

(No Model.)

3 Sheets—Sheet 1.

F. BROTHERHOOD.

APPARATUS FOR WASHING PHOSPHATE ROCK, ORES, &c.

No. 299,337.

Patented May 27, 1884.

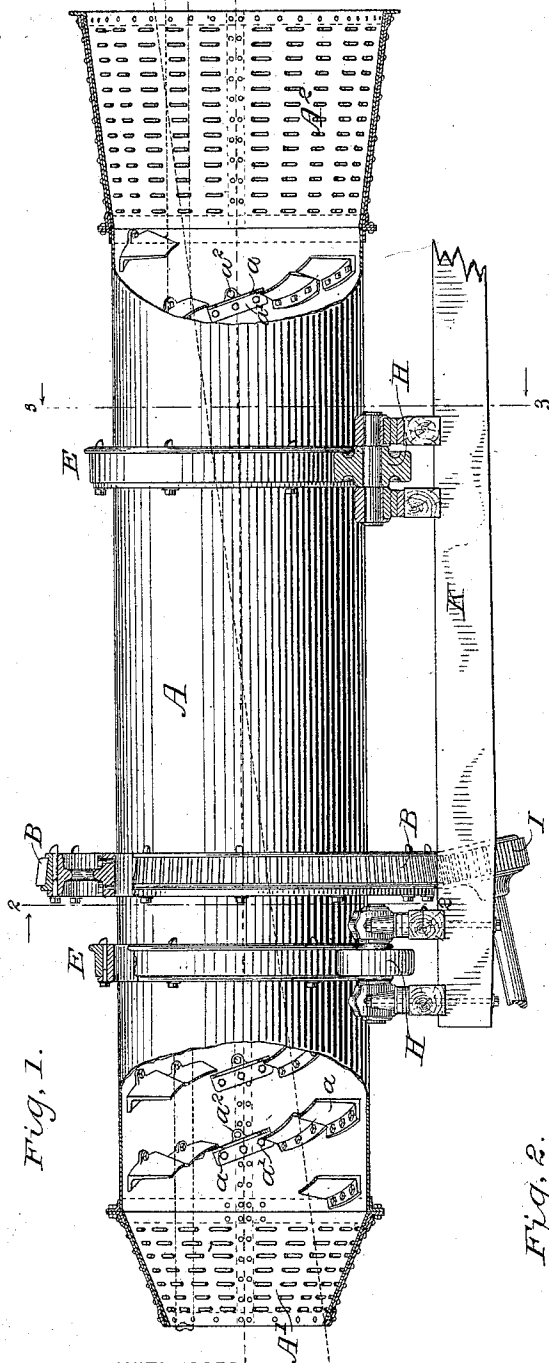


Fig. 1.

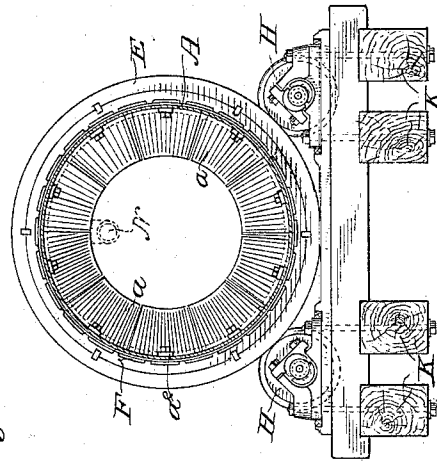


Fig. 3.

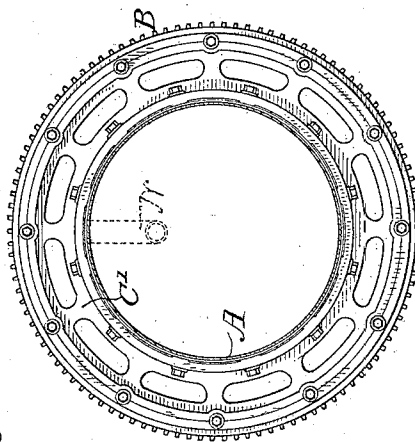


Fig. 2.

WITNESSES

*Wm A. Skinkle*  
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INVENTOR

*Fred Brotherhood.*

By his Attorneys

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Fig. 4.

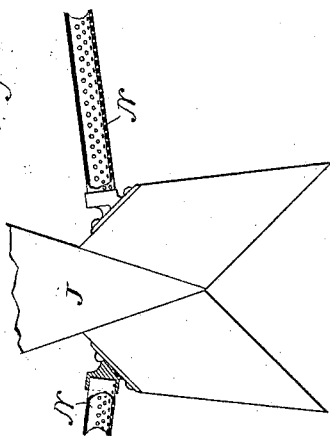
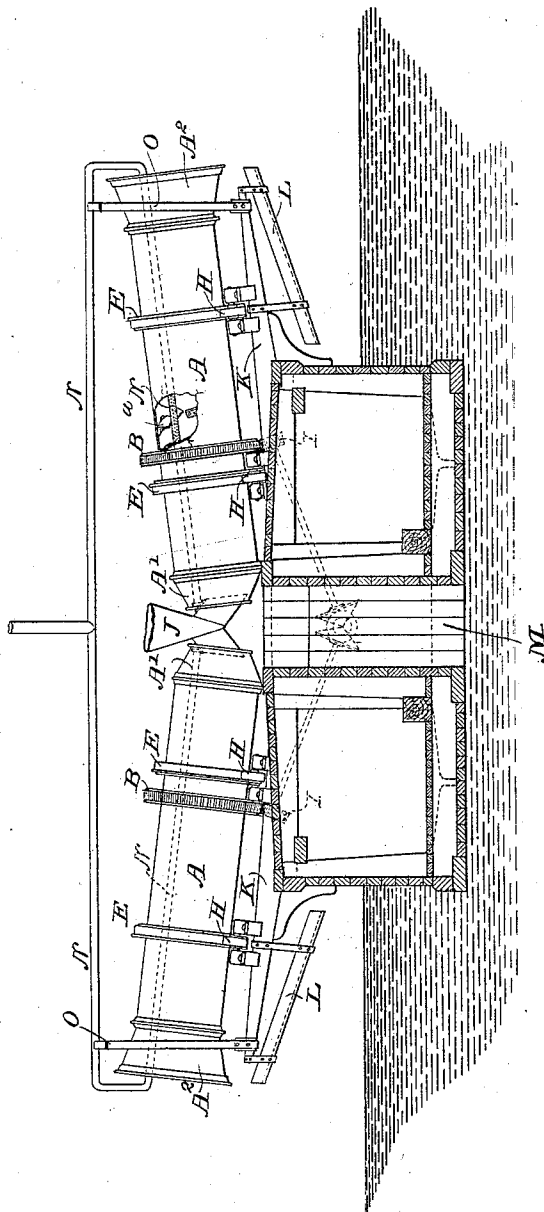


Fig. 12.



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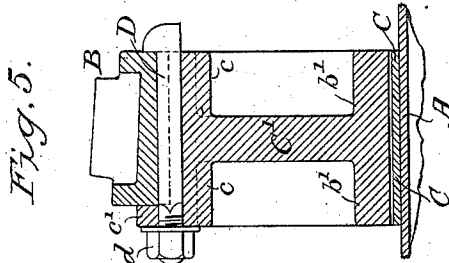
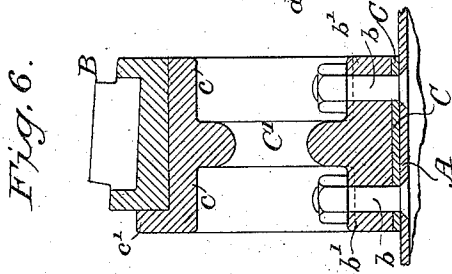
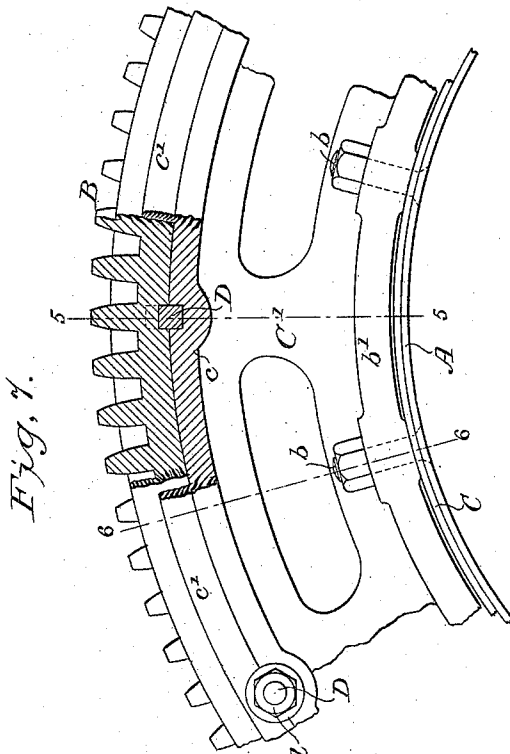
*Ballou, Stephens & Ayer.*

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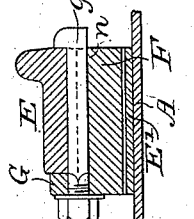
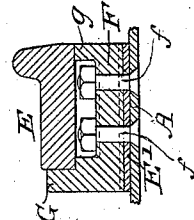
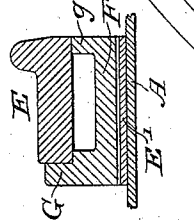
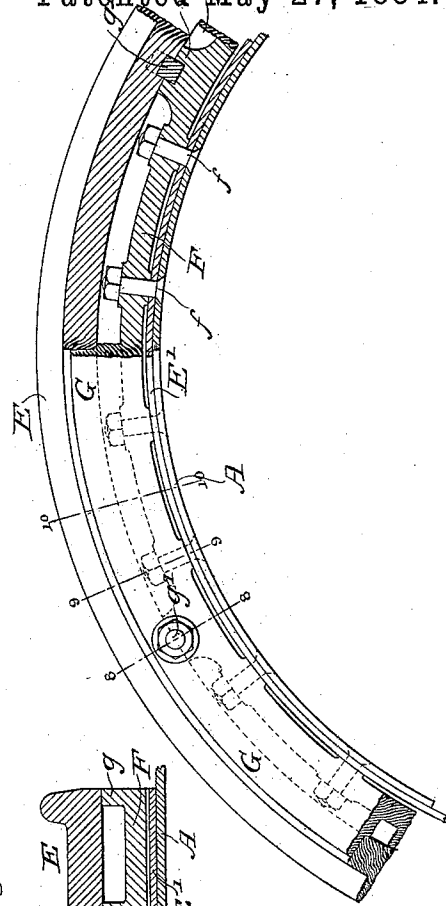
WITNESSES

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Geo. W. Young

Fig. 10.

Fig. 9.

Fig. 8.



INVENTOR

Fred Brotherhood

By his Attorneys

Goldman, Hoffman & Co.

# UNITED STATES PATENT OFFICE.

FRED BROTHERHOOD, OF CHARLESTON, SOUTH CAROLINA.

## APPARATUS FOR WASHING PHOSPHATE ROCK, ORES, &c.

SPECIFICATION forming part of Letters Patent No. 299,337, dated May 27, 1884.

Application filed January 23, 1884. (No model.)

*To all whom it may concern:*

Be it known that I, FRED BROTHERHOOD, of Charleston, South Carolina, have invented, certain new and useful Improvements in Apparatus for Washing Phosphate Rock, Ores, &c., of which the following is a specification.

My invention relates to improvements in apparatus, especially designed for washing phosphate rock, of the class in which the material to be washed is delivered into the lower end of an inclined rotating cylinder, upon the inner surface of which there is arranged a spiral or screw-like rib or series of ribs, by which the material being treated is gradually conducted from the lower to the upper end of the cylinder and discharged, while the refuse substances—such as sand, mud, &c.—are forced out at the lower end of the cylinder by means of a current of water passing through it. My object is to provide washing apparatus for most effectually cleansing the material, and which shall be strong and of economical construction.

My improvements, hereinafter particularly designated in the claims, as shown in the accompanying drawings, are adapted for use upon a vessel, so that the phosphate rock as dredged and crushed by suitable appliances may be delivered to the washing apparatus and discharged from it into other vessels or lighters.

In the drawings, Figure 1 is a view, partly in side elevation and partly in vertical section, with some of the parts broken away. Fig. 2 is a view, partly in end elevation and partly in section, on the line 2 2 of Fig. 1. Fig. 3 is a view, partly in end elevation and partly in section, on the line 3 3 of Fig. 1. Fig. 4 is a detailed view, partly in section, showing in part the forked conductor by which the material is directed to the washing-cylinders, and parts of the perforated pipes for supplying water to the cylinders. Fig. 5 is a transverse section on the line 5 5 of Fig. 7. Fig. 6 is a similar section on the line 6 6 of Fig. 7. Fig. 7 is a view in elevation, with parts broken away, representing the manner of securing a ring-gear about the cylinder. Figs. 8, 9, and 10 represent transverse sections on the lines 8 8, 9 9, and 10 10, respectively, of Fig. 11. Fig. 11 is a view in elevation, with parts

broken away, representing the manner of securing one of the supporting-ring wheels about the cylinder. Fig. 12 is a view, partly in elevation and partly in vertical section, with some parts broken away, representing the manner of arranging a pair of the cylinders upon the hull of a dredge-boat or other vessel.

Two cylinders, A A, of stout boiler-iron, and similar in construction, are each made as follows: The cylinders rotate about inclined axes (see Fig. 12, and dotted lines, Fig. 1,) indicating the angle of inclination. At the lower or inner ends of the cylinders they have short inwardly-flaring sections A' A', perforated with numerous small openings; or, if preferred, a skeleton frame may be substituted for the perforated sheet-metal inwardly-flaring section, and the frame thus formed be covered with steel-wire net-work. Each of these inwardly-flaring sections is secured by flanges and rivets to the body of the cylinder in an obvious way. To give the required strength to the sections, they are preferably made of two thicknesses of metal riveted together. (See Fig. 1.) At the upper or outer ends of the cylinders they are provided with short outwardly-flaring sections A<sup>2</sup> A<sup>2</sup>, perforated and of double thickness, as are the just above described sections A'. Arranged upon the inner surfaces of the cylinders in spiral or screw-like form are projections *a*, formed with perforated base-flanges *a'* and lugs *a''*, by which to secure them in place by bolts or rivets. These projections or rib-sections are arranged so that at their adjacent ends they approach very closely to each other, leaving only very narrow spaces between them, to admit of sand, mud, &c., passing downward and out at the lower ends of the cylinders, as the material to be washed is carried forward and upward, as hereinafter will be made apparent. These rib-sections may either be slightly "staggered" or arranged in the same continuous spiral line. Each cylinder is provided with a ring-gear, B, which is detachably secured to the cylinder in the following way: A band, C, is fitted tightly about the cylinder and riveted or bolted thereto, so as to give increased strength, and a strong cast-iron ring, C', is secured about this band by the same bolts, *b*, and nuts which attach or assist in attaching the band to the

cylinder. This cast-iron ring is formed with flanges *b' b'*, for the passage of the bolts *b*, and with an outer or peripheral flange, *c*, having a slightly-inclined or beveled surface and a continuous side rib or edge flange, *c'*. Intermediate these inner and outer flanges, *b' c*, the ring is formed with a slotted web, so as to reduce its weight to the proper limit. The ring-gear, which is slightly beveled on its inner surface, is drawn in place about the cast-iron ring, and against the peripheral edge-flange *c'* thereof, by means of a series of bolts, *D*, and their nuts *d*. These bolts are formed with square body portions, (those portions intermediate the heads and threaded ends of the bolts,) which pass through recesses formed partly in the flange *c* of the cast-iron ring and partly through the ring-gear, as plainly shown in Fig. 7, and at their threaded ends the bolts pass through the edge-flange *c'* of the cast-iron ring. By screwing up the nuts upon the bolts it will be seen that the heads which project sidewise from the bolts in only one direction are drawn firmly against the ring-gear, and it is held to its seat upon the cast-iron ring and against the peripheral edge-flange thereof. In this way the parts may be readily connected and separated, are rendered very durable, and repairs are greatly facilitated, as will be obvious.

Flanged ring wheels or tires *E*, preferably of steel, two for supporting each cylinder, are each formed and secured in place in the following way: Bands *E' E'* are secured about the cylinder on opposite sides of its center, or near each end, and a cast-iron ring, *F*, is bolted about each band. The bolts *f* and their nuts, which secure the cast-iron rings about the cylinder, also secure or assist in securing the bands *E'* in place. The rings *F* are formed at intervals with cross-ribs *n*, with intermediate recesses in their peripheries, and upon one edge with a shouldered annular rib or flange, *G*, and upon the opposite edge with a shorter annular flange, *g*. A line drawn from the flange *g* to the shoulder of the flange *G* would incline slightly. The flanged ring-wheels are slightly beveled on their inner surfaces, and are secured in place upon the shoulder of the flange *G* and upon the flange *g* by means of a series of headed bolts and nuts *g'*, such as those above described in connection with the ring-gear. These bolts are at the cross-ribs *n*. In this way separation of the parts is rendered easy to facilitate repairs, and great strength attained. Supporting-rollers *H*, preferably of chilled iron, four for each cylinder, and arranged in pairs on opposite sides of each of the ring-wheels, are suitably mounted upon appropriate supports secured to the vessel, and projecting from the sides thereof, such as those, *K K*, represented in Fig. 12. The flanges of the ring-wheels prevent downward endwise movement of the cylinders, as will readily be understood by inspection of Figs. 1 and 12. Rotation is imparted to the cylinders by means

of bevel-pinions *I I* meshing with the before-described bevel ring-gears *B B*. The bevel-pinions are secured upon inclined shafts actuated by suitable connection with any appropriate motor.

The water for washing the material is conducted to the upper or outer ends of the inclined cylinders by means of pipes supplied from any suitable source; or, if preferred, and as in this instance shown, perforated pipes *N* may be employed extending the whole length of the cylinders. The material to be washed is supplied to the cylinders at their lower ends by means of a forked conductor or chute, *J*, as shown in Fig. 4, and when long perforated pipes are employed their lower ends may be supported by being attached to the forks of the conveyer, as shown. The pipes are suitably supported at the outer ends of the cylinders by braces *O*, connected with the supporting-arms *K K*.

For the purpose of separating from the washed material and carrying off such refuse substances as may pass through the cylinders at their perforated outer ends or flaring sections, conveyer troughs or chutes *L L* are provided, which carry this refuse material, passing through the perforated ends of the cylinders downward toward their lower ends and beneath their imperforate portions, close to the sides of the hull, and discharge it there, so as not to interfere with the proper loading upon lighters of the washed material as discharged from the outer ends of the cylinders. At their lower ends the water and refuse substances run from the cylinders into a central well, *M*, in the hull.

For the purpose of enabling either one or both of the cylinders to be operated at the same time, suitable cut-offs—such as sliding gates—are provided in the forks of the conductor *J*.

From the above description it will be seen that a most thorough cleansing of the material is accomplished, as provision is made for the escape of refuse substances, both as first delivered to the lower end of the cylinder and at the upper end of the cylinder, as well as by being washed downward by the flow of water.

It is obvious that the apparatus above described may be located upon any suitable frame-work or structure instead of being arranged upon the vessel-hull, and that only one cylinder may be used.

I am aware that it is not new to provide inclined rotating cylinders or equivalent structures with internal spiral ribs or rib-sections, in addition to means for supplying the cylinders with water, so that the finer and refuse particles may be discharged at the lower ends of the cylinders and the material to be saved conveyed to and discharged from the upper ends; and I do not broadly claim such apparatus. Neither do I unqualifiedly claim a cylinder having perforated sections, as such is old.

I claim as of my own invention—

1. The inclined rotating cylinder having the inwardly-flaring perforated lower section, the outwardly-flaring perforated upper section, and spirally-arranged rib-sections, substantially as and for the purpose hereinbefore set forth.

2. The combination of the inclined rotating washing-cylinder imperforate for the greater portion of its length, and having the rib-sections, the perforated outwardly-flaring outer section of the cylinder, and the chute by which refuse material passing through the perforations of said outer section is conveyed away beneath the imperforate portion of the cylinder and toward its lower end, substantially as and for the purpose hereinbefore set forth.

3. The combination of the cylinder, the ring C', having the peripheral edge-flange *c'*, the ring-gear constructed independently of said ring, and the securing bolts and nuts by which the ring and ring-gear are detachably connected with each other, and these parts secured to the cylinder, substantially as and for the purpose hereinbefore set forth.

4. The combination of the cylinder, the ring F, the flanged ring-wheel, and the bolts and nuts by which it is secured in place, substantially as and for the purpose hereinbefore set forth.

5. The combination of the cylinder, the ring C', secured thereto, and having inner and outer flanges, *b' c*, and the peripheral flange *c'*, the

ring-gear, and the securing bolts and nuts by which it is detachably secured about the ring and against its peripheral flange, substantially as and for the purpose hereinbefore set forth.

6. The combination of the cylinder, the band C, the ring C', bolted to the cylinder with the band, and having the inner and outer flanges, *b' c*, and the peripheral flange *c'*, the ring-gear, and its securing bolts and nuts, substantially as and for the purpose hereinbefore set forth.

7. The combination of the cylinder, the ring F, secured thereto, and having the shouldered flange G, and shorter flange *g* upon its opposite edges, the flanged ring-wheel, and the securing bolts and nuts by which the ring-wheel is secured in place, substantially as and for the purpose hereinbefore set forth.

8. The combination of the cylinder, the band E, the ring F, bolted to the cylinder with the band, and formed with the cross-ribs *n*, the shouldered flange G, and the shorter flange *g*, the flanged ring-wheel, and the bolts and nuts by which the ring-wheel is secured in place, substantially as and for the purpose hereinbefore set forth.

In testimony whereof I have hereunto subscribed my name this 5th day of January, A. D. 1884.

FRED BROTHERHOOD.

Witnesses:

W. C. DUVALL,  
EUGENE V. BROWN.