(No Model.) 2 Sheets—Sheet 1.

N. F. BURNHAM.

TURBINE WATER WHEEL.

No. 427,552. Patented May 13, 1890.

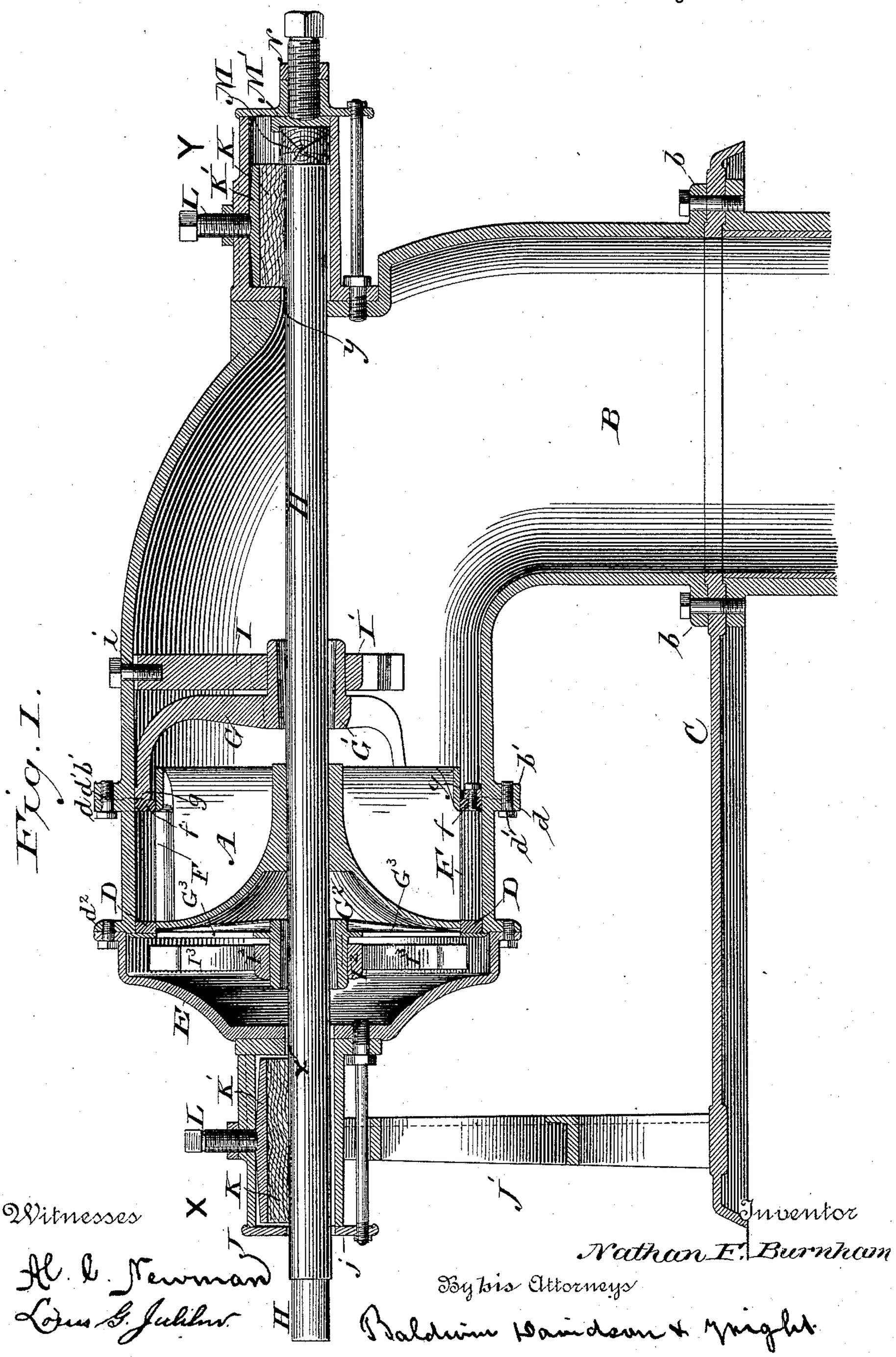

Fig. 1.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

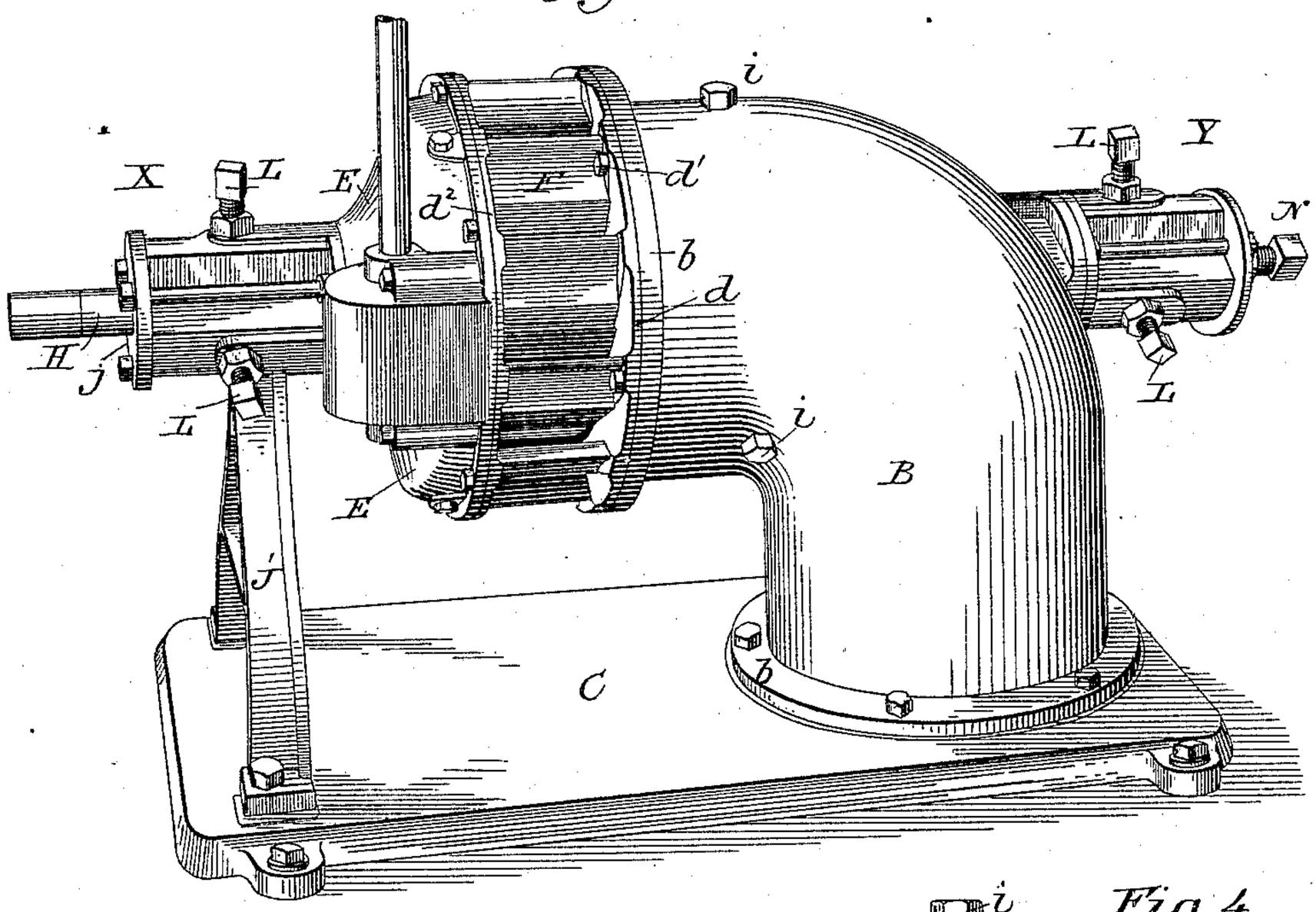


Fig. 3.

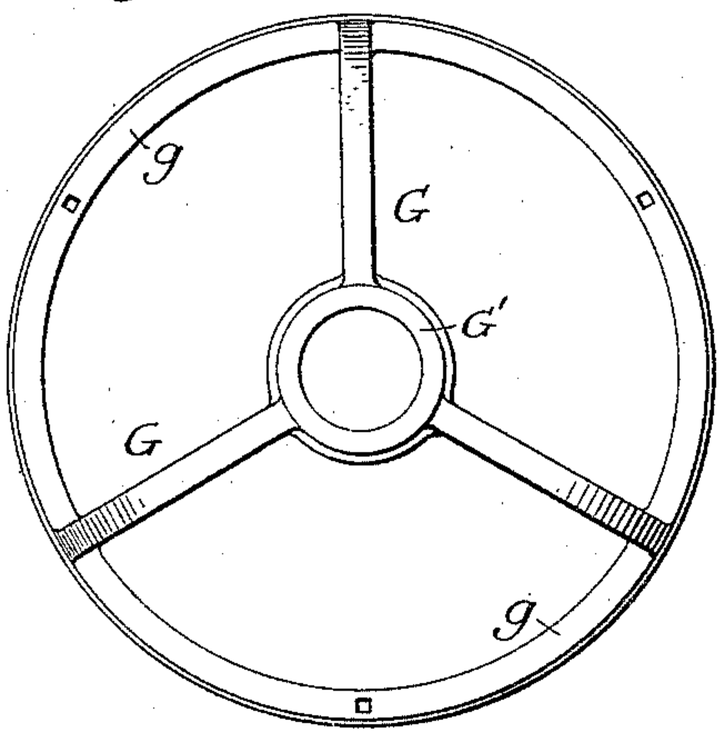


Fig. 4.

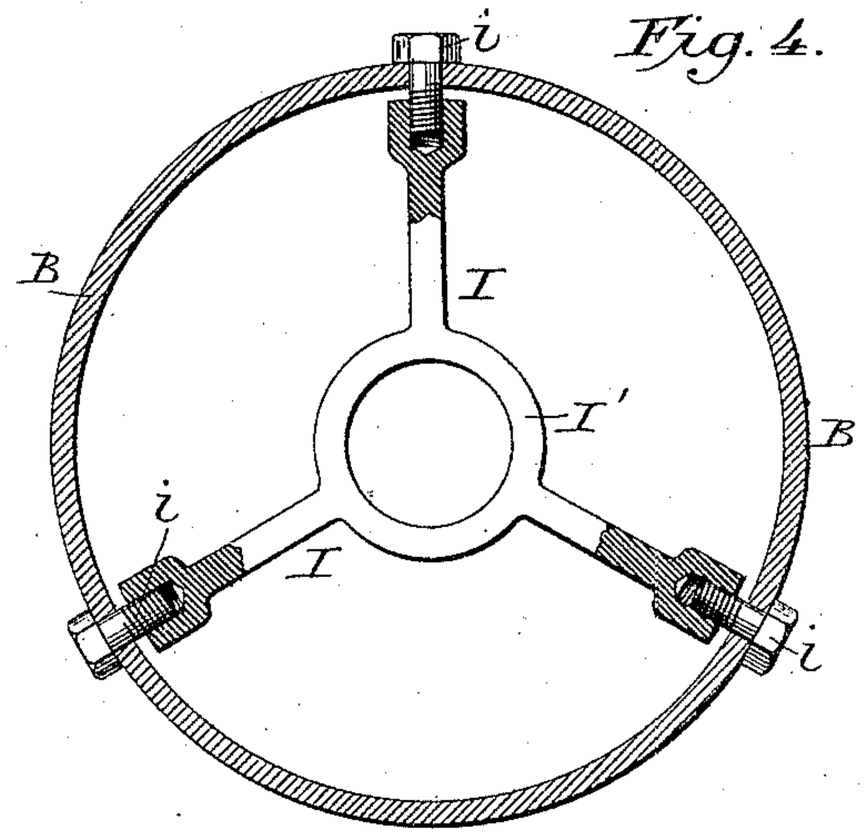
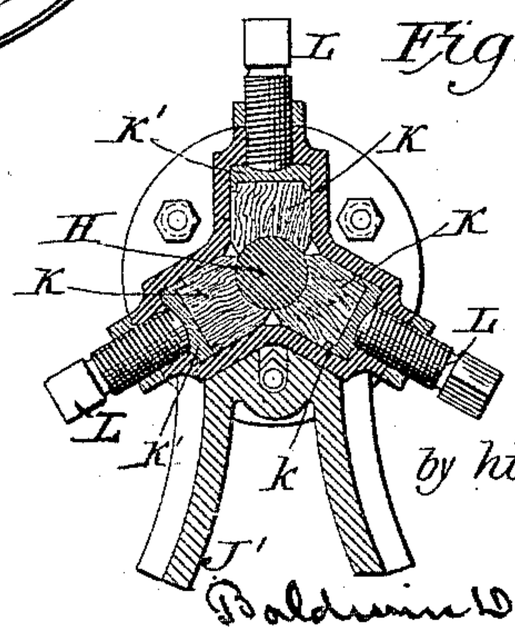


Fig. 5.



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Inventor:

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by his Attorneys

Baldwin Dawson & Wright.

UNITED STATES PATENT OFFICE.

NATHAN F. BURNHAM, OF YORK, PENNSYLVANIA.

TURBINE WATER-WHEEL.

SPECIFICATION forming part of Letters Patent No. 427,552, dated May 13, 1890.

Application filed October 22, 1889. Serial No. 327,795. (No model.)

To all whom it may concern:

Be it known that I, NATHAN F. BURNHAM, a citizen of the United States, and a resident of the city and county of York, in the State of Pennsylvania, have invented certain new and useful Improvements in Turbine Water-Wheels, of which the following is a specification.

My invention specially relates to that class of turbine water-wheels mounted on a horizontal shaft. The numerous advantages incident to the employment of such an organization heretofore, so far as my knowledge extends, have not been fully utilized. As heretofore constructed great difficulty has been encountered in avoiding wear of the wheel and gates in their bearings, which consequently soon become defective, causing attrition between the wheel proper and its gate, the suction of the draft-tube likewise causing endwise pressure on the shaft. The parts consequently are liable soon to get out of alignment and the joints to become worn and leaky and proportionately inoperative.

The objects of my invention are not only to obviate these objections, but to attain other essential advantages, which ends I attain, first, by mounting the gate at each end on adjustable supports, by which it may be accurately centered and adjusted to compensate wear; secondly, by mounting the horizontal shaft in self-adjustable bearings, in addition to the usual adjustments, to compensate wear and secure accurate alignment; thirdly, by making the shaft-bearing not only self-adjustable, but self-lubricating, to secure accuracy and durability, and, fourthly, by combining the flat end of the shaft with a correspondingly-shaped adjustable end bearing to compensate wear and relieve the end-thrust of the shaft caused by the suction of the draft-tube.

The subject-matter of my improvements is hereinafter specifically designated in the claims.

The accompanying drawings show so much of a turbine water-wheel and its appurtenances, embracing all my improvements, as is necessary to illustrate the subject-matter claimed.

Unless otherwise designated, the parts are of suitable well-known construction, preferably like that shown in United States Letters Patent, respectively, granted to me as No. 274,884, dated March 27, 1883, and No. 382,026, dated May 1, 1888.

Some of my improvements may, however, be used without the others and in machines differing somewhat in their details of construction from those herein shown.

Figure 1 represents a vertical longitudinal central section through my improved wheel and its appurtenances; Fig. 2, a perspective view thereof; Fig. 3, an end elevation showing the details of the gate-arms and ring; Fig. 4, a similar view, partly in section, showing the adjustable bearing in which the journal of the gate-arms fits; Fig. 5, a vertical transverse section through one of the bearings of the horizontal shaft.

The drawings show my improvements as adapted to a central-discharge turbine water-wheel, and the parts, for convenience, will be described relatively to the position they would occupy were they mounted on a vertical shaft, as they are in my patents above mentioned.

The flanged bottom *b* of a "quarter-turn" draft-tube B is shown as bolted to a bed-plate C, as usual. This bed-plate may form the bottom of a penstock, in which the wheel is immersed, as well understood. An annular flange *b'* on the other end of the draft-tube abuts against a similar flange *d* on the wheel-casing, bolts *d'* clamping the two flanges together. A flange d^2 on the opposite end of the wheel-casing is similarly bolted to a corresponding flange on the wheel-cover E, as usual.

The gate F moves in suitable bearings in the casing. Gate-arms G on the discharge side of the wheel are cast or otherwise secured to a ring *g*, abutting against and secured to the gate-ring *f*. The arms G unite in a central boss or journal G'.

Radial stay-arms I are provided with sockets at their outer ends, into which screw-bolts *i*, passing radially through the draft-tube, enter, thus forming an adjustable connection. These stay-arms unite in a central ring or bearing I', which fits snugly over the journal G' of the gate-arms above described, thus forming a long bearing therefor. The opposite end of the gate is similarly mounted and adjusted by means of corresponding gate-

arms G^3, their journals G^2, stay-arms I^3, and their bearing I^2. This organization secures long bearings, and consequently large bearing-surfaces for the journals at each end of the wheel and gate, the latter of which can therefore readily and accurately be adjusted at either end or at both ends simultaneously, and thus always be maintained in correct relation to the other parts of the apparatus. This correct alignment is especially necessary in a wheel and gate turning on a horizontal axis, as in such an organization the weight of the parts causes downward pressure crosswise of the shaft in addition to the end-thrust, due to the pressure of the water, and there is consequently a greater tendency to disturb correct alignment than is the case with a vertical shaft.

The wheel A is mounted on a shaft H, passing through the journals G' G^2, above described, in which it fits loosely. It projects at one end beyond the cover E and at the other beyond the draft-tube, through the horizontal portion of which it extends centrally and is supported at each end in self-adjusting bearings X Y. The end of this shaft projects through the cover, and its bearing at that end carries the usual driving-gear. (Not shown.) The bearing X at this end of the shaft consists of a box J, bolted to the wheel-cover E and provided with a removable end piece *j*, held in position by bolts passing through its projecting edge outside the bearing. Wooden bearing-blocks K, inclosed within the box J, which is of the usual three-armed form in cross-section, (see Fig. 5,) are provided with longitudinal concave grooves on their inner faces to fit the shaft which they surround. Metal holder-plates K′, interposed between these blocks and the box J, are each provided with central concave bearings, in which the inner rounded ends of their respective adjusting-screws L fit. The holder-plates (see Fig. 1) are made thicker in the middle than at their edges, so as to leave a space between said edges and the box. Consequently they can rock on their pivots to adjust themselves and the wooden bearing-blocks to the shaft, thus forming self-adjusting bearings to compensate the wear of the wooden blocks K. The ordinary adjustment of the bearing-blocks on the shaft is effected by the screws L. The box J, besides being secured to the wheel-cover, is supported in a suitable bearing or standard J′, mounted on the base or bed-plate C, thus bracing both the draft-tube and casing and correspondingly diminishing the strain on the shaft.

The bearing Y, which supports the opposite end of the shaft, is similar to the one X, hereinbefore described, in its details of construction, except as hereinafter described. It is bolted on the outer side of the draft-tube. The shaft H projects into it, its end being made plain, square, or flat, and bearing against a wooden bearing-block M, resting in a holder M′, having a rounded recess in its back in which the correspondingly-shaped end of an adjusting-screw N fits, this screw working through a bearing in the cover or end plate of the bearing-box. The self-adjusting bearing-blocks K are made shorter than the bearing-box to admit of the interposition of the end bearing-block M and its holder M′ between the adjustable bearing-blocks and the end of the bearing-box. This organization enables me to adjust the wheel and shaft endwise in their bearings, and to compensate wear on the parts without interfering with the self-adjusting action of the bearings at that end of the shaft.

My Patent No. 382,026, of May 1, 1888, shows a water-wheel mounted on a vertical shaft with apparatus above the gate substantially similar to that herein shown for supporting and adjusting it, and I of course do not broadly claim such apparatus. My present invention, however, constitutes an improvement adapting that wheel to work on a horizontal shaft and involves consequent changes in organization. In that patent, for instance, the gate-ring is provided with a bearing at its upper end only, which is all that is necessary, as its weight is supported by the casing, which is not the case where the gate turns on a horizontal shaft, in which case its weight and the water pressing thereon tend to throw the parts out of alignment and produce wear and friction of the parts.

It is old to mount a turbine water-wheel on a horizontal shaft, the wheel, the gate, and its casing all being inclosed in a draft-tube large enough to constitute another casing for them all, which casing constitutes the supporting-frame of the entire apparatus, in which the geared or working end of the shaft projected through a stuffing-box in the cover and was provided with an ordinary external oil-lubricated valve. The inner or bearing end of the shaft projected through a self-lubricated bearing in a bridge, and was acted upon by a bearing-block inclosed in a draft-tube, which organization required the cutting off of the water in order to get at the shaft through a man-hole. In this apparatus, however, the wheel-case and gate were rigidly secured at their peripheries to a tubular opening in the casing and were consequently non-adjustable. In this case the bearing end of the shaft was also made concave to receive the conical end of a bearing-block worked by an adjusting-screw; but such an arrangement is obviously defective, as, in addition to the wedge-like action of the bearing-block, the wearing-surface was largely increased and the parts consequently more liable to be deranged, as any wear on the bearings would throw all the weight on the upper part of the concave and tend to force the shaft endwise.

I am also aware that a flat-ended shaft, in combination with a bearing-block and adjusting device, is old in a vertical-shaft water-wheel, and do not broadly claim such a device.

It will be observed that the openings *x y*, through which the shaft H passes through the wheel-cover and draft-tube, are somewhat larger in diameter than the shaft, and consequently permit the water in which the bearings are immersed to enter and lubricate the journal boxes or bearings, thus rendering them both self-lubricating and self-adjusting, the advantage of which arrangement is obvious.

The operation of the apparatus will readily be understood from the foregoing description.

Having thus fully described the construction and operation of my improved horizontal-shaft turbine water-wheel, what I claim therein as new and as of my own invention is—

1. The combination, substantially as hereinbefore set forth, of a turbine water-wheel gate with its horizontal adjustable bearings on opposite sides thereof to secure correct alignment.

2. The combination, substantially as hereinbefore set forth, of the quarter-turn draft-tube, the casing secured on the end of the horizontal portion thereof, the gate inside the casing, its arms, the long journal secured thereon centrally in the draft-tube, and the adjustable journal-bearing at the discharge end of the gate and supported by the draft-tube.

3. The combination, substantially as hereinbefore set forth, of the quarter-turn draft-tube, the casing secured on the end of the horizontal portion thereof, the cover secured on the opposite end of the casing, the gate, its arms, and horizontal bearings on opposite ends of the gate and respectively supported by the cover and draft-tube.

4. The combination, substantially as hereinbefore set forth, of the quarter-turn draft-tube, the casing secured on the end of the horizontal portion thereof, the cover secured on the opposite end of the casing, the gate, arms on opposite ends of the gate uniting in corresponding central horizontal bearings or journals, and adjustable radial supporting-arms carrying central bearings, respectively mounted on the wheel-cover and draft-tube, in which bearing the gate-journals turn, whereby accurate alignment, compensation for wear, and proper support for both ends of the gate are secured.

5. The combination, substantially as hereinbefore set forth, of the quarter-turn draft-tube, the casing secured to the end of the horizontal portion thereof, the cover, the horizontal shaft projecting at one end therethrough and at the other through the draft-tube, the bearing-box outside the draft-tube, its lateral bearing-blocks, the flat end block bearing on the flat end of the shaft, the end-block holder and adjusting-screw, all the bearing-blocks and their holders being inclosed and adapted to move within the bearing-box.

6. The combination, substantially as hereinbefore set forth, of the quarter-turn draft-tube, the casing secured on the end of the horizontal portion thereof, the cover secured on the opposite end of the casing, the gate, its supporting-arms and journals, horizontal bearings on opposite ends of the gate, respectively supported by the cover and draft-tube, the horizontal shaft passing through the gate-arm journals and projecting at one end through the cover and at the other through the draft-tube, its self-adjusting self-lubricating bearings outside of the draft-tube, and the wheel mounted on the shaft between the gate-bearings.

7. The combination, substantially as hereinbefore set forth, of the quarter-turn draft-tube, the casing secured on the end of the horizontal portion thereof, the cover secured on the opposite end of the casing, the gate, gate-arms on opposite ends of the gate uniting in corresponding central horizontal bearings or journals, adjustable radial supporting-arms carrying central adjustable bearings, respectively mounted on the wheel-cover and draft-tube, the horizontal shaft passing through the gate-arm journals, projecting at one end through the cover and at the other through the draft-tube, the self-adjusting self-lubricating bearings outside the draft-tube, the bearing-block, its holder, and set-screw acting on the end of the shaft, and the wheel mounted on the shaft between the gate-bearings.

In testimony whereof I have hereunto subscribed my name.

NATHAN F. BURNHAM.

Witnesses:
CHAS. H. MAYER,
EDWD. CHAPIN.