

(No Model.)

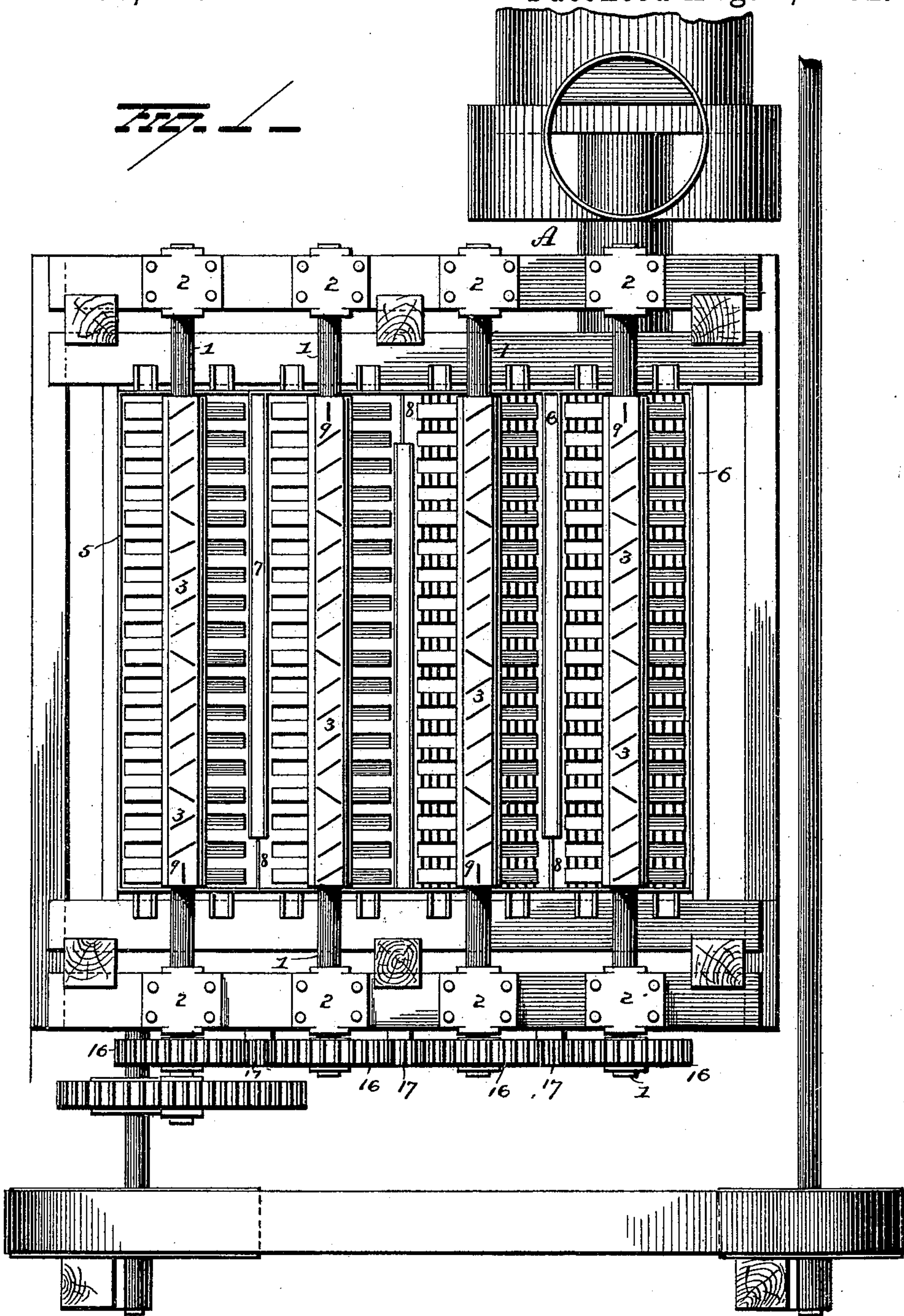
2 Sheets—Sheet 1.

S. HUGHES.

APPARATUS FOR REMOVING IRON AND ALUMINA.

No. 479,882.

Patented Aug. 2, 1892.



Witnesses
E. J. Nottingham
G. F. Downing

Inventor
Samuel Hughes
By *H. A. Seymour*
Attorney

(No Model.)

2 Sheets—Sheet 2.

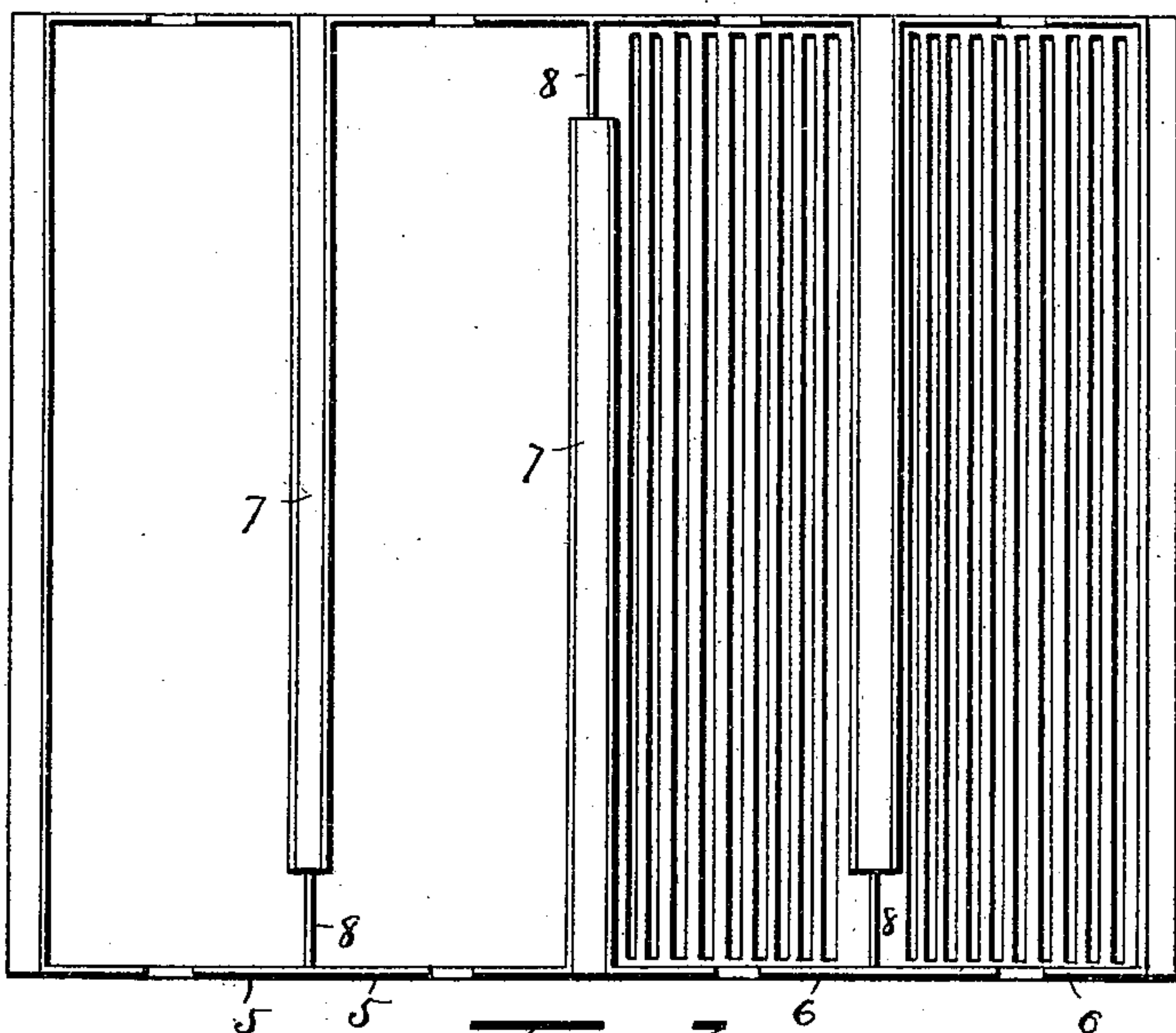
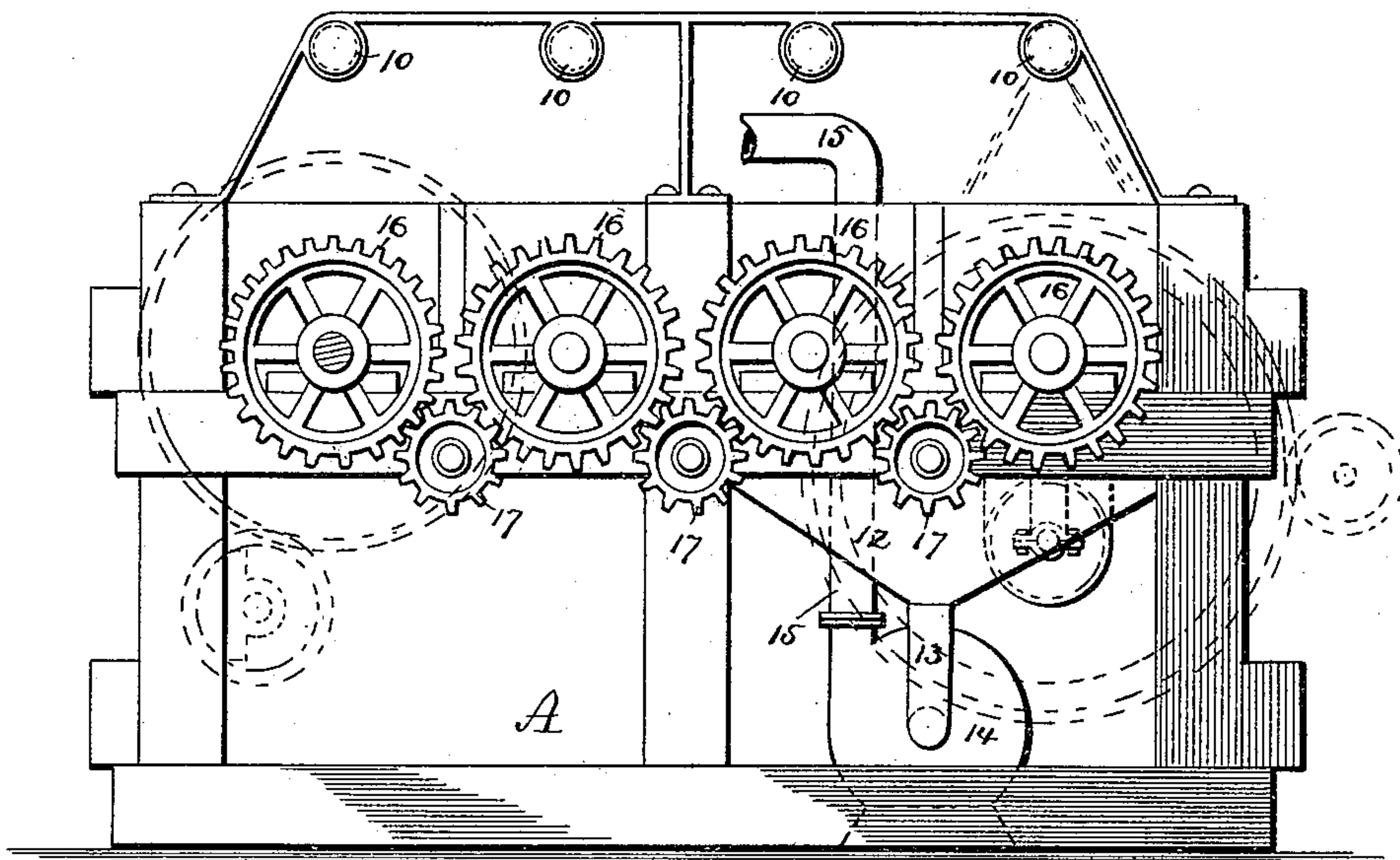
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FIG. 2.



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UNITED STATES PATENT OFFICE.

SAMUEL HUGHES, OF CHARLESTON, SOUTH CAROLINA, ASSIGNOR OF ONE-HALF TO WILLIAM B. CHISOLM, OF SAME PLACE.

APPARATUS FOR REMOVING IRON AND ALUMINA.

SPECIFICATION forming part of Letters Patent No. 479,882, dated August 2, 1892.

Application filed April 13, 1891. Serial No. 388,620. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL HUGHES, a resident of Charleston, in the county of Charleston and State of South Carolina, have invented certain new and useful Improvements in Apparatus for Removing Iron and Alumina; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in the apparatus for removing iron and alumina from phosphate rock and other phosphatic material. Heretofore screw-washers for this purpose have consisted of a single tub or troughs having a single screw therein for agitating the rock and feeding it through the tub or trough. To facilitate the operation and passage of water through the material during the process of washing, these tubs or troughs have been placed on an incline. The great objection to these washers has been that they were necessarily limited in length, because it has been found that a shaft more than twenty-six feet long cannot be used because its own weight would materially weaken and soon break it, and it is impossible to successfully support it at any points other than at the ends. This length is hardly sufficient to wash some qualities of rock and it requires too much time, too many machines, and consequently is much more expensive to pass the material all through twice or through two machines; also, such machines are long and cumbersome and require much room for their accommodation; also, from their construction it is impossible to vary the length of passage through which the material passes according to the amount of washing necessary.

It is the province of my invention to mechanically remove the coating or foreign matter found to exist on the surface of phosphate rock; and my invention consists in certain steps and procedure for doing this and in a series of communicating tubs or troughs, in combination with toothed shafts so arranged as to feed the material forward gradually and retard its motion sufficiently to produce a rubbing or grinding action upon the surface of the material undergoing treatment; and, further, it consists in means for supplying

water to the washer and in passing it through the same during the passage of the material through it, whereby the latter is pulped, cleaned, and scoured, and is thoroughly cleansed and rinsed during a single passage through the machine.

In the accompanying drawings, Figure 1 is a plan view of the washer complete. Fig. 2 is an end elevation, and Fig. 3 is a plan with the rollers removed.

A represents the frame of the washer. A series of shafts 1 1, preferably four in number and eight-sided, are journaled in suitable boxes 2 2 in the frame. These shafts extend parallel with one another and are provided on their several faces with the flat obliquely-set agitating teeth or stirrers 3 3. These teeth are for the most part set in the same direction, in order to force the material placed in the washer forward through the machine; but in addition to this it is of the utmost importance, to give the required scrubbing and grinding effect, that the rock should be given a slight backward motion as well as a forward motion. This is accomplished by the employment of the required number of backing teeth. By so doing the material is suddenly retarded when it strikes these backing teeth, thus causing it to rub back and forth against the forwardly-moving material, and by this frictional contact of rock against rock and teeth against rock to gradually scrub and wear away the alumina and iron from the surface of the rock. As previously mentioned, this has been accomplished by conveying the material through one long tub or trough; but this has been impracticable, and in order to make a more compact and rigid machine and take less space and otherwise add to its efficiency by making it possible to shorten or lengthen the passage as much as desired, I attain the required length of passage to thoroughly clean and scour the rock by shortening the troughs and employing the required number to make up the required length and arranging them to communicate with each other. Hence the four shafts alluded to are used, and corresponding in number with these shafts are the tubs or troughs 5 5 and 6 6. These are separated by partitions 7 7, and in these partitions openings 8 8 are formed alternately

at opposite ends, so that the material passes in one direction through one trough and back in the opposite direction through the next, and so on, wide paddles 9 9 being secured to the shaft at points opposite the openings to assist in forcing the material through the openings into the next tub or trough. Over each trough a water-pipe 10 extends, and these pipes are perforated on their lower sides to discharge water into the troughs. The troughs 5 5 have closed bottoms and the other two 6 6 have grated bottoms. The material as mined or excavated is placed in outer tub or trough 5, the water about half filling the latter, and in the two troughs 5 5 the material and water is thoroughly stirred, the water remaining with it and washing and soaking the soft material from the hard, and also removing such of the material as is liberated by the combined grinding and scrubbing action from the surface of the rock. As soon, however, as the trough having the grating bottoms are reached the water and débris pass out into a receptacle 12 below and the water discharging from the perforated pipes above passes through the mass, thus having a rinsing effect and carrying off with it not only the débris which has been carried through the washer to that point, but in addition such foreign substance as may be removed at the later stages of the passage through the washer. Finally the material is discharged through an opening for the purpose at the rear end or at the side of the last tub or trough through which the material is conducted. The water and débris discharges directly into a pipe 13, leading into a pump 14, so that instead of locating the washer to a considerable height, as is generally customary in order to allow the débris to flow off, it is only necessary to raise it high enough or sink the pump low enough to allow the water to flow freely into it, a suitable pipe being provided to remove the débris from the pump.

To recapitulate briefly, it may be stated that in a machine thus constructed with washing-compartments arranged in a horizontal plane there is no lost space, and the parts, instead of being built high and disconnected, are made compact, thereby economizing space and making all parts accessible, and also reducing the outlay of material in the construction of the machines. Heretofore communicating troughs for this purpose have been arranged one above another, each being on an incline; but thus constructed the machine is necessarily high and the space between the troughs is wasted. On the contrary, in my invention the troughs are all arranged side by side in a horizontal plane and a débris-pump

is located beneath them, so that the débris from the troughs empties directly into it, thus economizing a large amount of power hitherto expended in raising the débris first from a well into which it had been emptied from the machine and then to the place where it is to be discharged.

Suitable gearing, comprising the large gear-wheels 16 16 on each shaft, is provided in connection with the intermediate gear-wheels 17 17, so as to drive the several wheels in the same direction.

Other gearing could be used, though any suitable means can be employed for driving the machine, and hence I do not care to limit myself to the exact mechanism set forth; but,

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a washer, of a débris-pump so located and arranged that the débris from the washer flows into it, substantially as set forth.

2. The combination, with a series of communicating compartments and rotary shafts therein, of a débris-pump into which the débris from the compartments flows, substantially as set forth.

3. In a washer, the combination, with a series of troughs, a part of which have closed bottoms and a part grated bottoms, of toothed shafts revolubly supported and adapted to operate in the troughs, means for supplying water to the several troughs, and a débris-pump into which the water passing through the grate is discharged, substantially as set forth.

4. In a washer, the combination, with a set of communicating compartments, a part of which have open-work bottoms, the alternate compartments communicating through corresponding ends, so that the material has a continuous passage from one end of the washer to the other, of rotary shafts located in said compartments and means for communicating motion to said shafts, substantially as set forth.

5. The combination, with suitable troughs having grated bottoms, rotary shafts, and means for discharging the débris from the troughs, of a débris-pump and means for conducting the débris from the washer into the pump, substantially as set forth.

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

SAMUEL HUGHES.

Witnesses:

W. F. TAYLOR,
V. E. HODGES.