May 9, 1933.

R. GARLICK

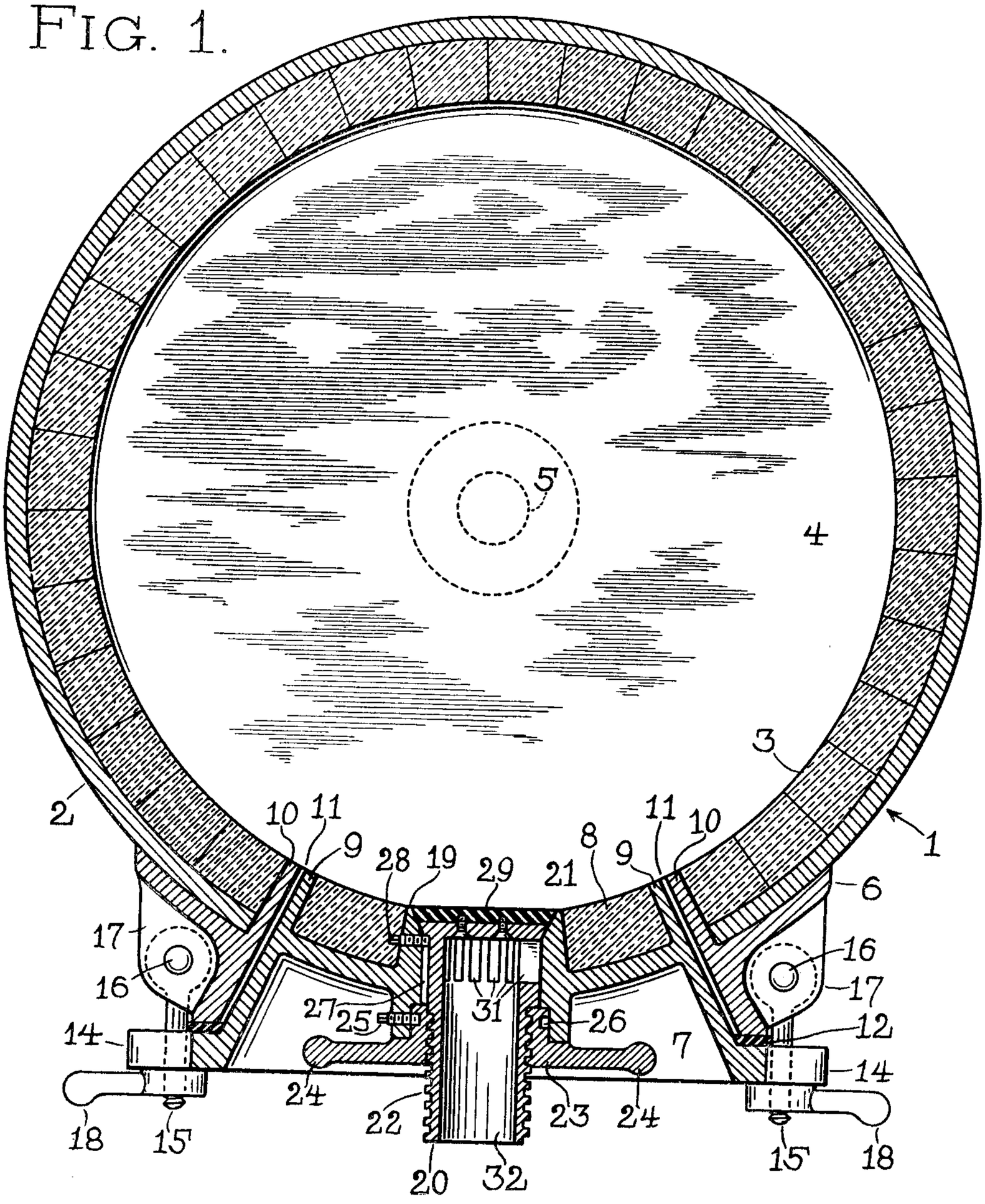
1,907,785

BALL AND PEBBLE MILL

Filed March 27, 1931

2 Sheets-Sheet 1

FIG. 1.



Inventor

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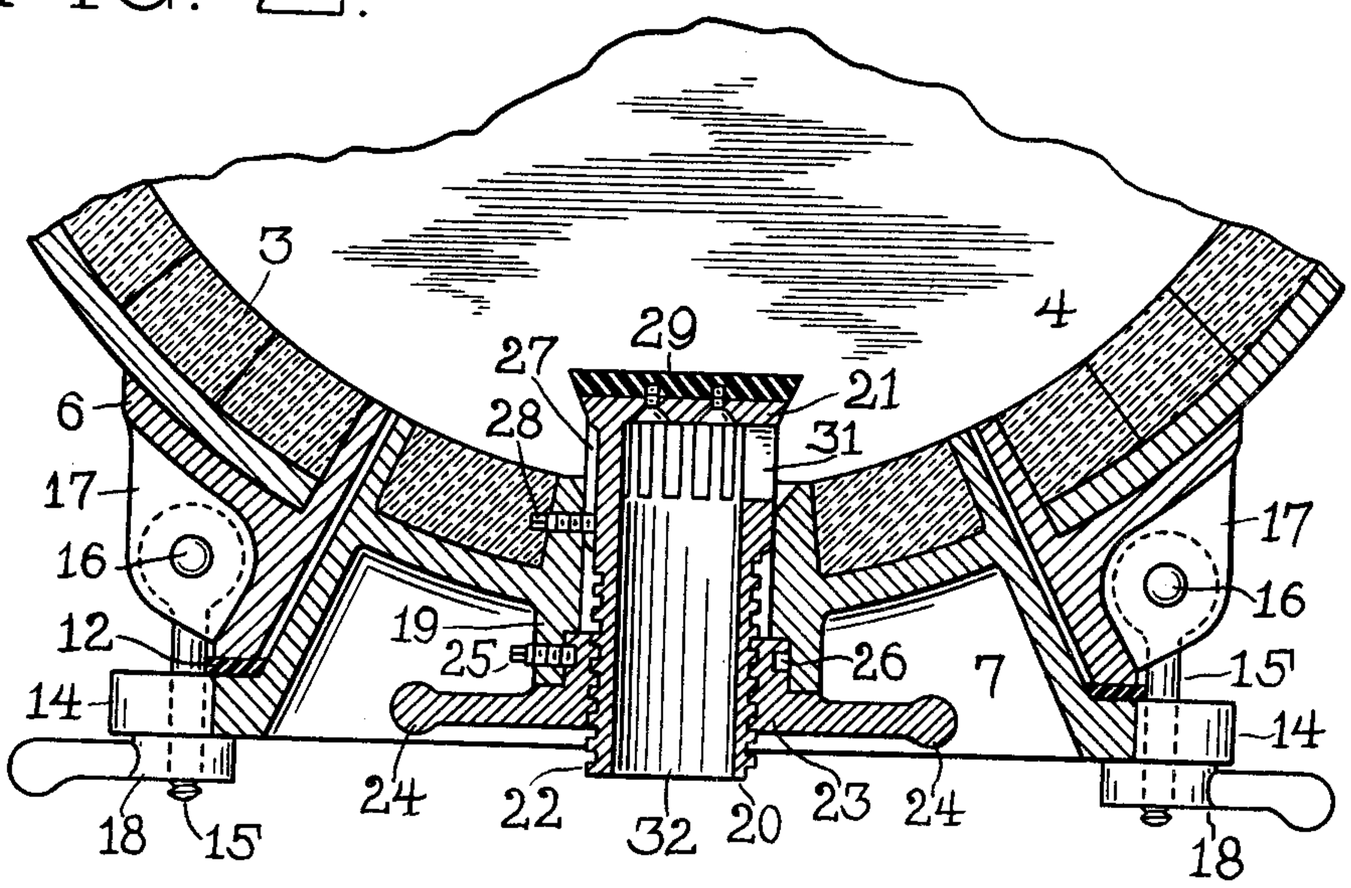
FIG. 2.



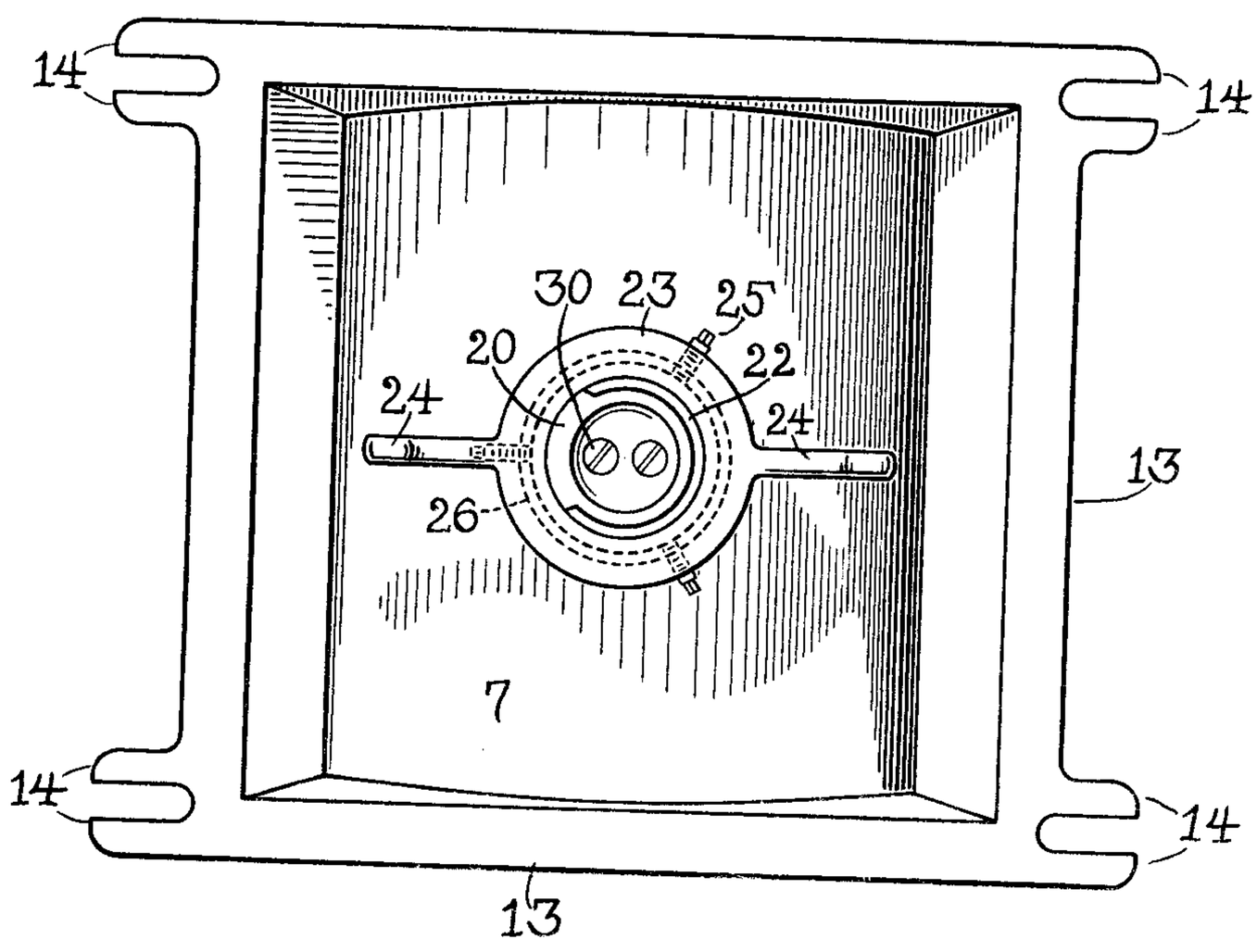


FIG. 3.

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1,907,785

UNITED STATES PATENT OFFICE

RALPH GARLICK, OF TOTOWA, NEW JERSEY, ASSIGNOR TO PAUL O. ABBÉ INC., OF LITTLE FALLS, NEW JERSEY

BALL AND PEBBLE MILL

Application filed March 27, 1931. Serial No. 525,739.

This invention relates to ball and pebble mills, and particularly to the class in which the normal charging or tight cover is provided with a discharge valve in order to eliminate the necessity of removing the cover as a whole when discharging finished ground products from such a mill.

The main object of my invention is to provide a mill drum with a tight cover which is only removed when it is desired to charge the drum with a new batch of raw materials which are to be ground, the same cover being still in position when later discharging the batch, as already indicated.

Another object of my invention is to provide the tight cover of such a mill drum with a discharge valve which is removed with the cover when charging the drum with a new batch, and which valve can then be conveniently cleaned, if so desired, as it is then perfectly accessible inside and out.

A further important object is to so construct a tight cover for such a mill drum that it need not be removed for discharging purposes, whereby contamination of the finished batch with crude materials caught around the edges of the cover is avoided, as these crude unground materials are not disturbed at such times.

Further objects and the various advantages of the novel structural features of my invention will appear more fully in detail as this specification proceeds.

In the accompanying drawings forming part hereof,

Fig. 1 is a vertical transverse section of a mill drum with a tight cover and discharge valve incorporated therein according to the main features of my invention, and embodying the novel features thereof in a practical form.

Fig. 2 is fragmentary section of the same mill drum from the same viewpoint, showing the altered position of the valve.

Fig. 3 is a bottom plan view of the tight cover of the preceding views, the cover being shown as removed from the drum.

Throughout the views, the same reference numerals indicate the same or duplicate parts.

In ball and pebble mills of the intermittent charge type, it is usual to remove a cover from the drum for discharging a finished batch of ground material, this cover being often one of a pair. The first cover, commonly called the tight cover, is removed when a new charge of raw materials is to be put into the drum, while the second cover is the one used for discharging purposes. Even in the case of a drum where only one cover solely is used, there is a serious problem involved in keeping the finished batch clean and free of all contamination from unground particles, extraneous sediments and oils, etc., which may film or even completely ruin the batch in the process of discharging the batch from the mill.

The problem arises from the fact that any cover which is used in such drums cannot in a practical manner be made a perfect fit, but instead is ordinarily made a very free and loose fit into the opening of the drum, the resulting space becoming filled with crude unground materials all around such a cover during the very first few rotations of the drum when grinding is commenced. Later, when the whole batch is ground to the desired degree of comminution and discharge of the batch is desired, the slightest disturbance of the cover will dislodge the crude materials caught around the edges of the same in the space between said cover and the drum opening, and said crude materials will drop right into the finished material and contaminate it, sometimes rendering it unfit for use. Commonly, a strainer cover is used to take the place of the main cover when the latter has been removed before discharging the drum contents.

It is with a view to eliminating the danger of contaminating a finished batch of materials in such a mill, and also in order to avoid the necessity of using a strainer cover for discharging that the present invention is designed, aside from other structural advantages already mentioned, and I particularly design to avoid disturbing the cover of such a mill when discharging contents from the same and thereby avoid disturbing any raw unground materials which may have become lodged around the cover, and in some forms of valve, above the latter, as well.

In the practice of my invention, bearing all the foregoing objects and features in mind, a mill drum or cylinder, generally indicated by 1 is provided with an outer wall 2 and is usually lined or faced interiorly with porcelain, stone or sometimes even with metal as indicated at 3. Such a drum is usually furnished at each end with a trunnion as indicated on the end wall 4 at 5, while a manhole opening in the peripheral wall 2 is reinforced by a frame 6 secured to the drum in any manner known to the art, such as welding, brazing, riveting, etc. Into the frame is fitted a removable cover 7 formed interiorly as a continuation of the drum itself, and may also be provided with a porcelain or other lining 8, corresponding with the drum lining 3. It is hardly practical to attempt to make the cover an absolutely accurate fit in the frame 6, as the cover is first of all quite heavy, and therefore unwieldy, and the expense would not warrant such work. Hence, there is usually an appreciable space between the flanges or edges 9, 9 of the cover and the frame flanges or edges 10, 10, as indicated at 11, 11.

The cover is made tight in relation to the drum as a container by inserting a rubber or other gasket 12 between the cap edges 13 of the cover and the frame 6, the corners of the cover being formed into pairs of corresponding holding lugs 14, 14, etc. The frame is also preferably provided with a plurality of swing bolts similar to 15, 15 having supporting pins 16, 16 mounted in the frame lugs 17, 17, and are normally in position between the adjacent cover lugs 14, 14, while the cover is held up against the frame by means of hand nuts 18, 18 which are screwed up on swing bolts 15, 15. Sometimes crossbars are also used in addition to support the cover, but are not shown as not being essential. However, it is but necessary to loosen the hand nuts described by unscrewing them a few turns on the swing bolts in order to permit them to clear the lugs 14, 14 of the cover, when the bolts can readily be swung out and the cover released for charging the drum with raw materials. Of course, other releasable means may be used to support and secure the cover than those shown whenever preferred.

Now, it is manifest that if a charge of crude unground materials is dropped into the drum while the cover is off and the opening thereof is at the top or uppermost position, and the cover then replaced and secured by screwing up all the hand nuts against the cover lugs, and the mill thereafter started off in its rotation, some of the crude material will fall into the marginal spaces about the cover, until said spaces are packed full practically up to the surface level of the cover and drum interior. In order to leave this packed crude material undisturbed after the whole batch has been sufficiently ground, I propose to let the cover remain in its place absolutely undisturbed, the drum being merely turned over until the cover is at the lowest possible point and there stopped. In this position, all the crude material lodged about the cover in the marginal spaces 11, 11 is held down by the force of gravity and has no tendency whatever of creeping up or being displaced.

The cover, in order to be useful for discharging purposes in the mentioned low position is furnished with a discharge valve built into the same, and one useful form of such a valve is shown, though other forms might be used. In the present instance, a valve seat is formed or fitted into the cover in the form of a casing 19, in which a valve member 20 is fitted so as to be slidable upward into the drum. The upper portion of the valve casing is preferably flared and the upper end of the valve member at 21 correspondingly widened to fit, and these parts being round, it is relatively easy to make a good fit. The valve member has an exterior thread 22 upon which is mounted a threaded control nut 23 which may be manually turned by means of a pair of arms 24, 24. The valve is opened by raising the said valve member, the latter extending up into the casing 19 and in closed position having its widened portion 21 snugly fitting down into the top of the valve casing. The member is raised by turning the arms 24, 24, while the control nut 23 is thereby rotated upon thread 22. In order to insure positive raising of the valve member upon rotation of said control nut, a plurality of set screws similar to 25 are secured in the casing and extend through the same into a groove 26 in the control nut, which prevents this nut from dropping out of the casing or becoming dislodged. Sometimes the friction between the valve member 20 and the casing 19 is also sufficient to prevent the valve member from rotating with the control nut, and the only possible effect of the thread on the valve member is then to raise said member when the nut is rotated in one direction and to lower said member when rotated in the other direction. In practice it is found advisable to have a slot 27 along one side of the valve member and a pin or screw 28 in the casing extend into the slot, which effectively prevents any tendency on the part of the valve member to rotate with the control nut. In the case of other valves which might be used, these details may not, of course apply, for such a valve as that shown and described in the patent of the United States dated December 28, 1920 and the number of 1,363,620, is not projected in part into the drum when opened, as herein. Any type of valve may be used which is found desirable and practical, the office of the valve in any case being to afford an effective means for conveniently discharg-

ing finished materials from the drum while retaining the balls, pebbles or other grinding devices within the same which are ordinarily present therein.

It is also a common feature of discharge valves that a strainer or some structure corresponding to a strainer is associated with the valve or incorporated into its structure. Here, the valve member has a plurality of side ports as at 31 which become exposed to the drum interior when the control nut is sufficiently rotated to raise the valve member to the position of Fig. 2. Any fluid contents of the drum will then tend to run through said ports into the interior discharge chamber 32 of the valve member and thence directly down into whatever vessel which may be placed beneath the valve in order to receive the ground product. Owing to the fact that the cover is not disturbed during discharge of the finished mill contents and also that the valve top herein is a good fit when in closed position, there is no unground crude material released in any way to contaminate the batch, the latter simply pours out in perfectly clean condition through the valve upon opening the same. The ports are small enough to prevent escape of any of the balls or other comminuting bodies from the drum, and thus serve as a coarse strainer in the primary effect of separating the fluid batch from said bodies. A fine strainer may also be used within the valve, although not shown, as this is often done, but the preferred construction is to have the strainer form part of the valve, as just indicated.

Then, again, there are certain mixtures which are easily contaminated by undue contact with metal such as the whole area of the top of the valve member if the whole of the same is exposed directly to the interior of the drum, and for this reason, an insulation on said top may be used as indicated at 29, which may be of rubber, fibre, bakelite, porcelain such as the rest of the interior of the drum lining, or even special metal, as found best in practice. The insulation is either screwed onto the valve top by screws such as 30 or secured thereto by any other practical means. When the valve is closed, as shown in the first view, the top of the valve is practically a continuation of the cover interior or face, which in turn is a continuation of the drum interior or wall.

When the batch has been discharged from the drum, the latter may be rotated half of a revolution until the cover is at the top of the drum, as previously mentioned, when the hand nuts may be released, the swing bolts swung off the cover lugs, and the cover then lifted off. It is then possible to clean out the whole drum into which some of the lodged crude material may have dropped from about the released cover, this material now being of no importance and no longer able to do any damage. On the other hand, as the valve is not located elsewhere on the drum proper, where it would be necessary to loosen and dismantle various fittings in order to remove such a valve for cleaning, but is now a part of the equipment of the cover, the mere removal of the latter for charging purposes at once exposes the valve in convenient and accessible position for most thorough all around cleaning to any extent desired, and that without any particular effort to reach the valve. Moreover, it is thus but necessary to handle the cover just once for each charge of materials that is put into the mill, the finished and ground materials being discharged by way of the valve through the cover while the latter remains securely in position. This saves the extra labor otherwise expended in changing the cover and placing a strainer cover in its place, and in addition saves the cost of such a cover as well.

The particular type of cover and valve illustrated need not be that actually used, for the cover may still remain in position if another type valve were incorporated in said cover, whatever its shape, hence, parts may be omitted and other changes and modifications made to suit the best conditions in practice. I have, as already mentioned, used other valves such as that found in the patent of December 1920, but, of course, I am not limited either to the valve herein or the one there described in said patent, it being also true that the size, shape, proportions or other details such as interior lining or lack thereof of the cover plays no important part in relation to the valve.

Having now fully described my invention, I claim:

1. In a ball and pebble mill including a revoluble drum, the combination, with a frame lining an opening in the wall of said drum, of a tight cover removably located in said frame, there being a marginal space about said cover within said frame where a limited amount of crude materials may lodge during grinding operations, and means for avoiding removal of said cover in order to discharge finished products from said drum and also for avoiding contamination thereof by disturbing said crude materials lodged in said marginal space, including a manually operable discharge valve built into said cover and permanently forming part of the structure thereof, whereby to discharge said finished products through said cover at will while said lodged crude materials are held between said cover and said frame by the force of gravity.

2. In a ball and pebble mill including a revoluble drum adapted to contain a plurality of grinding bodies such as balls or pebbles, the combination, with a frame reinforcing the wall of the drum about an opening in said wall, of a tight cover removably located in said frame, there being a marginal space

about said cover within said frame where a limited amount of crude materials may lodge during grinding operations, means for avoiding removal of said cover in order to discharge finished products from said drum and also for avoiding contamination thereof by disturbing said crude materials lodged in said marginal space, including a manually operable discharge valve built into said cover and forming part of the structure thereof, whereby to discharge said finished products through said cover at will while said lodged crude materials are held about said cover in said marginal space by the force of gravity, and means for retaining the grinding bodies within the drum while discharging said finished products, including a strainer associated with said valve in said cover.

3. In a ball and pebble mill including a revoluble drum, the combination, with a portion of the wall of said drum having an opening therein, of a tight cover removably located in said opening and having a flange exteriorly overlapping the edges of said opening, there being a marginal space about said cover within said opening and beneath the flange of the cover where a limited amount of crude materials may lodge during grinding operations, and means for avoiding removal of said cover in order to discharge finished products from said drum and also for avoiding contamination thereof by disturbing said crude materials lodged in said marginal space, including a manually operable discharge valve built into said cover and forming part of the structure thereof, whereby to discharge said finished products through said cover at will while said lodged crude materials are held in said marginal space about said cover by the force of gravity.

RALPH GARLICK.