No. 703,056. Patented June 24, 1902.

A. GIESLER.

TURBINE WATER WHEEL SYSTEM.

(Application filed Oct. 22, 1900.)

(No Model.) 3 Sheets—Sheet 1.

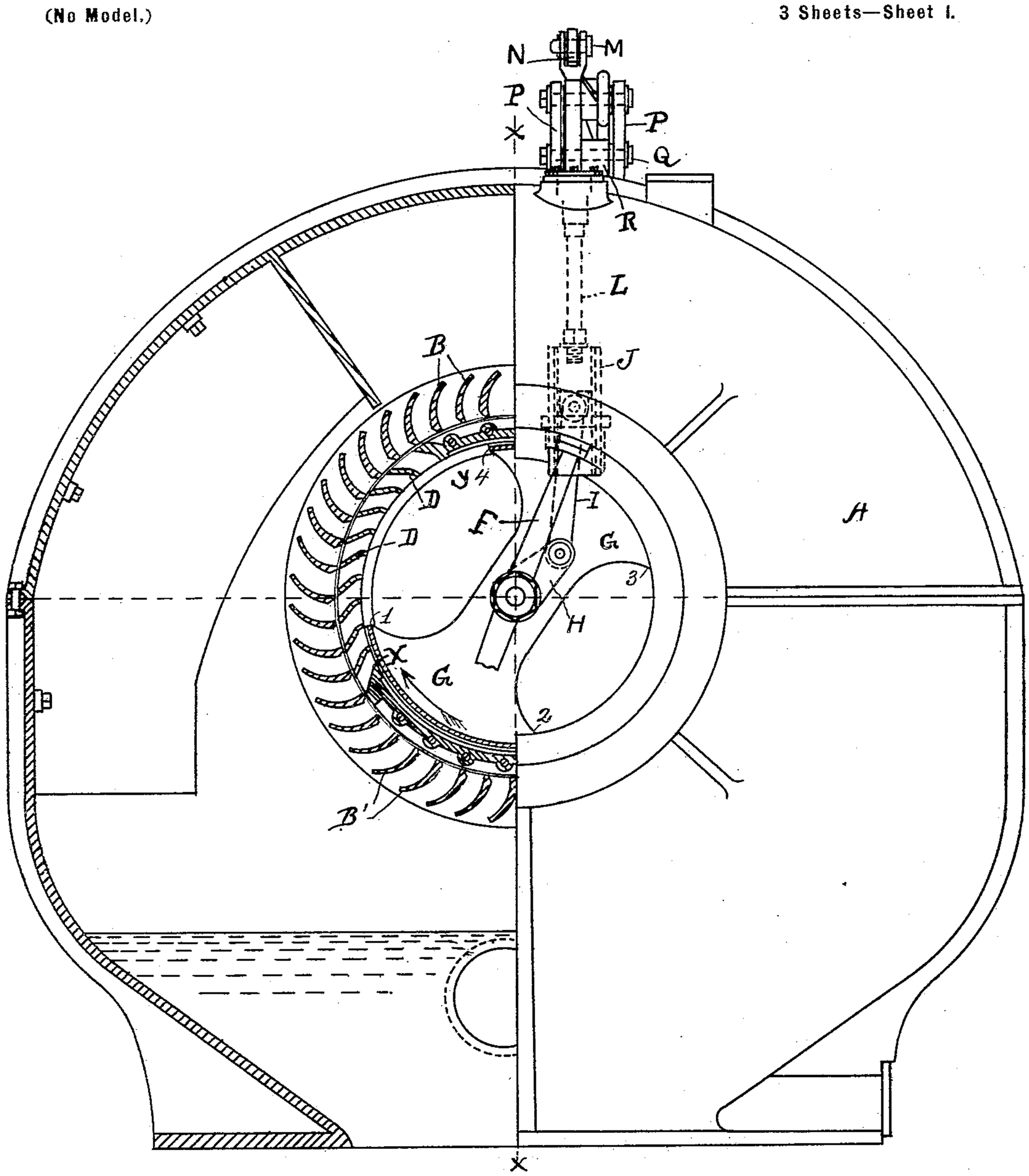

Fig. 1.

Witnesses.
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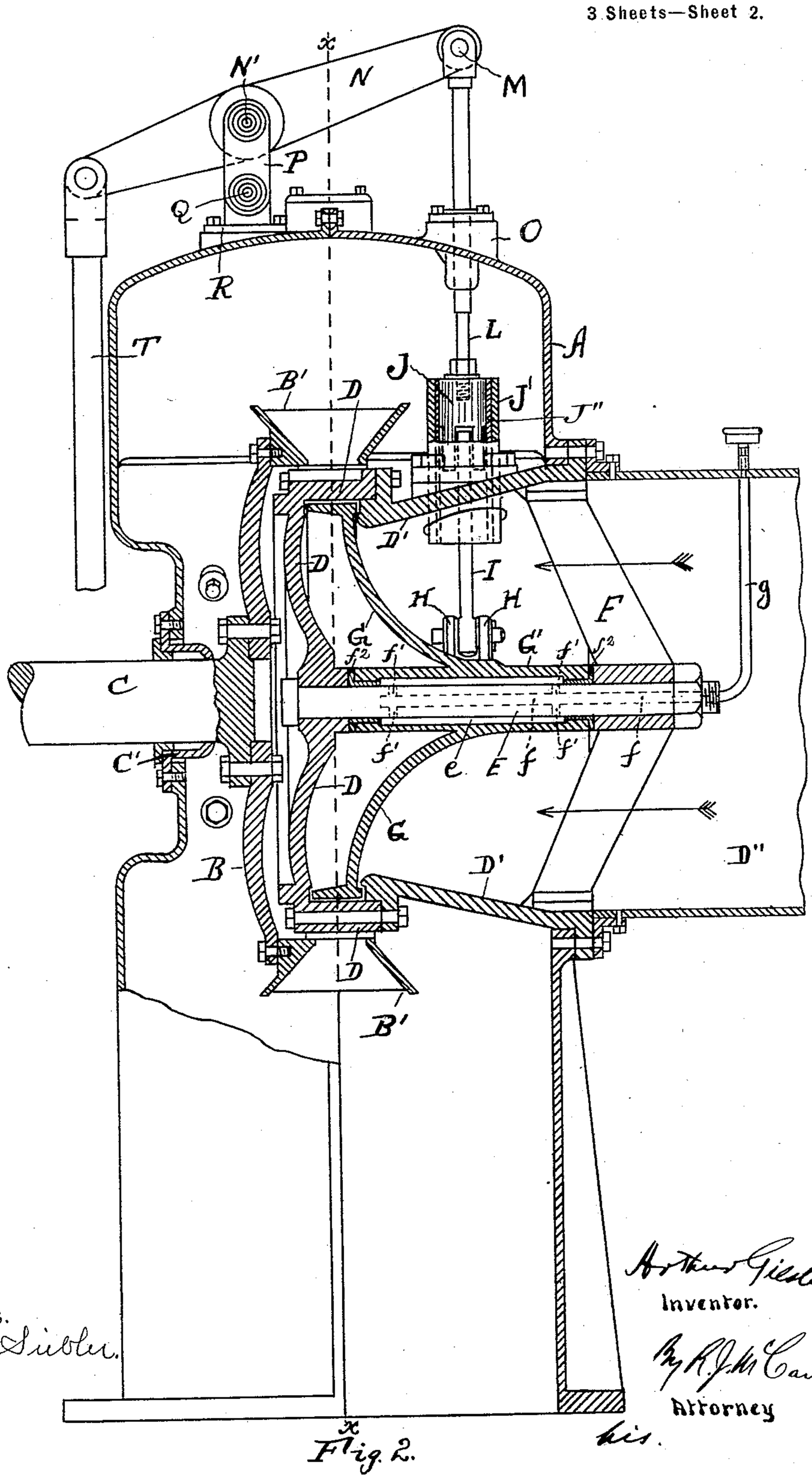

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

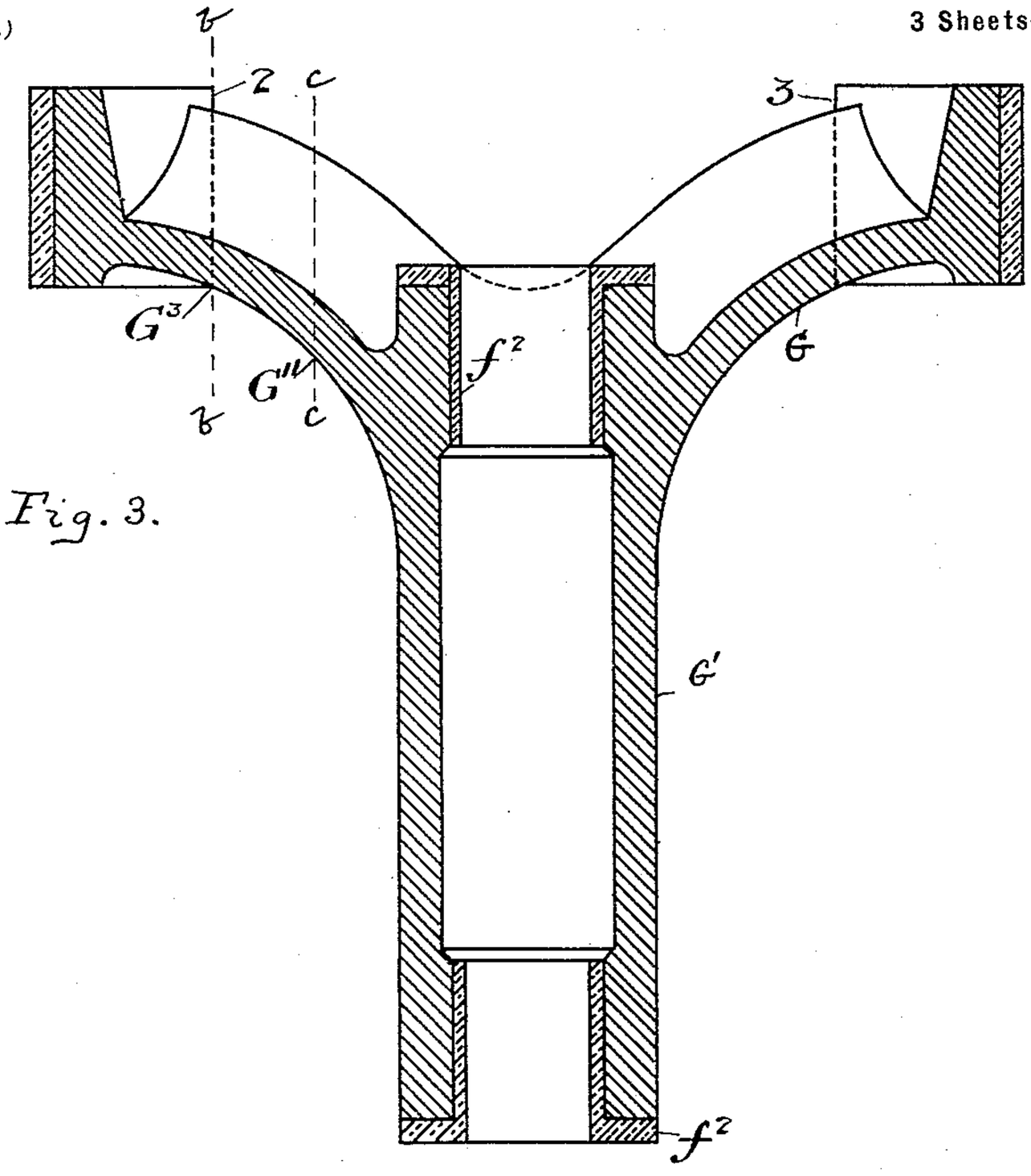


Fig. 3.

b -- b

Fig. 4.

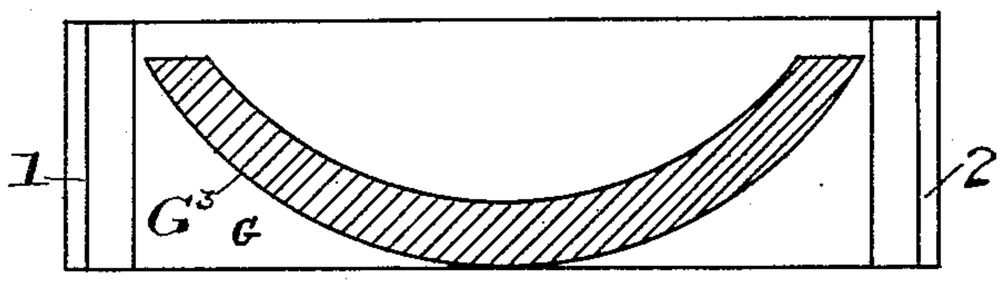
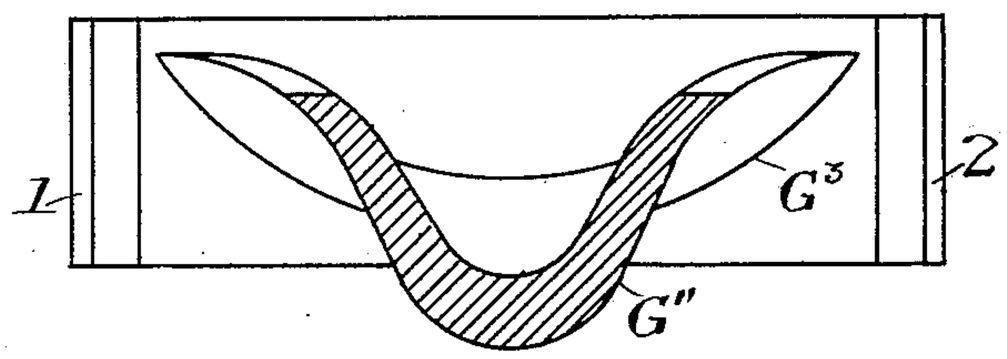


Fig. 5.



c --- c

Witnesses.
C. M. Thebald.
Matthew Sibler

Arthur Giesler
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UNITED STATES PATENT OFFICE.

ARTHUR GIESLER, OF DAYTON, OHIO, ASSIGNOR TO THE STILWELL-BIERCE & SMITH-VAILE CO., OF DAYTON, OHIO, A CORPORATION OF OHIO.

TURBINE-WATER-WHEEL SYSTEM.

SPECIFICATION forming part of Letters Patent No. 703,056, dated June 24, 1902.

Application filed October 22, 1900. Serial No. 33,823. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR GIESLER, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Turbine-Water-Wheel Systems; and I do 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, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in turbine water-wheels, and more particularly to the water-wheel gate and the operating mechanism therefor.

The object of the invention is to provide a perfectly-balanced gate, the same being of peculiar construction and provided with a long bearing which is mounted in a manner that will maintain the gate in proper alinement at all times.

The invention also comprises means for operating said gate to open and close the openings in the chute-case. With these objects in view the invention comprises certain structural features that will be fully described in the following specification, reference being made to the accompanying drawings, of which—

Figure 1 is a partial elevation and vertical sectional view looking from the right-hand side of Fig. 2, the portion in section being on the line *x x* of Fig. 2. In this view the gate, with the exception of the rims, is entirely shown in elevation. Fig. 2 is a sectional elevation on the line *x x* of Fig. 1. Fig. 3 is a longitudinal mid-sectional elevation of the gate. Fig. 4 is a cross-section on the line *b b* of Fig. 3. Fig. 5 is a section on the line *c c* of Fig. 3.

In a detail description of my invention similar reference characters indicate corresponding parts.

A designates a turbine-casing which incloses one or more turbine wheels B, having buckets B′.

C is a shaft projecting through a stuffing-box C′ and having suitable bearings, which are not shown. The turbine wheel B is mounted upon this shaft.

D designates a chute-case, and E is a central shaft which provides a bearing for the rotating gate G. This shaft has at one end a bearing F, which is rigidly secured in the mouth of the induction-pipe D′, and at the other end said shaft has a bearing in the chute-case D. The induction-pipe D′ is rigidly secured to the chute-case and to the turbine-casing A. It will be noticed that said induction-pipe is of a conical shape. This is an important structural feature and will be again referred to. Connected to and discharging into the induction-pipe D′ is a water-pipe D″.

The gate G has two webs extending from opposite sides of the sleeve G′ to the rim and presenting convex water-surfaces to the incoming water, substantially as appears in Figs. 3, 4, and 5. The portions of said web adjacent to where they depart from said sleeve have a more abrupt or decided curvature, as at G″, and partake of a more gradual curvature, as at G^3, as said webs approach the rim of the gate. The curvatures G″ and G^3 lie on both sides of a line running through the center of the gate. These curvatures will of course vary in extent with different diameters of gates. The function of these convex water sides is to direct the water in the chute-case. The rim of said chute-case has two sets of openings, with intervening closed portions and surrounded by the rim of the gate, the said gate-rim controlling said openings. The water directed by the convex water sides of the gate is divided in two opposite directions toward the exit of said water through the chute-case and the wheel. This division of the water above referred to is due to the curvature of the gate, which is clearly shown in Figs. 4 and 5 of the drawings. The gate terminates in an elongated sleeve G′, before referred to. This sleeve incloses a central shaft or pin E, which affords a long and true bearing for the gate. The ends of the sleeve G are closed by bushings f^2. The shaft or pin E, as before stated, has a bearing at one end of the chute-case D and at the other end in a bracket F. The function of the shaft or pin E is twofold—first, it relieves

the chute-case D of a part of its pressure, transmitting it to the bearing F, and, secondly, the said shaft or pin E provides a bearing for the gate to revolve and to be supported upon in proper alinement. The gate when operated turns upon the pin or shaft E about ninety degrees of the circle or less, and when the circular part or rim of the gate is covering all the openings of the chute-case the water-wheel is out of action. The reverse is the case when the wheel is running at its full capacity.

While I have shown in the drawings a mounting of the gate G which permits said gate to rotate independently of the shaft E, I do not limit myself to such mounting, as it will be readily understood that the gate and the shaft may rotate together, the gate being keyed or otherwise rigidly secured to the shaft. Between the sleeve G′ of said gate and the shaft or spindle E there is an oil-space *e*, from which the spindle or shaft is thoroughly oiled. The said shaft has a bore or oil-channel *f* through it, which is indicated in dotted lines and into which oil is injected or fed by gravity or pressure through a pipe *g*. Leading from the oil-channel *f* are oil-channels *f′*, which communicate with the chamber *e* on opposite sides and feed it.

H H designate a slotted crank-arm, which projects from the sleeve G′ of the gate. This crank-arm may be an integral part of the gate or it may be attached thereto in any suitable manner.

I is a pitman or connecting-rod which is pivotally connected to the crank-arm. The other end of the pitman I is connected to a piston J, which moves in the cylinder J′, the said cylinder being rigidly secured to the induction-pipe D′. The cylinder J′ has an inner brass lining J″. The piston J is a solid piece of metal turned to fit the cylinder J′. In the upper end of said piston the connecting-rod L, hereinafter referred to, is screwed, and to the lower part of this piston the connecting-rod or pitman I is attached. The piston J is an essential feature of the invention, as thereby additional means are afforded for obtaining a correct balancing of the gate, which means is necessary, owing to the fact that on the bottom of the piston there is a pressure that is due to the entire head of water that the wheel works under, while on the top of the piston in most cases there is a partial vacuum or at any rate the same vacuum that exists in the case A.

Referring to Fig. 1 of the drawings, the water flowing by edge 1 with a spouting velocity will exert no pressure on it, but will exert pressure on the opposite edge 2 of the gate and the same on edges 3 and 4. In other words, there will be a pressure on edges 2 and 4, which will tend to move the gate in the direction of the arrow, and at the same time the piston J is opposed to this movement, because there is water-pressure under such piston and none above it. It will be understood that the water passes the rims 1 and 3 of the gate with spouting velocity. The other edges 2 and 4 of the gate being in the still water must have pressure on their edges, due to the hydrostatic pressure in the wheel. Consequently it would try to close the gate without the piston. In other words, the combined pressure on the two edges of the gate 2 and 4 is equal to the combined pressure in square inches on the piston J. It will be borne in mind that the difference in pressures on edges 4 and 1 is due to the edge 1 of the gate, as shown in Fig. 1, being close to an opening in the chute-case, through which water is directed to the wheel-runner. This water, owing to the static head, will pass edge 1 with nearly spouting velocity. Consequently there can be little or no pressure on that edge of the gate. With edge 4 it is different, as that edge is not close to a chute-case opening. Therefore the pressure against it is such as is due to the pressure in the flume, which is nearly static head. By the term "edges" 1, 2, 3, and 4 is meant the narrow rectangular surfaces at the ends of the curved rims and situated at right angles to the plane of the gate-rims. It will therefore be seen that there is a very great upward pressure on the piston, which may be increased by changing the diameter of said piston. The cylinder J′ is open at the top to the rarefied atmosphere in the wheel-casing, while the bottom part of said cylinder is also open and is under hydrostatic pressure, due to the head. It therefore will be seen that the bottom part of said cylinder may have, say, one hundred pounds pressure and the upper part a negative pressure, due to the action of the draft-tube.

L designates a connecting-rod which passes through and is guided by a stuffing-box O, mounted on the turbine-casing A. This connecting-rod is pivoted at M to a walking-beam N and is connected to the piston J. The walking-beam N is fulcrumed at N′ to a double link P, which is pivoted at Q to a stand R, the stand R being bolted to the turbine-casing A. By means of the double link P, upon which the walking-beam N is pivoted, the said walking-beam N is provided with a changeable fulcrum, which is necessary in its movement, owing to the connecting-rod L being compelled to move in a straight line. T designates a pitman or rod which is connected to the other end of the walking-beam and by means of which movement is imparted to said walking-beam and thence to the gate G through the connecting-rods L and I and the piston J. The movements thus imparted to said gate will open or close the same, as may be desired. The gate makes one-quarter-of-a-revolution movement. Referring to Fig. 1, in said movement the said gate would move from point X when the gate is opened and to the point Y when the gate is closed. The movement transmitted through the pitman T may be either by hand or power connection.

As shown in the drawings, two chute-openings are closed by said gate and the remaining eight are open. The same condition exists on the opposite side of the gate. In other words, sixteen openings in the chute-case would be opened and four closed, two being closed on each side of the gate and eight being opened. By revolving the gate one-quarter of a revolution to and fro all the chute-openings are either opened or closed.

In a chute-case with less chute-openings than is shown in the drawings—say with one or two openings—the gate would only have to be moved the extent of one or two chute-openings, respectively.

The operation of the wheel is as follows: Water enters through suitable pipe connections into the induction-pipe D′, as indicated by the arrows, and is guided by the curve of the gate G into the openings of the chute-case D and thence into the turbine wheel B through the buckets B′ into the case A, where it will discharge into the tail-race by means of a draft-tube or without a draft-tube, as the case may be.

As before stated, the conical or tapering form of the induction-pipe D′ is important for well-known reasons. The highest velocity of a water-jet entering the buckets of a turbine wheel is at the outer periphery of the chute-case D. This velocity is almost up to spouting velocity. Consequently it is essential in order to obtain high efficiency to speed the water up gradually, which can only be done by means of a tapering or conical pipe, as shown.

By means of the above-described gate mechanism I am enabled to obtain a perfect-balanced gate. Owing to the fact that the water issues into the wheel on opposite sides, it requires in consequence very little power to move the gate. The gate must remain in proper alinement, owing to the character of the bearing for the shaft E. The shaft is thoroughly lubricated by forcing oil through the channels therein into the space surrounding said shaft.

Having described my invention, I claim—

1. In a turbine, the combination with a chute-case having two sets of openings with closed portions between, of a rotary gate having a sleeve, a pin upon which said sleeve is mounted and affording an elongated bearing therefor, two webs extending from opposite points of said sleeve and presenting convex surfaces to the incoming water, and a rim at the outer end of each web constructed to control the openings in the chute-case.

2. In a turbine, the combination with a chute-case having two sets of openings with closed portions between, of a rotary gate having a sleeve, a pin upon which said sleeve is mounted and affording an elongated bearing therefor, a bracket F, one end of the pin being secured in said bracket, the other end in the chute-case, two webs extending from opposite points of said sleeve and presenting convex surfaces to the incoming water, and a rim at the outer end of each web constructed to control the openings in the chute-case.

3. In a turbine, the combination with a chute-case having two sets of openings with closed portions between, of a rotary gate having a sleeve, a pin upon which said sleeve is mounted and affording an elongated bearing therefor, two webs extending from opposite points of said sleeve and each carrying at its outer end a rim constructed to control the chute-openings, said webs presenting curved surfaces to the incoming water, the curvature of such surfaces lessening in abruptness from the sleeve to the rims, substantially as described.

4. In a turbine water-wheel, the combination of a chute-case, a gate having a curved water side which terminates in a sleeve, a central shaft projected through said sleeve, the said shaft having bearings at each end, a piston, a connecting-rod between said piston and the gate, a walking-beam having a changeable fulcrum, and a connecting-rod between said walking-beam and the piston, the said connecting-rod being movable in a straight line, while the connecting-rod between the piston and the gate has an oscillating movement, substantially as specified.

5. In a turbine water-wheel, the combination of a chute-case, a gate having a curved water side terminating in a sleeve, a central shaft projecting through said sleeve and affording a bearing for said gate approximately throughout the length of said shaft, a bearing at each end of said central shaft, a conical induction-pipe inclosing said gate and shaft and being rigidly attached to the chute-case, a piston, a walking-beam, connecting-rods between said walking-beam and the piston and the piston and the gate, the connecting-rod between the walking-beam and piston being movable in a straight line, and a changeable fulcrum for the walking-beam, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

ARTHUR GIESLER.

Witnesses:
R. N. BRUMBAUGH,
R. J. MCCARTY.