March 12, 1940. H. HOWIE 2,192,912

WASHER

Filed Feb. 15, 1939 2 Sheets-Sheet 1

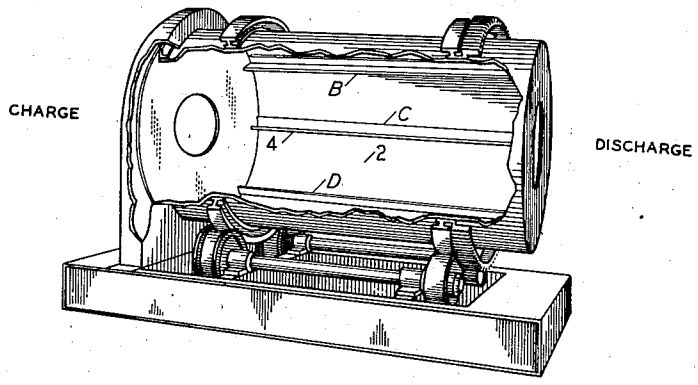


FIG. 1

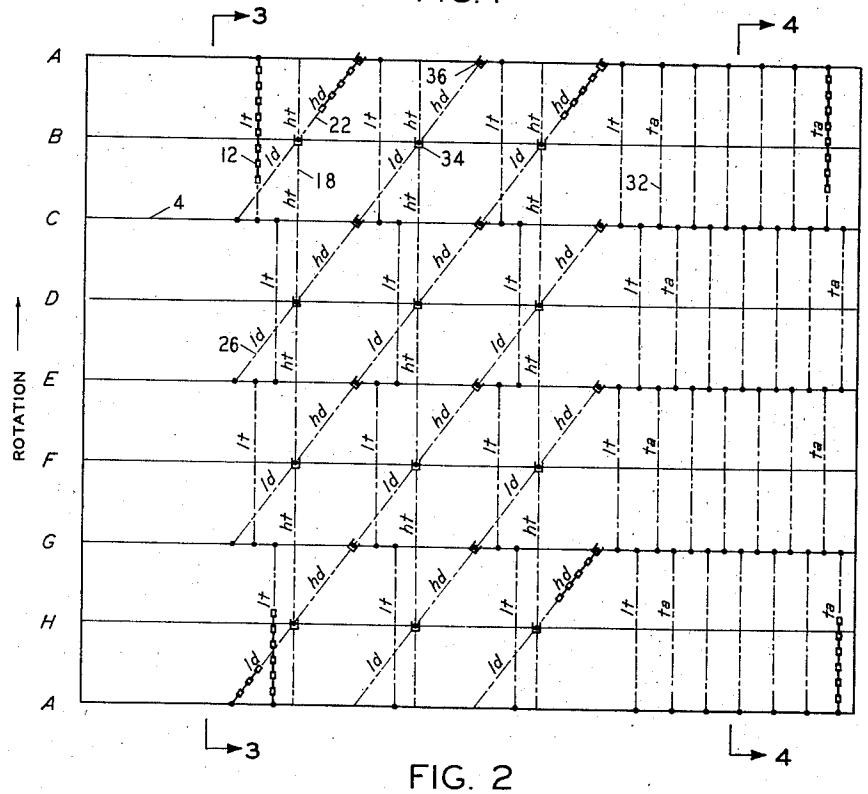


FIG. 2

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Filed Feb. 15, 1939 2 Sheets-Sheet 2

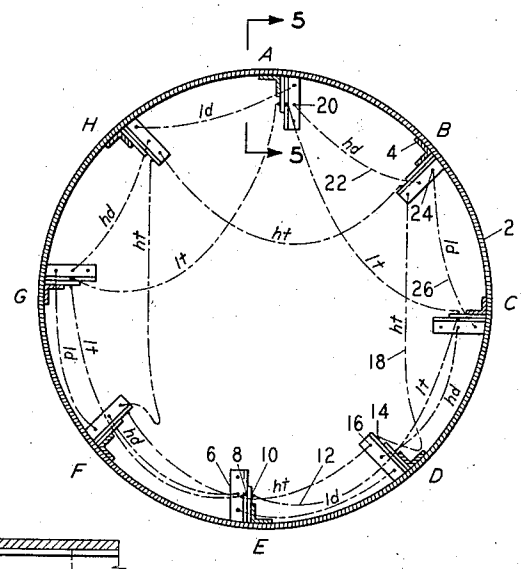


FIG. 3

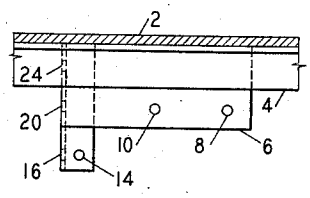


FIG. 5

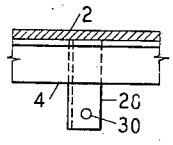


FIG. 6

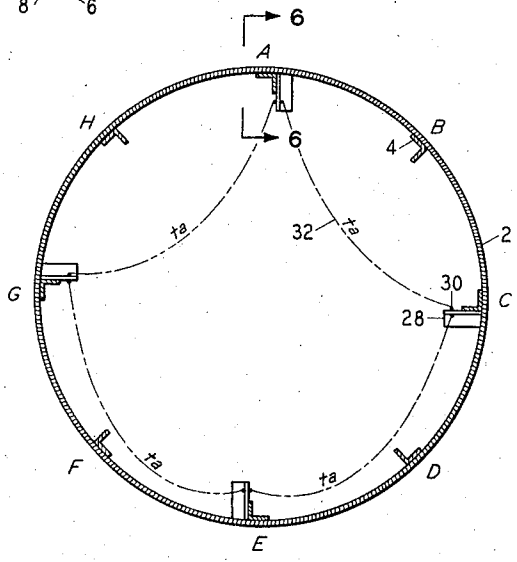


FIG. 4

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UNITED STATES PATENT OFFICE

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WASHER

Howard Howie, Florence, Ala.

Application February 15, 1939, Serial No. 256,491

6 Claims. (Cl. 209—451)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention herein described may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to an improvement in washers of the rotary type, particularly for the removal of clayey matter from ore or gravel.

Washers for this character of service may have a solid drum wall or longitudinal or circumferential sections of the wall may consist of perforated plates or metal screens. The relative positions of solid wall members and perforated wall members or radial partitions within the drum of such a washer may be so positioned that one section of the washer serves only as a scrubber while the following section serves both to scrub and screen the material being washed. However, with all such combinations it has been difficult to effectively soak and disintegrate lumps of ore agglomerated with clay. Consequently, it has been necessary to use apparatus of considerable length to afford sufficient length for the path of travel of the charge and also to provide excessively large quantities of water to effect separation of the clayey constituents of the charge.

The principal object of the present invention is to provide a washer of small size for the separation of clayey material from an ore agglomerated with the clay by using relatively long, effective paths of travel of the charge through the washer. Another object of this invention is to provide a washer which will require the use of a minimum amount of water for the effective removal of the most finely divided constituents of the charge. A further object of this invention is to provide a washer with means for effectively disintegrating agglomerated material charged thereto. Other objects of this invention include the provision of a washer provided with means for retarding the flow of charge through said washer and, at the same time, to prevent extraneous matter from accumulating on the inner wall of the washer.

The present invention consists of a rotary washer having in combination a plurality of longitudinal flights in substantially uniform spaced relationship on the inner wall of said washer, a plurality of flexible, abrasion resistant elements connected to said flights and extending transversely through said washer adapted to disintegrate charged material contacting said elements, and a plurality of flexible, abrasion resistant elements connected to said flights and extending diagonally through said washer adapted to both disintegrate charged material contacting said elements and retard the flow of such material through said washer.

In the accompanying drawings which form a part of the specification and wherein reference symbols refer to like parts wherever they occur,

Fig. 1 is a perspective view of a rotary washer with a portion of the drum removed to show internal flights.

Fig. 2 is a diagrammatic development of the interior of the drum, showing a plurality of scrubber chains attached to the flights.

Fig. 3 is a sectional view through the drum of the washer showing the position of scrubbing chains adjacent to the charge end and corresponding to the position of line 3—3 of Fig. 2.

Fig. 4 is a sectional view through the drum of the washer showing the position of scrubbing chains adjacent to the discharge end and corresponding to the position of line 4—4 of Fig. 2.

Fig. 5 is a sectional view taken on line 5—5 of Fig. 3.

Fig. 6 is a sectional view taken on line 6—6 of Fig. 4.

In Fig. 1 to Fig. 6, inclusive, a rotary drum 2 has a plurality of lifting blades, or flights, represented by blade 4. At the charge end of the drum, attached to each lifting blade 4 is a plurality of radial members, represented by member 6. Each member 6 is provided with a connection 8 and a connection 10 for low transverse (*lt*) chains, represented by chain 12, a connection 14 and a connection 16, for high transverse (*ht*) chains, represented by chain 18, a connection 20 for high diagonal (*hd*) chains, represented by chain 22, and a connection 24 for low diagonal (*ld*) chains, represented by chain 26. At the discharge end of the drum, attached to each lifting blade 4 is a plurality of radial members, represented by radial member 28. Each member 28 is provided with a connection 30 for transverse (*ta*) chains, represented by chain 32. All of the aforementioned diagonal and transverse chains are suspended in the form of a catenary during a substantial part of each revolution of the drum 2, with lateral restraint provided by a plurality of shackles, represented by shackle 34 for the high transverse (*ht*) chains 18 and a plurality of shackles, represented by shackle 36 for the high diagonal (*hd*) chains 22. The lateral restraint on transverse chains 18 creates a baffle effect while the lateral restraint on diagonal chains 22 creates an effect similar to a screw conveyor conveying counter to the general gravitational flow of material. These latter effects are very

advantageous because, in addition to performing the same functions as the other chains, they further increase the time of passage of the material through the washer. All the chains are so arranged that they perform a function similar to the application of the ball milling process by their undulatory movement throughout a complete cycle.

It is evident that there are numerous factors which will influence conditions for the most satisfactory operation of this invention, the actual limits of which cannot be established except by a detailed study of each set of conditions surrounding the treatment of the respective materials being processed.

This invention is directed toward the improvement of various elements within a rotary type washer with the conventional shell or drum which generally rotates about a horizontal axis or an axis slightly declined from the charge end to the discharge end. Such a shell or drum may be imperforate in whole or in part and may serve either as a washer or a combined washing and screening unit as required.

Rotary washers of the type to which this improvement relates are generally provided with one or more means for distributing or disintegrating the charge as the charge usually supplied to this type apparatus is an ore or gravel agglomerated with finely divided material, such as clay. The use of lifting blades or flights positioned longitudinally within the wall of the shell or drum is well known. Numerous auxiliary elements have been proposed to aid in the disintegration of the constituents of the charge and for causing the same to be effectively washed during the course of passage through the washer. Even with the application of these various improvements it is still necessary to have a relatively long washer to provide a sufficient length of path of travel for the charge in order that it may become effectively disintegrated and the finer constituents thereof satisfactorily removed. Furthermore, the water requirement per ton of charge through such a washer is quite large.

In the present invention a plurality of scrubber chains are connected to the longitudinal flights in such a manner that the chains extend transversely through the washer during the rotation of the latter. These transverse scrubber chains are preferably connected to said flights in substantially uniform spaced relationship, particularly in any one zone of the washer. For example, one spaced relationship may be used for treating the charge as it enters the washer and another in the zone adjacent to the discharge end of the washer. These transverse scrubber chains are particularly adapted to disintegrate charged material contacting said chains.

In the present invention there is also provided a plurality of scrubber chains connected to the longitudinal flights in such a manner that the chains extend diagonally through the washer during the rotation of the latter. These diagonal scrubber chains are preferably connected to said flights in substantially uniform spaced relationship. Although such diagonal scrubber chains may be used throughout substantially the entire length of the washer their use in the zone within the washer adjacent to the charge end has been found to be particularly effective when used in combination with the transverse scrubber chains used in this same zone. These diagonal scrubber chains are particularly adapted to both disintegrate charged material contacting said chains and retard the flow of said material through said washer.

The end links and intermediate links of the transverse and horizontal scrubber chains may be connected to the flights such as by the use of shackles to permit free movement of the same at the point of connection or a part of the transverse and diagonal scrubber chains may have end links and intermediate links connected to the flights by shackles affixed to radial members attached to said flights.

In the zone within the washer adjacent to the charge end it is preferable to have a part of the transverse scrubber chains and a part of the diagonal scrubber chains connected to the flights relatively close to the shell or drum of the washer and the remainder of such transverse and diagonal scrubber chains connected to the flights more remote from the shell or drum of the washer. In this manner it is possible to have both the transverse and diagonal scrubber chains positioned more effectively throughout the cross section of the washer concerned. This distribution of close and remote connection in respect to the shell is preferably equally distributed although in certain instances it may be preferable to vary this relationship. It will be noted that, in describing the illustration of the respective transverse and diagonal scrubber chains so variously positioned, those chains which are connected to the flights relatively close to the shell or drum are designated as low transverse (*lt*) and low diagonal (*ld*) respectively, while those chains which are connected to the flights more remote from the shell or drum are designated as high transverse (*ht*) and high diagonal (*hd*), respectively.

The diagonal scrubber chains may, of course, be used throughout the entire length of the washer. However, it is ordinarily desirable to provide such diagonal scrubber chains in the zone adjacent to the charge end of the washer wherein said zone is sufficiently long to provide adequate disintegration of the constituents of the charge. After that, it is ordinarily only desirable to have the transverse scrubber chains since they tend to permit a more ready flow of the charge through the washer than do the diagonal scrubber chains since an important function of the latter is to retard the flow of the charge when it comes in contact with the latter and simultaneously effect substantial disintegration of such charge as a result of such contact.

The apparatus for effecting intimate solid and fluid contacting as described and claimed herein is adapted not only for intimate solid and liquid contacting as required in washing operations but for intimate solid and gaseous contacting such as required in low temperature drying operations and high temperature heating, roasting, or calcining operations.

It will be seen, therefore, that this invention may be actually carried out without departing from its spirit and scope, with only such limitations placed thereon as are imposed by the prior art.

I claim:

1. A rotary washer having in combination a plurality of longitudinal flights in substantially uniform spaced relationship on the inner wall of said washer, a plurality of scrubber chains connected to said flights and extending transversely through said washer adapted to disintegrate charged material contacting said chains, and a plurality of scrubber chains connected to said

flights and extending diagonally through said washer adapted to both disintegrate charged material contacting said chains and retard the flow of such material through said washer.

2. The rotary washer according to claim 1 wherein said scrubber chains extending respectively transversely and diagonally through said washer are connected to said flights in substantially uniform spaced relationship.

3. The rotary washer according to claim 1 wherein part of the scrubber chains are connected to said flights by means of short radial members.

4. The rotary washer according to claim 1 wherein substantially half of said diagonal scrubber chains are connected to said flights close to said wall and the remainder of said chains are connected to said flights more remotely from said wall.

5. The rotary washer according to claim 1 wherein substantially half of said transverse and of said diagonal scrubber chains adjacent to location for admission of material charged to said washer are connected to said flights close to said wall and the remainder of said transverse and of said diagonal chains are connected to said flights more remotely from said wall.

6. A rotary washer having in combination a plurality of longitudinal flights in substantially uniform spaced relationship on the inner wall of said washer, a plurality of flexible, abrasion resistant elements connected to said flights and extending transversely through said washer adapted to disintegrate charged material contacting said elements, and a plurality of flexible, abrasion resistant elements connected to said flights and extending diagonally through said washer adapted to both disintegrate charged material contacting said elements and retard the flow of such material through said washer.

HOWARD HOWIE.