(No Model.) 2 Sheets—Sheet 1.

J. HUMPHREY.

TURBINE WATER WHEEL.

No. 260,202. Patented June 27, 1882.

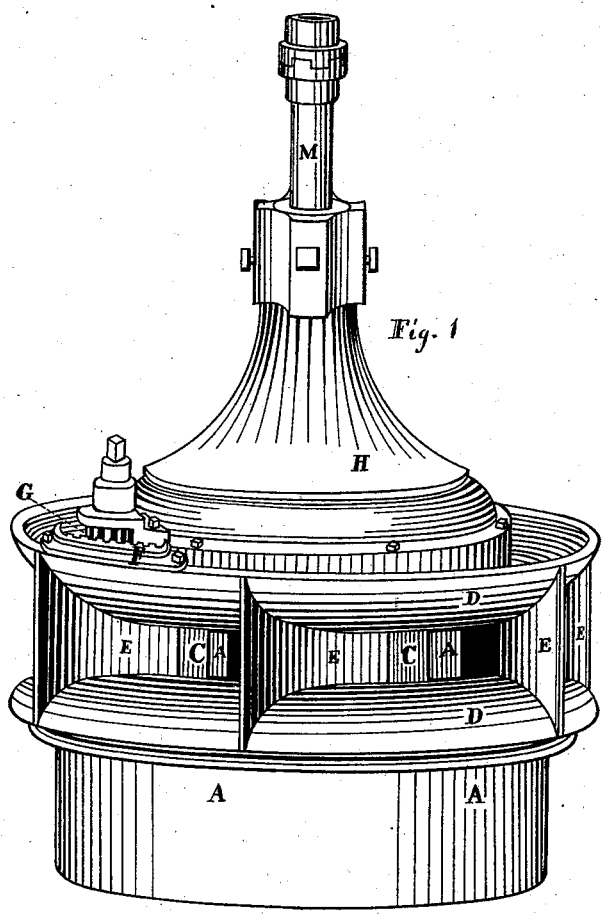

Fig. 1

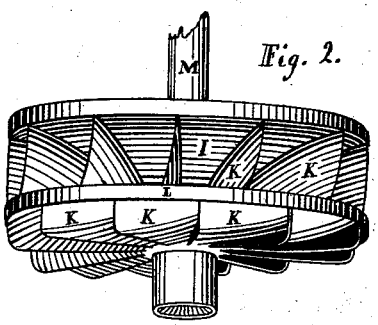

Fig. 2.

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Fig. 4.

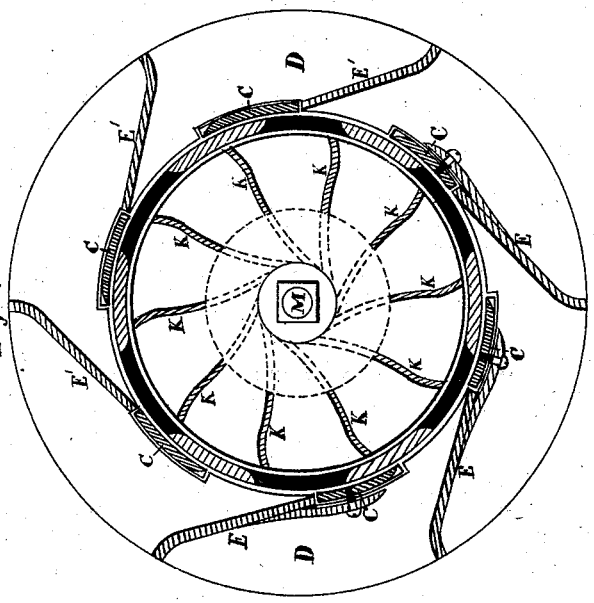
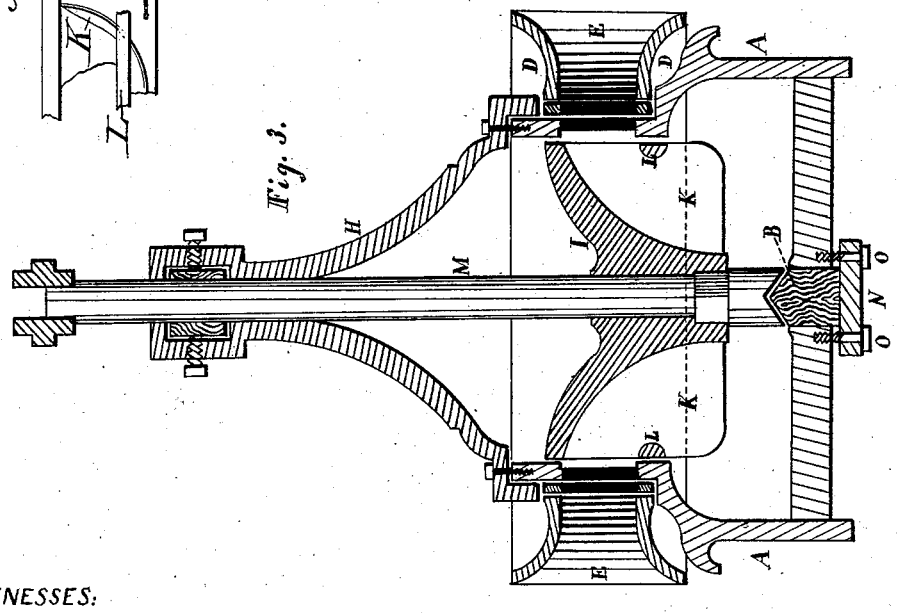


Fig. 5.

Fig. 3.



WITNESSES:

S. H. Brackett

M. A. Brackett

INVENTOR:

John Humphrey

UNITED STATES PATENT OFFICE.

JOHN HUMPHREY, OF KEENE, NEW HAMPSHIRE.

TURBINE WATER-WHEEL.

SPECIFICATION forming part of Letters Patent No. 260,202, dated June 27, 1882.

Application filed January 28, 1875.

To all whom it may concern:

Be it known that I, JOHN HUMPHREY, of Keene, county of Cheshire, State of New Hampshire, have invented a Turbine Water-Wheel, of which the following is a specification.

The object of my invention is to produce a simple, efficient, and economical hydraulic motor by a combination and arrangement of requisite appliances for regulating and directing the flow of water so as to impart its force for the propulsion of machinery, with improved facilities for adjustment and repair of its parts.

It consists, first, in the construction and arrangement of a series of guide-vanes set between annular rims or crowns with detached sliding gates, used with a cylindrical casing having alternate open and closed spaces, so as to form suitable chutes for directing and graduating the flow of water to a wheel, as more fully set forth in the claims; second, in the construction and arrangement of a curved disk or crown with a series of floats, to make a wheel which shall receive the impact of the water at its periphery and discharge the same from radial apertures extending from the hub of said disk or crown to and upon its periphery, so as to utilize the entire area of an outlet-casing or draft-tube of enlarged diameter for the exit of the inert water, as more fully set forth in the claims.

Figure 1 is a perspective view of the turbine complete. Fig. 2 is a perspective view of the wheel without casing. Fig. 3 is a vertical section through center. Fig. 4 is a plane section through chutes, gates, &c. Fig. 5 is a view to show the general conformation or curvature of the floats on a line near the periphery of the wheel as they extend downward from its disk or crown-plate.

A is a cylindrical casing, which incloses and supports other parts of the wheel. It has an external rim or flange to rest upon the floor of a flume or water-box, in which it may be used. Its lower portion, which serves as an outlet-casing or draft-tube, is larger in diameter than the upper, to make room for the outward discharge from the wheel and provide for the egress of the inert water at a greatly reduced velocity. The internal arms in same hold a step or pivot, B, for the wheel.

The upper part of A has a series of apertures for admitting water to the wheel. These apertures are provided with gates C C C, which slide upon the external surface of the casing, and are made to open and shut by a partial rotation of the chute-rim, which has chambers or cavities for the gates. These are made in separate or detached plates fitted loosely within the chamber, so that the water-pressure will keep them properly seated to prevent leakage, and yet allow either of them to yield a little, if necessary, to pass over any minor extraneous substance without disturbing the others, thus avoiding troubles incident to the ordinary circular or "solid-ring gate," which, if closely fitted, are easily clogged or obstructed by particles of sand, grass, leaves, &c.; or, if made to work easily, are subject to constant leakage. The loose gates, however, when used under considerable height of water may be subject to excessive pressure, requiring too much power to move them. They may be relieved by attachment to rigid parts of chute-rim, as represented in Fig. 4, in which a portion of the guide-vanes are shown with extensions overlapping the gates, with screws which pass through the rigid part and tap into the plates C C C, which may be made to counteract so much of the excessive pressure as may be desirable by transferring it to the chute-rim without drawing the gates entirely from their seats; or springs may be applied to counteract such part of the pressure as may be necessary to prevent their dragging too heavily. These appliances are not required with moderate falls, and the guide-vanes need not overlap the gates, but may be formed as represented at E′ E′ E′ in Fig. 4.

The chute-rim consists of two crowns or annular bands, D, between which a series of guide-vanes, E E, are set, whose inner surfaces are oblique to the gates and nearly tangential to the periphery of the wheel, so as to give proper direction to the water. These vanes correspond in number with the apertures, and may be reversed to change direction of water by inverting the chute-rim. The inner surface of the crowns of the chute-rim is made paraboliform to produce a proper contraction of the vein of water as it approaches the wheel.

The gate is opened by moving in the direction of the flowing water, uncovering the side

of the aperture next the guide-vanes first, which preserves a proper form of chute at any position, which is essential to obtain good results with the gate partially open.

The rotation of the chute-rim to open and close the gates may be effected by a rack and pinion, or by levers, and in other ways. The rack and pinion are simple and effective, and I have used them for this purpose applied as represented by F and G, the rack F being attached to the chute-rim D and the pinion G working on a rod or shaft with suitable hangings attached to the dome or cover H.

Projecting pieces attached at the ends of rack, for the pinion to strike against, provide an easy method of arresting the movement of the gates at their proper position in either direction.

The dome H forms a cap or cover for the wheel, and may have a suitable box or sleeve for the shaft to pass through. It may be attached to the top of the casing A by screws or tap-bolts.

The wheel, (or part which is put in motion by the water,) as represented by Fig. 2, consists of a curved disk or crown, I, a series of floats or vanes, K K K, and a band or rim, L, (which latter may or may not be used,) all of which may be constructed by casting in a single piece; or the floats and rims may be formed separately and joined together by any suitable means.

The disk I, which supports the floats and forms a connection with the shaft, is made with a suitable curvature to change the flow of the water from its inward direction to one that is downward or parallel with the axis of the wheel. The floats K K K, as they extend downward from the crown I to the rim L, have a slight inclination or curvature (from a perpendicular) toward the stream, and the upper portion of the floats, as they extend from the outside or point of impact toward the center, have a similar inclination from the radii of the wheel, so that the angle of reflection from the line of impact will at all times fall in an outward and upward direction, or against the approaching current, which tends to preserve its solidity and insures the greatest efficiency.

The curvature of the floats as they extend below the plane of the rim L is accelerated to correspond with the decreasing angular velocity (or whirling motion) of the water, as its power is imparted to the wheel until the floats are terminated at the points where the angular velocity and force of the water are expended and should be discharged. The degree of curvature and length of floats are varied to correspond with the velocity of each portion of the radius of the wheel, due regard being had to the length, curvature, and number of floats to provide suitable spaces between them for the discharge-apertures, the same being determined in accordance with the quantity and velocity of water to be applied. The outer portion of the float below the line of impact is made with a curvature to connect with the rim L, so that the inner surface of each will form a suitable path for the water, and the discharge-orifices are made to extend from the hub or central portion of the disk or crown I to and upon a portion of the periphery of the wheel, so that, in addition to the diametral area, a portion of the circumferential area of the wheel is rendered available for an outward discharge, which, with the enlarged outlet-casing before mentioned, allows the water to make its exit at a greatly reduced velocity, thereby combining the acknowledged excellence of the outward and parallel flow turbines in the disposal of the inert water, with the superior advantages of application peculiar alone to the outward-flow turbines.

The wheel is connected to the shaft M by a bored and turned fit or joint (which may be slightly tapering) through a portion of its hub. Another portion is made with an angular or irregular socket or chamber in the hub, which incloses and engages with a corresponding form on the shaft, so as to impart motion to it. This supersedes the necessity of keys or set-screws, and is less expensive, quite as efficient, and very much more convenient to put together and take apart.

The shaft M extends upward through the dome or cover H to connect with appropriate mechanism for the transmission of its power. Its lower end is made to run upon the step or pivot B, which, being immersed in water at times rily or foul with sand and other matter, is liable to become worn, so as to need adjustment or repairs, to facilitate which it is fitted to slide through a socket, bored concentric with the casing, its lower end resting upon a plate, N, which is suspended by bolts or screws O O, by which it may be raised or lowered; or by detaching the same the step may be withdrawn and replaced without taking the wheel from its place, thus often saving great trouble and expense.

The base of step B may be secured to plate N by a tongue and groove or other means to prevent its turning in the socket; or it may be fitted to revolve upon the plate, as desired.

The operation of the several parts will be readily understood from the description of the same already given, and I will designate what I claim as my invention, and desire to secure by Letters Patent, as follows:

1. A chute-rim for a turbine water-wheel having annular paraboliform crown, and a series of guide-vanes with inner surfaces nearly tangential to the periphery of the wheel, in combination with an inner casing having a corresponding series of apertures opened and closed by movable gates operated by rotating the chute-rim, substantially as shown and described.

2. In combination with a curved disk or

crown-plate in an "inward-flow" turbine, a series of floats or pressure-vanes with surfaces for the action of the water, which in their extension inwardly from the line of impact at the periphery of the wheel have an inclination from the radii toward the impinging stream, and in their course from the surfaces of impact, near the upper and outer portions of the crown-plate, they trend at first slightly from a perpendicular to the plane of said crown-plate, and then with accelerating deflection and curvature until the discharge-line is reached, where the transverse curvature is such as to extend the discharge-orifices from the hub or lower central portion of the curved crown-plate to and upon a portion of the periphery of the wheel, thereby uniting a circumferential with the diametral discharge to increase the effective area for the escape of the inert water, substantially as specified.

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Witnesses:
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S. H. BRACKETT.