathering and retaining scoop mounted on the unit generally tangent thereto and forming a passage open to the outside and inside of the unit, a liquid receptacle positioned to receive the scoop when the latter is at a bottom position on the unit whereby the scoop will pick up liquid upon rotation of the mill, a disc valve opening inwardly of the mill, disposed to normally close the inner end of the passage, said inner end being substantially radially of the mill, a stem on the valve projecting to the outside of the scoop and substantially radially of the mill, spring means acting on the valve to yieldably hold the same closed, means disposed exteriorly of the mill to depress the stem and open the valve upon arrival of the scoop at a position approaching the top of the mill, a cylinder in the scoop and forming a part of the scoop passage in parallel relationship with the stem and extending from the inner end of the scoop passage to the outer wall of the scoop in crossing relation to the outer portion of the passage, and a plunger fixed on the valve stem and riding in the cylinder and normally disposed at the outer end thereof; said valve opening means being arranged to cause the stem to move axially sufficient to cause the plunger to move across the passage to a point adjacent the inner end of the passage when the valve is moved to a fully open position.

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