G. L. DAVISON.

APPARATUS FOR WASHING PHOSPHATE ROCK.

APPLICATION FILED JULY 18, 1913.

1,140,962.

Patented May 25, 1915.

2 SHEETS—SHEET 1.

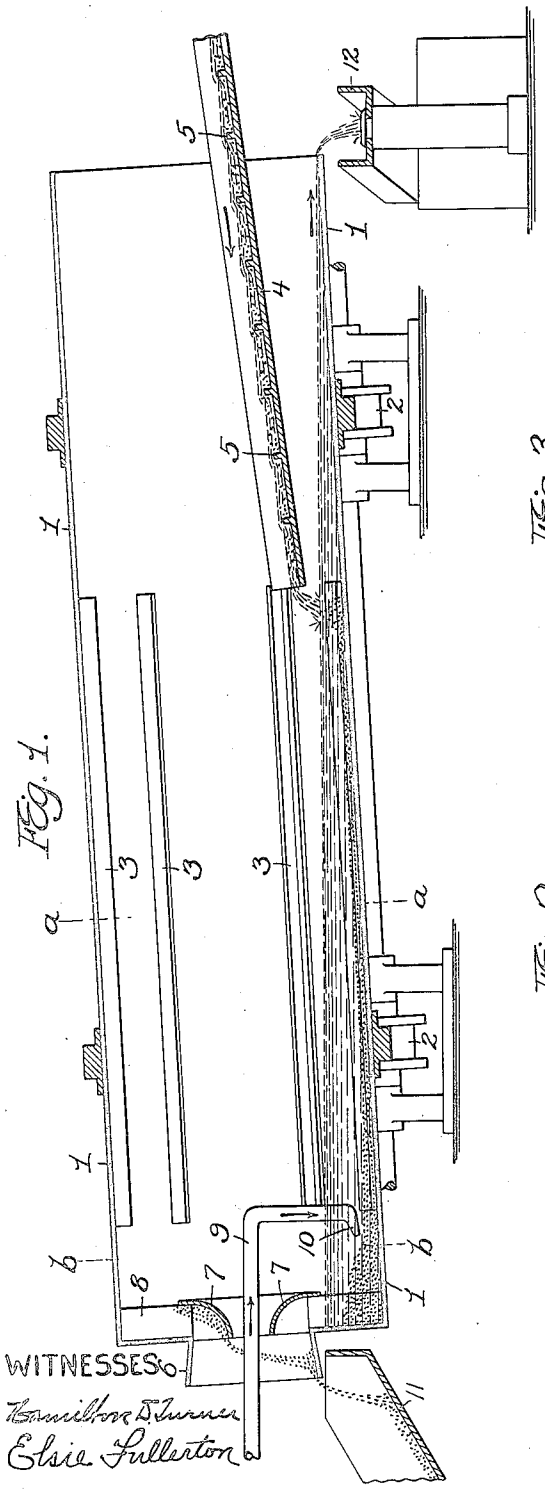


Fig. 1.

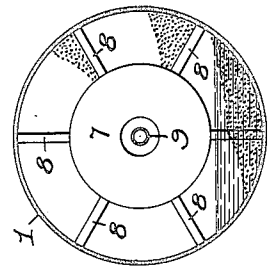


Fig. 3.

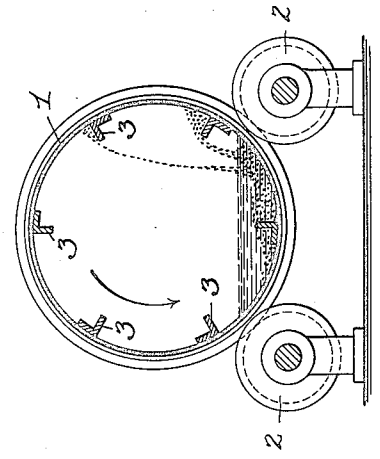


Fig. 2.

WITNESSES

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Fig. 4.

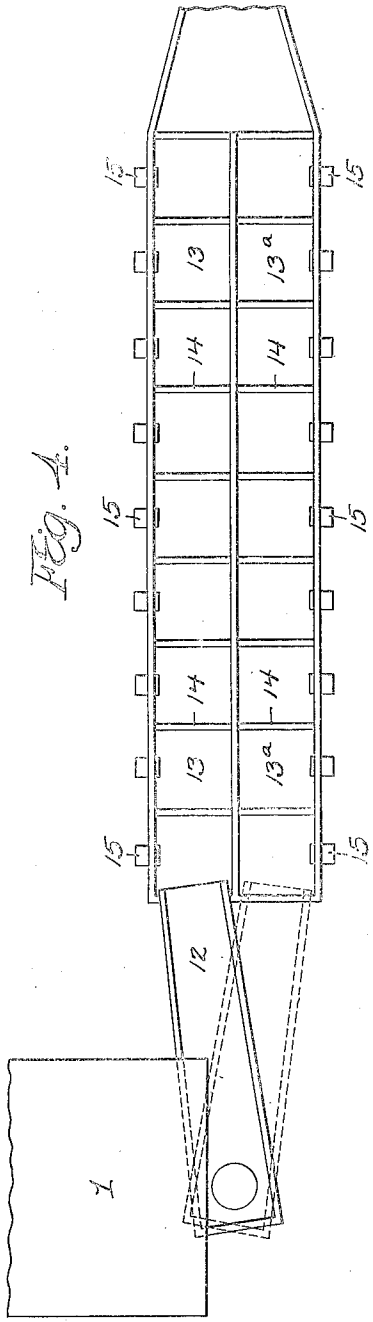
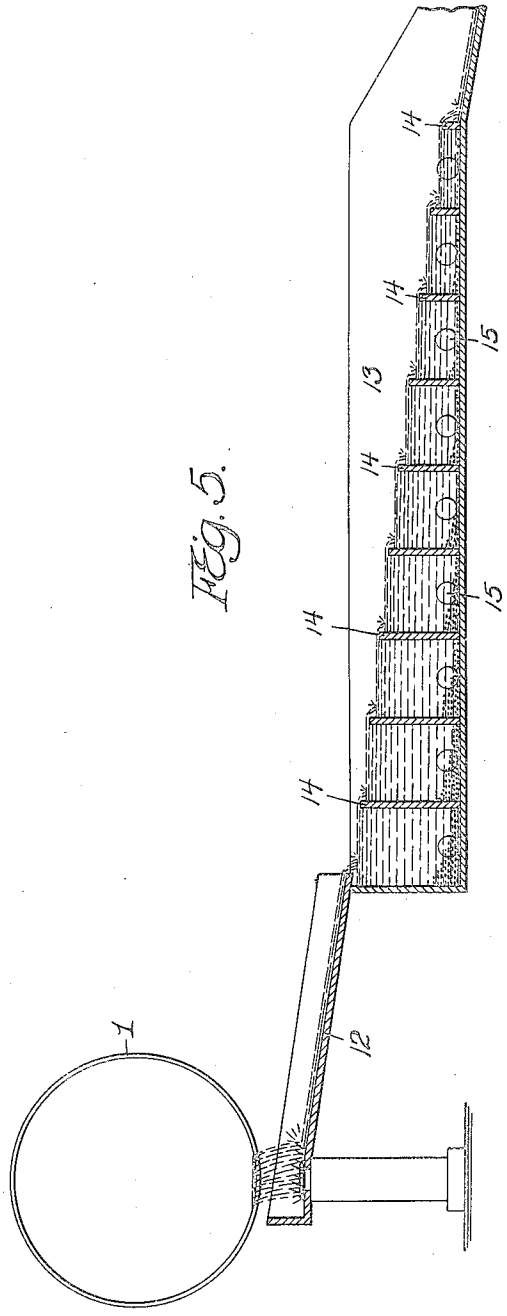


Fig. 5.



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GEORGE L. DAVISON, OF MOUNTPLEASANT, TENNESSEE, ASSIGNOR TO RUHM PHOSPHATE MINING COMPANY, OF MOUNTPLEASANT, TENNESSEE, A CORPORATION OF TENNESSEE.

APPARATUS FOR WASHING PHOSPHATE-ROCK.

1,140,962. Specification of Letters Patent. Patented May 25, 1915.

Application filed July 18, 1913. Serial No. 779,794.

To all whom it may concern:

Be it known that I, GEORGE L. DAVISON, a citizen of the United States, residing in Mountpleasant, Tennessee, have invented certain Improvements in Apparatus for Washing Phosphate-Rock, of which the following is a specification.

In preparing Tennessee phosphate rock for the market much of it must, after mining, be put through a washing process to separate it from the clay and other earthy impurities with which it is usually associated. After the clay and earthy impurities have been kneaded and tempered by means of a crusher, pug mill, log washer, or like device, it is necessary to separate the lumpy and granular particles of phosphate from the clay and other earthy impurities by a washing operation, and the object of my invention is to provide efficient means for the latter purpose.

In the accompanying drawings—Figure 1 is a longitudinal section of a cylindrical washer constructed in accordance with my invention; Fig. 2 is a transverse section of the same on the line *a*—*a*, Fig. 1, but omitting the mechanism at the lower end of the cylinder; Fig. 3 is a transverse section on the line *b*—*b*, Fig. 1, showing said mechanism; Fig. 4 is a plan view of a riffle box separator used in connection with the cylindrical washer, and Fig. 5 is a longitudinal section of the same.

Referring in the first instance to Figs. 1, 2 and 3 of the drawing, 1 represents a longitudinal cylinder of any available material and of any desired length and diameter, this cylinder being mounted in a slightly inclined position upon suitable supporting rollers 2 and being rotated in the direction of the arrow, Fig. 2, by any appropriate mechanism which it has not been deemed necessary to illustrate or describe.

The cylinder has a series of internally projecting lifters 3, preferably in the form of angle bars bolted to the inner wall of the cylinder, these angle bars being, preferably, discontinued some distance from the ends of the cylinder for a purpose hereinafter explained.

Projecting into the upper end of the cylinder is a feed trough 4 the bottom of which may be provided with riffles 5, if desired, although this is not essential. The lower end of the cylinder has a central opening surrounded by an outwardly projecting discharge flange 6 and projecting into said central opening from the inside of the cylinder is an annular deflector 7 with radiating ribs 8 projecting therefrom to the inner wall of the cylinder, and, by preference, bearing upon the lower end of the cylinder, as shown in Figs. 1 and 3. Projecting inwardly through the central opening of the annular deflector 7 is a pipe 9 downwardly bent at its inner end and terminating in a nozzle 10 which discharges toward the lower end of the cylinder. A trough 11 receives the material discharged from the flanged outlet 6 at the lower end of the cylinder and conveys the same to any suitable point of discharge. The upper end of the cylinder discharges into the upper end of a trough 12 centrally pivoted at said upper end so that its lower end can be swung into line with either of two sets of longitudinal riffle boxes 13 and 13ª (Fig. 4) each consisting of a box open at the top and at one end and having at suitable intervals transverse riffles 14 so as to provide progressively decreasing height, as shown in Fig. 5, or, if of the same height, the riffle box being suitably inclined so that each receiving chamber will discharge into the chamber in advance.

Near the lower end of each receiving chamber the side of the box has an opening, normally closed by a plug 15, so that material accumulating in the receiving chambers of either box can be readily removed therefrom, as by washing it, through the openings in the side of the box when the plugs 15 are withdrawn from said openings.

The operation of the apparatus is as follows: The mixture of various sized granular particles of phosphate rock with clay or other earthy impurities is fed into the cylinder 1 over the trough 5 preferably by means of a stream of water which discharges onto the bottom of the cylinder carrying the phosphate rock and impurities with it.

The water supplied by the trough 5 and by the pipe 9, as hereinafter described, soon establishes and thereafter constantly maintains a fixed level of water in the lower portion of the cylinder, as shown in Fig. 1, and as the solid material passes down the inclined bottom of the cylinder toward the lower end thereof it is subjected to the constant action of the lifters 3 and is thereby alternately raised from and thrown back into

the water, thereby washing the adhering bodies of clay or earthy matter from the particles of phosphate rock, so that, by the time the latter reach the lower end of the cylinder, they are reasonably free from such impurities. In order, however, to complete the washing operation the mass at the lower end of the cylinder is subjected to the action of a jet or jets of clean water from the nozzle 10 of the pipe 9 which is in communication with any available supply of such clean water under pressure. The thoroughly cleaned particles of phosphate rock are delivered from the lower end of the cylinder into the directing trough 11, the particles being first raised from the mass in the bottom of the cylinder by the blades 8 and then directed by the latter into the annular deflector 7 which discharges them into the flanged outlet 6, the latter in turn delivering them into the trough 11, as shown in Fig. 1.

The constant inflow of water into the cylinder causes a current or flow toward the upper end of the cylinder and this flow carries with it the clay or earthy matter which has been washed from the phosphate rock and also the smaller and lighter particles of rock and sand, and in order to recover the latter the discharge from the upper end of the cylinder is directed by the trough 12 into the first chamber of one or other of the riffle boxes 13—13ª, said chamber, when it becomes filled with water, overflowing into the next chamber ahead of it, and so on throughout the series of chambers.

The body of water in the receiving chambers of the riffle box carries with it, in its flow from chamber to chamber, only the mud and lighter impurities contained in it, the particles of phosphate rock or sand settling in the lower portion of each chamber, as shown in Fig. 5. When a sufficient amount has accumulated in either riffle box the directing trough 12 may be swung over so as to direct the discharge from the cylinder 1 into the other riffle box and the plugs 15 of the loaded box may then be removed and the contents of the receiving chambers of said box washed therefrom into a collecting basin or other suitable receptacle from which the water is subsequently drawn off. By discontinuing the lifter ribs 3 short of the lower end of the cylinder the mass of material is permitted to accumulate in said lower end in position to be readily acted upon by the jet or jets from a nozzle 10, and by discontinuing the ribs at and near the upper end of the cylinder I prevent agitation of the body of water at that point, such as would tend to prevent the flow of water toward the upper end of said cylinder and the carrying of the lighter impurities with it for discharge from said upper end.

I claim:

1. The combination, in a phosphate rock washer, of an inclined cylinder having a central discharge at its lower end, means for feeding the material to be washed into the upper portion of said cylinder, means for maintaining such a volume of water in the cylinder as will cause an overflow from the upper end of the same, lifting ribs on the inner wall of the cylinder for raising the material from the water and then dropping it back into the same as the material flows through the cylinder, the lifting ribs being discontinued some distance short of the lower end of the cylinder so as to provide a settling chamber at said lower end, means at the lower end of the cylinder for raising the material from the bottom of the same and discharging it through the central outlet, and a clean water pipe having a nozzle directed toward the material in said settling chamber and serving to discharge a jet of clean water directly into said material.

2. The combination, in a phosphate rock washer, of an inclined cylinder having a central discharge at its lower end, lifting ribs on the inner wall of the cylinder for raising the material and then dropping it back, said lifting ribs extending only part way throughout the length of the cylinder so as to provide at the upper end of said cylinder a zone of such extent that the bulk of water therein will be free from disturbance by the ribs, means at the lower end of the cylinder for raising the material from the bottom of the same and discharging it through the central outlet, and means for feeding to that portion of the cylinder which is provided with the lifting ribs the material to be washed together with water in volume sufficient to cause overflow from the upper end of the cylinder.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

GEORGE L. DAVISON.

Witnesses:
JNO. RUHM, Jr.
C. Y. CLARKE.