No. 648,055. Patented Apr. 24, 1900.

W. D. REYNOLDS.

WATER WHEEL.

(Application filed Dec. 27, 1898.)

(No Model.) 2 Sheets—Sheet 1.

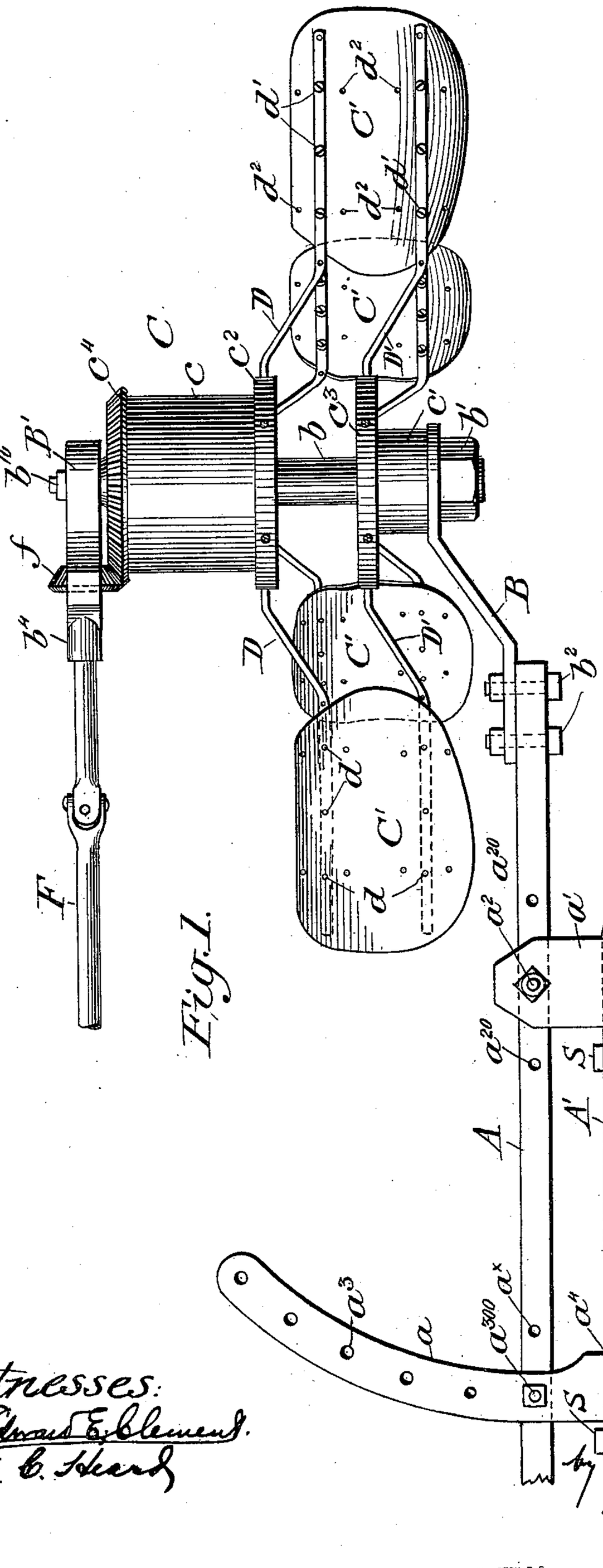
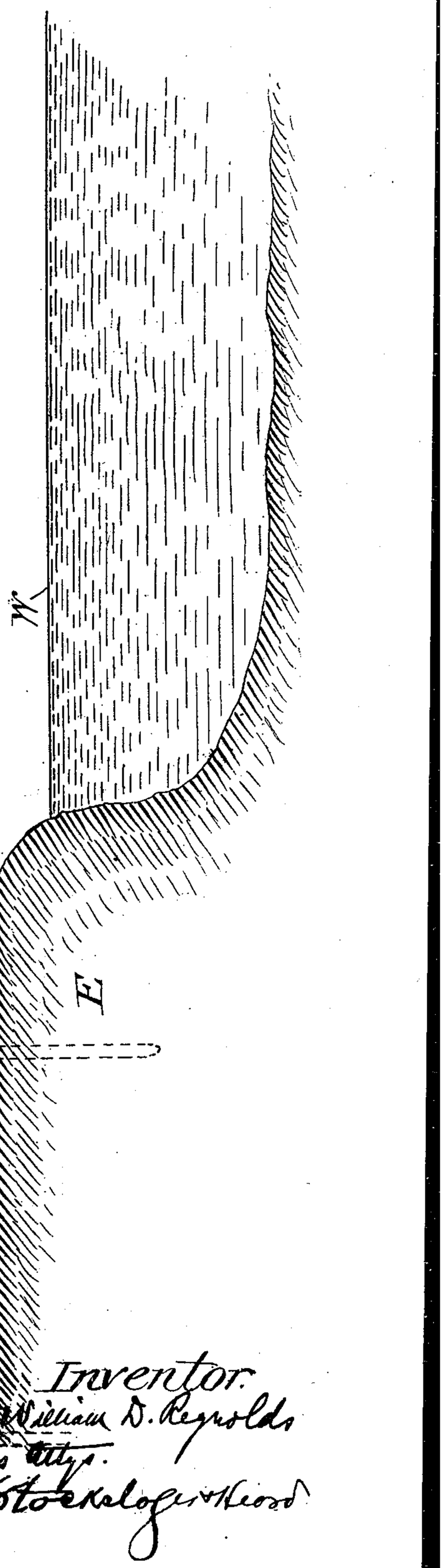


Fig. 1.



Witnesses:
Edward E. Clement.
A. B. Heard

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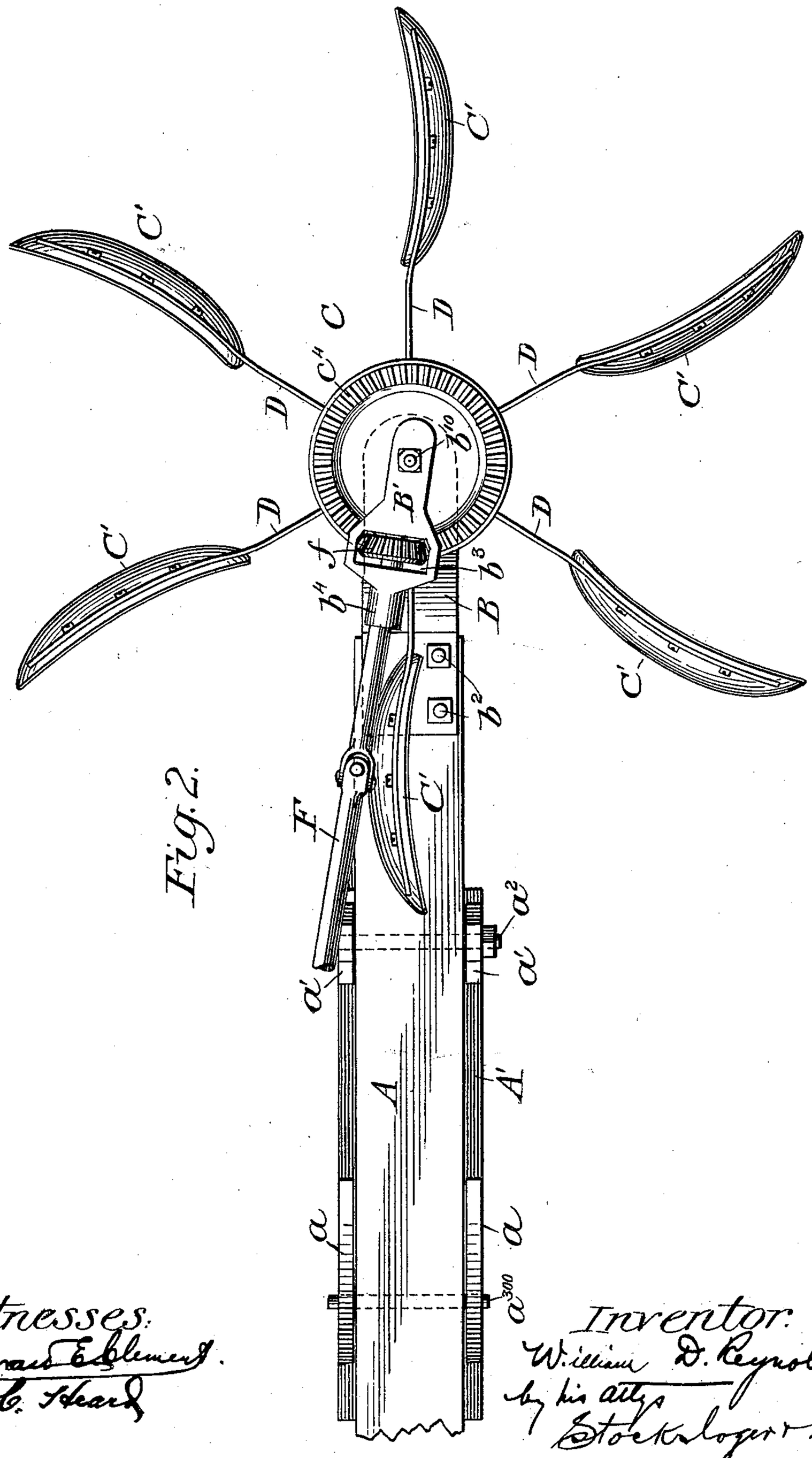
Fig. 2.



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UNITED STATES PATENT OFFICE.

WILLIAM D. REYNOLDS, OF MOUNTAIN HOME, IDAHO, ASSIGNOR OF ONE-HALF TO WILLIAM F. SMITH, OF SAME PLACE.

WATER-WHEEL.

SPECIFICATION forming part of Letters Patent No. 648,055, dated April 24, 1900.

Application filed December 27, 1898. Serial No. 700,309. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM D. REYNOLDS, a citizen of the United States, residing in Mountain Home, Idaho, have invented an Improvement in Water-Wheels, of which the following is a specification.

My invention relates to water-wheels, and has for its object the production of a motor-wheel that will be light and easily transported and yet of high efficiency in proportion to its weight and size. In addition it is designed to have no superfluous parts, to be readily set up and used where elaborate foundations and fittings are not obtainable, and to be very readily repaired if accidentally damaged.

A service in which my new motor-wheel is of particular value is in deriving power from streams or falls in wild or sparsely-settled country in the woods and mountains of the northwest and in regions where it would be next to impossible to transport cumbrous and complicated apparatus—such as turbines with their piping, valves, shafting, &c.—and where it would not pay to invest the capital required even if transportation were easy. Of course this is not to mean that the motor is not of wide use in all fields where water rights are running to waste and where power for field work, mining, machinery, &c., is required. It is a fact, however, that the points of design above enumerated bid fair to make the wheel indispensable in certain fields, while useful everywhere.

Speaking generally, in order to attain my ends I use a tilting frame and a side-immersion wheel journaled on a vertical shaft carried by the frame, so that if the frame be located at any convenient spot on the bank the wheel may be raised or lowered by simply tilting the frame, the variation in depth of immersion of the paddles serving to determine the exact power developed. I believe this specific arrangement to be original with me, although I am aware that horizontal "current-wheels" have been used and that oblique immersion is very old. I am also aware that ordinary undershot wheels have been mounted heretofore on tilting frames; but the combination I shall set out is more than any of these, and none of them can obtain by their construction the results I have produced.

The vertical or substantially-vertical journals and shaft-bearings of my wheel permit the use of ball-bearings. Heretofore, in heavy work particularly or where the power transmitted was considerable, the wear from the direct weight on the bearings and the initial strain were such as to forbid the use of balls for the reason that only a few balls in the upper side of the bearing received the entire strain at a given moment, frequently breaking and splintering as a result thereof, then grinding out the bearing-surfaces and jamming, and consequently crushing, the other balls, thus completely ruining the bearings and rendering inoperative an entire machine. By my arrangement the weight of the wheel is balanced and distributed over all the balls in the bearings, and each takes a portion of the thrust due to the water impact on the blades, a factor of safety being thus introduced that insures the long life of the balls and the consequent safe use of the entire wheel out of reach of repair-shops.

Other advantages will become apparent as I proceed with the detailed description.

My invention is fully illustrated in the accompanying drawings, in which the same letters of reference point out the same parts throughout.

Referring to the drawings, Figure 1 is a side view of my motor-wheel as mounted ready for use, but not yet immersed, the line of the bank and the water-line being indicated in a conventional manner. Fig. 2 is a plan view.

In Fig. 1, E indicates a bank, and W the surface, of a moving stream. The stream for the proper utilization of my invention may be any moving body of water from an ocean-current to a mill-race. The bank, which is here represented in a conventional manner only, may be natural, of earth or rocks, or it may be artificial, such as a suitable stone pier or abutment or a wooden structure. The rate of flow for the current in the stream is

immaterial so far as successful operation of the motor goes, greater velocity producing no added strains and being offset for purposes of regulation by regulating the depth of immersion of the blades or paddles.

Supported upon the bank and fastened securely thereto is a bed-plate A′. I secure this bed-plate in various ways, according to the nature of the bank. In the present case I have shown it for the purposes of illustration as held down by spikes S. In the case of an earthen bank the spikes would be driven into posts sunk in the ground, and in the case of a rocky bank iron bands or bolts secured in leaded sockets are used. I do not limit myself, however, to any particular method of fastening, as the circumstances of the particular case will always determine the means to be used.

Secured to the bed-plate A′ are supporting-posts a', adapted to receive at their upper ends a transverse bolt a^2, upon which is journaled a tilting bar or lever A, which thus moves in the plane of the bed-plate axis. This tilting bar is of sufficient length to extend out a considerable distance over the stream, and it also extends inwardly over the bed-plate to a sufficient distance to give a good leverage for raising and lowering the weight of the wheel.

Secured to and extending upwardly from the bed-plate A′ are a pair of arcs $a\,a$, which lie upon opposite sides of the tilting lever A and whose center of curvature is in the axis of the bolt a^2. These arcs are provided with perforations a^3, corresponding to perforations in the lever A. A pin or bolt a^{300} is adapted to be inserted through any of the perforations a^3 in order to retain the lever in any angle of position to which it has been set. In order that the lever may be moved longitudinally as well as angularly when desired to move the wheel in or out over the water, I provide the lever A with additional perforations a^{20} to take the bolt a^2 and $a^{\times}$ to take the bolt a^{300}.

Securely attached to the outer end of the tilting lever A, as by bolts and nuts b^2, is a bent metallic arm B. For the purpose of securing lightness this is usually made of a plate of metal with ribs struck up or cast thereon in order to stiffen it. There are several reasons for the employment of this metal arm. It will be observed that it has its outer end elevated a considerable distance above the surface of the tilting lever, thus allowing a clearance for the paddles of the wheel on their inward swing. It also reduces the number of parts necessary to be carried in transporting the wheel, as the tilting lever and the bed-plate can be hewn out of any timber available at the place of use. Rigidly secured to the outer and upper end of this metal arm B is a substantially-vertical shaft b, upon which the wheel proper is journaled. This is accomplished by means of the freely-revoluble hubs c and c', to which are rigidly secured the rings c^2 and c^3, which receive the inner ends (preferably screw-threaded) of the radial arms D and D′. The only connection between the hubs in the present construction is through the arms D D′, although, if desired, they may be connected together in any other suitable way. The radial arms may be solid or tubular; but in either case they are bent downwardly and their outer ends are flattened for a considerable distance and perforated, as at d, to receive screw-bolts d', by which are attached the spoons or blades C′ of the wheel C. These blades are concavo-convex or spoon-shaped, the concave side being always turned upstream. This insures a full utilization of the current and permits the blades to leave the water without backlash. In order that the blades may be adjusted upon the arms to any desired dip, I arrange them as follows: The arms being perforated, each with a row of holes, and the arms lying parallel to each other, corresponding rows of holes must be made in the blade to register with the perforations in the arms. I shall speak of these as "pairs of rows," because there are two arms and there must always be one row or set of holes for each arm. Now as there are three bolts shown in each arm in Fig. 1 I provide not only the perforations d for normal engagement, but additional holes or perforations d^2 d^2, in sets of three each, the middle one of each set being the same and the end holes being angularly displaced, so that the middle bolt in each arm D and D′ may be retained, while the other bolts are removed and the blade turned up or down on the arms, which spring slightly, as required, to permit the rotation around the two bolts. I shall refer to these rows of holes as "pairs of rows" angularly displaced from the normal. This is a very important feature where the wheel is to be used in turbulent streams.

Firmly secured upon the head of the shaft b, as by a nut b^{10}, is a horizontal arm B′, recessed at b^3 and carrying a journal-box b^4. Journaled in this box, which is preferably fitted with ball-bearings, is a shaft F, carrying upon its outer end a bevel-gear f, which lies within the recess b^3 and meshes with a similar but larger bevel-gear c^4, the latter being rigidly mounted concentrically with and upon the wheel-box c. The shaft F is the power-transmitting shaft and is carried inwardly, overlying the entire machine, to any desired distance. It is preferably provided with universal joints to permit of the necessary raising and lowering of the wheel.

The operation of my machine, as thus described, is as follows: Having fixed the bed-plate and mounted the machine, as shown in Fig. 1, the power-shaft F is connected up to the machinery that is to be driven. The pin a^{300} is then withdrawn and the tilting lever adjusted by raising its inner end until the outer blades C′ of the wheel enter the current. The wheel will immediately begin to revolve, and the amount of power is then determined by raising or lowering the same un-

til the proper depth of immersion is had. The pin a^{300} is then reinserted through the particular aperture a^3, to remain until it is desired again to raise the wheel.

In order to provide for reverse rotation of the wheel—that is, in order that the wheel may be operated upon a given bank, no matter which direction the current takes—it is only necessary to remove all the screw-bolts d' and secure the blades upon the reverse side of the arms D D'.

With this wheel when it is desired to pack and ship the parts it should be observed that only an inclosure of very small dimensions is required. The bolts b^2 are removed. The arm B is taken off the shaft. The shaft F and the blades C' are removed. The parts a' and a, with the spikes or other securing means S, are taken away from the bed-plate A'. The arms D and D' are unscrewed from the hubs, and the entire aggregation of parts may then be packed in a very small compass. The bed-plate and the tilting lever may be packed or not, according to circumstances.

There are a number of changes which may be made in the arrangement of the parts hereinbefore set forth and in the size and shapes of the various members without departing from the scope and purview of my invention. I wish it to be clearly understood that I contemplate including all such changes and rearrangements.

What I claim as my invention, and desire to secure by Letters Patent of the United States, is—

1. In a water-wheel or hydraulic motor, the combination of the following instrumentalities: a bed-plate or foundation in proximity to a stream, a tilting lever thereon, a bent plate or arm, having a raised extremity, secured to the outer end of the lever, a shaft secured to and upstanding from said plate or arm, hubs journaled on said shaft, radial arms secured to said hubs, and radial blades or paddles adjustably secured to said arms, substantially as described.

2. A portable water-wheel or hydraulic motor comprising the following instrumentalities: a bed-plate, side plates and guides detachably secured to said bed-plate, a tilting lever journaled between said side plates and adapted to oscillate between the guides, a metallic supporting-arm detachably secured to the outer end of said lever, a shaft upstanding from said arm, hubs journaled on said shaft, radial arms detachably secured in said hubs, and radial blades or paddles reversibly and detachably secured to said arms, whereby the entire structure may be knocked down and packed into a small compass, substantially as described.

3. In a water-wheel, a pair of hubs and radial arms extending out therefrom, in pairs; the ends of each pair of arms being substantially parallel and correspondingly perforated for the reception of a set of bolts, and blades of concavo-convex or spoon shape each provided with several rows of perforations, in pairs to correspond to the perforations in the radial arms, one double row of holes being arranged along the length of the blade, and the others on lines at angles thereto; so that whether the blade is applied to the arms straight or at an angle with its outer end up or down, some of the pairs of rows of perforations in the blade will be found to register with those in the arms, so as to secure it in position, substantially as described.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, this 8th day of December, A. D. 1898.

WILLIAM D. REYNOLDS.

Witnesses:
R. W. SMITH,
FRANK HOBBS.