

# F. BROTHERHOOD.

## APPARATUS FOR DREDGING, CRUSHING, AND WASHING PHOSPHATE ROCK.

No. 298,443.

Patented May 13, 1884.

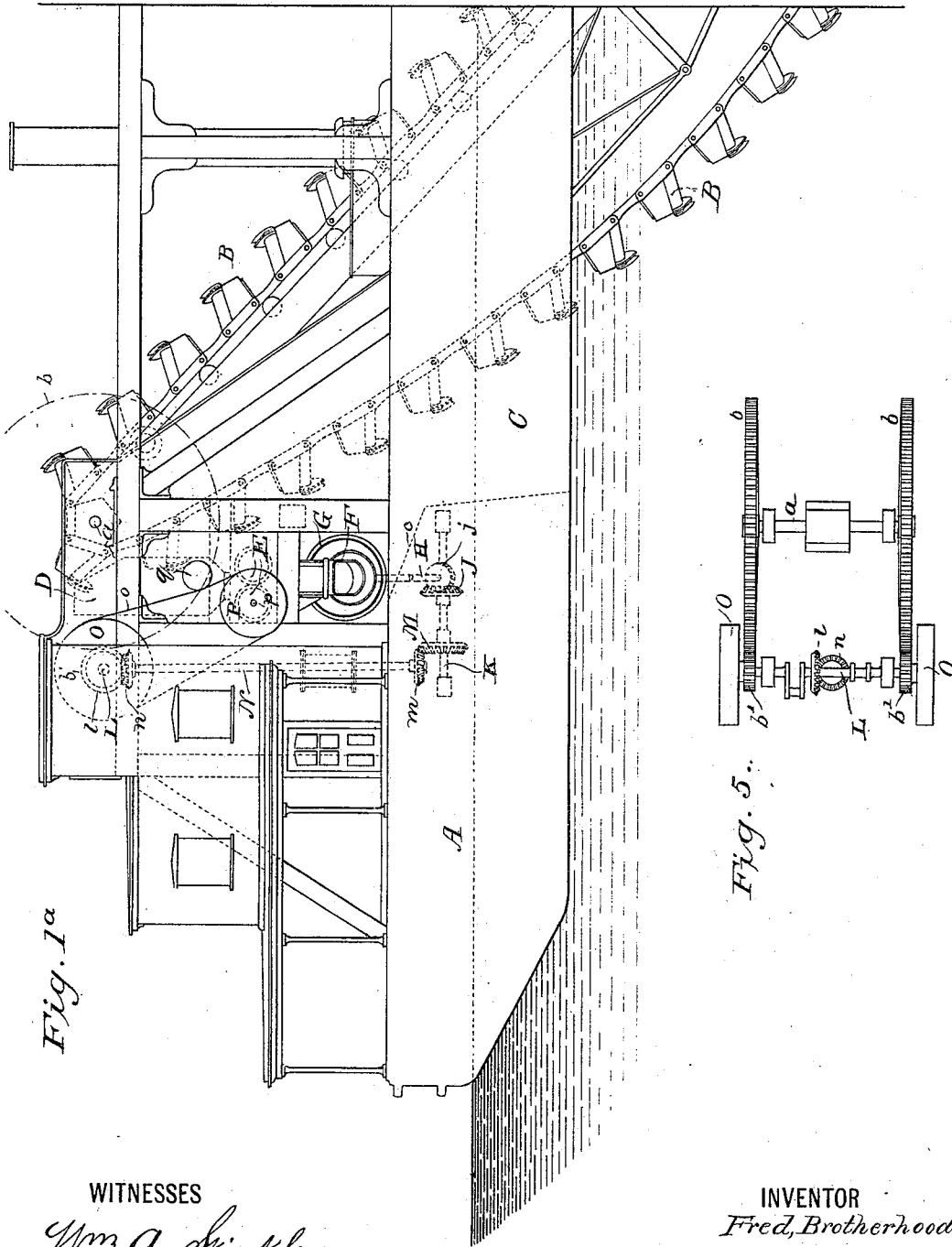


Fig. 1a

Fig. 5.

WITNESSES

*Wm A. Sinkle*  
*Al. C. Newman*

INVENTOR

*Fred. Brotherhood*

By his Attorneys

*Walden, Hopkins & Peyton*

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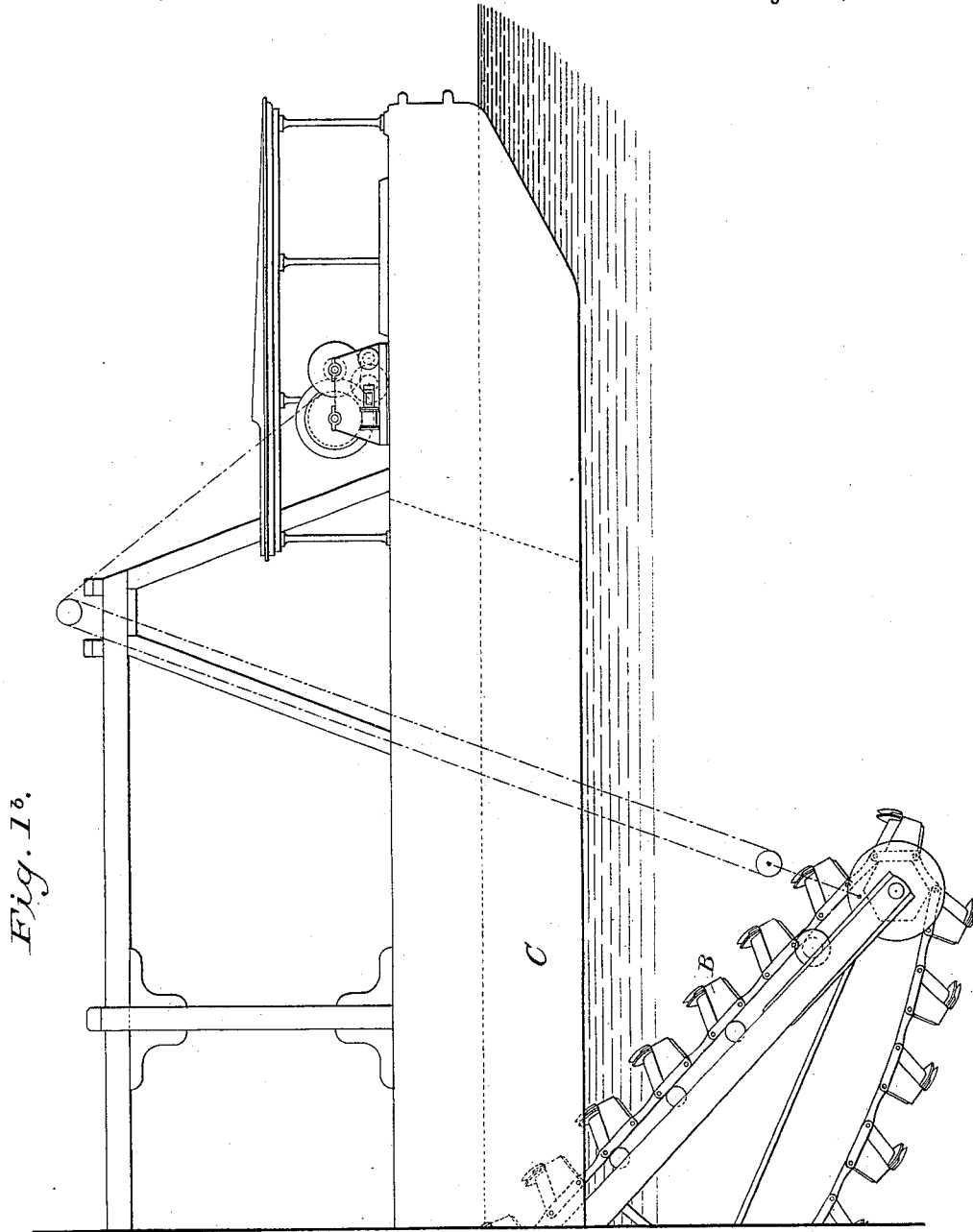


Fig. 1.

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(No Model.)

4 Sheets—Sheet 3.

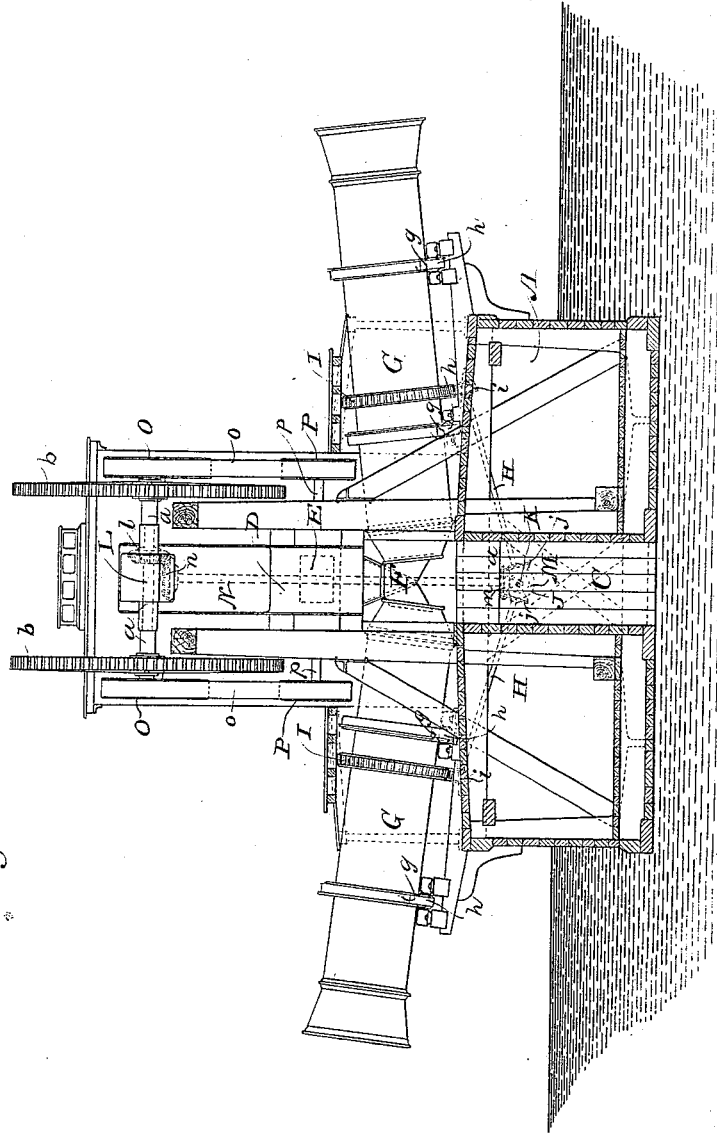
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Fig. 2.



WITNESSES

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APPARATUS FOR DREDGING, CRUSHING, AND WASHING PHOSPHATE ROCK.

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Fig. 4.

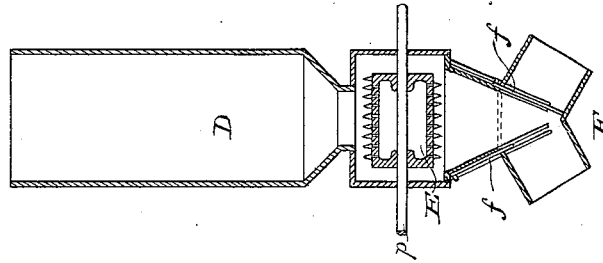
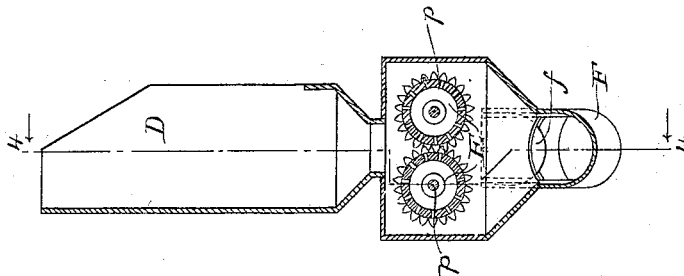


Fig. 3.



WITNESSES

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# UNITED STATES PATENT OFFICE.

FRED BROTHERHOOD, OF CHARLESTON, SOUTH CAROLINA.

APPARATUS FOR DREDGING, CRUSHING, AND WASHING PHOSPHATE-ROCK.

SPECIFICATION forming part of Letters Patent No. 298,443, dated May 13, 1884.

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

*To all whom it may concern:*

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

My object is to provide apparatus by which phosphate-rock and analogous materials may be dredged, (excavated from beneath water and elevated,) crushed, and washed, with considerable economy in time, labor, and expense, as compared with the means heretofore usually employed for this purpose.

It has been customary in securing phosphate-rock to provide a vessel or hull for the dredging apparatus and another for the crushing and washing apparatus, thus requiring, in addition to the cost of the second hull and its extra mechanism and attendants, the further cost of handling the material in delivering it from the first to the second hull. Now, in accordance with my invention, I dispense with the second hull, by providing upon one hull (the dredger-hull) all the mechanism required to secure the material, deliver it to the crushing apparatus, crush it, deliver it to washing apparatus, wash it, and deliver it into scows or lighters at the side or sides of the dredger.

The novel organization of mechanism constituting my improvements—hereinafter particularly designated by the claim—is sufficiently shown in the accompanying drawings, in which—

Figure 1<sup>a</sup> is a side elevation of a portion of the apparatus. Fig. 1<sup>b</sup> is a similar view of the remainder of the apparatus. Fig. 2 is a view partly in front elevation and partly in section. Fig. 3 is a detailed sectional view of the crusher, the conveyer by which the material passes thereto, and the discharge-conveyer by which the material is directed to the washers; and Fig. 4 shows the same devices in section on the line 4 4 of Fig. 3. Fig. 5 is a plan view, showing details of the connections between the engine-shaft and mechanism actuated thereby.

The vessel or hull A and its dredging appliances (the endless chain of buckets B, &c., by which to excavate and elevate the material) are of any suitable and well-known con-

struction, preferably such, as regards general features, as set forth in United States Letters Patent No. 285,565, granted to me September 25, 1883, the chain or dredging buckets being driven by connection with the engine-shaft, consisting of gears *b b* on the bucket-driving shaft *a*, actuated by pinions *b' b'* on the engine-shaft. The bucket-well or longitudinal channel-way C (represented in Figs. 1<sup>a</sup> and 1<sup>b</sup> by dotted lines) in the hull is extended by means of the incline *c* at rear, so that the refuse material discharged from the washing apparatus is directed into it without interfering with the preferred location of the devices for imparting motion to the washing-cylinders, as soon to be explained. The material, as excavated and elevated by the buckets, is delivered to a suitable conveyer, (shown as formed by a vertical chute, D,) by which it passes to crushing-rolls E, where the larger pieces of rock are reduced to proper size for washing; and from the crusher the material passes by way of a forked conveyer or channel, F, to the lower ends of the inclined cylinders G G of the washing apparatus. Instead of the upright conveyer D, an inclined conveyer may be employed by modifying the arrangement shown, and thus better opportunity may be given for readily removing foreign substances—such as marl, &c.—from the phosphate-rock on the way to the crushers. Cut-offs (shown as formed by sliding gates *f f*) operated in suitable way, by hand or otherwise, provide for controlling the feed of the material, so that it may be directed from the crusher to either one or both of the washing-cylinders at will. The details of construction of these washers may be considerably varied, and full description of them is not required here. I prefer, however, to employ washers such as shown and described and claimed in an application for Letters Patent of the United States filed by me simultaneously herewith.

The washing-cylinders, which are not here-in claimed, as shown are supported by means of wheels or rings *g g* upon rollers *h h*, and are rotated by connection with the engine-shaft L in the following way: Bevel-gears I I, formed by rings secured about the cylinders, are actuated by bevel-pinions *i i*, secured to inclined shafts H H, which shafts are rotated

by means of bevel-gears *j j*, meshing with a similar gear, *J*, upon a shaft, *K*, actuated from the engine crank-shaft *L* by means of a bevel-gear, *M*, on said shaft *K*, driven by a pinion, *m*, on the lower end of a shaft, *N*, having a pinion, *n*, at its upper end gearing with a pinion, *l*, on the shaft *L*.

The crushing-rolls are shown as driven by belt-and-pulley connections with the engine-shaft, fixed upon the ends of which are pulleys *O O*, from which bands *o o* pass to pulleys *P P*, fixed upon the ends of the shafts *p p* of the rolls. Suitable spring-actuated band-tightening pulleys are employed in connection with the bands *o*. One of these tightening-pulleys is indicated at *g*, Fig. 1<sup>a</sup>. In this way, in event of the clogging of the crusher, the yielding of the tightening-pulleys permits the bands to slacken, so that the crushing-rolls may stop to avoid injury to parts, as will readily be understood.

From the above description it will be seen that phosphate-rock, as elevated by the dredge-buckets and delivered to the conveyer *D*, passes first to the crusher and then to the forked conveyer, by which it is delivered to one or to both of the washing-cylinders, up and along which the material is forced in well-known way, while streams of water, directed into the cylinders at their outer or upper ends, carry down toward the lower end of the cylinders the mud, sand, &c., and discharge this refuse into the channel *C* at the inclined upper rear

end, *c*, thereof. The crushed and washed material is discharged from the outer ends of the washing-cylinders into suitable scows or lighters at the sides of the dredging-vessel, thus leaving nothing to be done, except to carry the material to the ordinary drying apparatus and evaporate the surplus moisture, preparatory to subjecting the material to the usual treatment, by which sulphuric acid is obtained from it.

I claim as of my own invention—

The combination of the endless chain of dredging-buckets, the driving-shaft thereof, the engine-shaft, the gears on said driving-shaft actuated by pinions on the engine-shaft, the crushing-rolls, the conveyer by which the material as excavated and elevated is delivered to said rolls, the belt-and-pulley connections between the crushing-rolls and the engine-shaft, the washing-cylinders, the gearing by which they are connected with and driven from the engine-shaft, and the conveyer by which the material is directed from the crushing-rolls to the washing-cylinders, all 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:

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EUGENE V. BROWN.