No. 809,147. PATENTED JAN. 2, 1906.

C. E. SMITH.

TURBINE.

APPLICATION FILED SEPT. 27, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

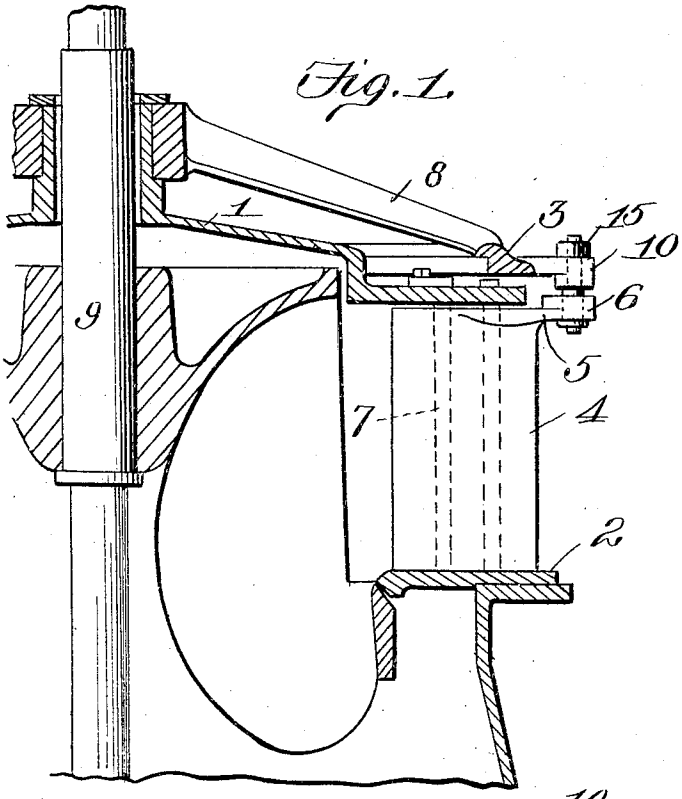



Fig. 3.

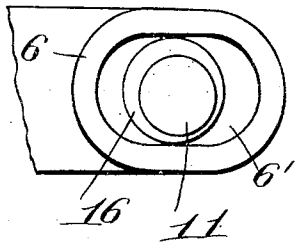



Fig. 4.

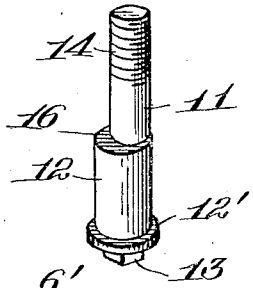
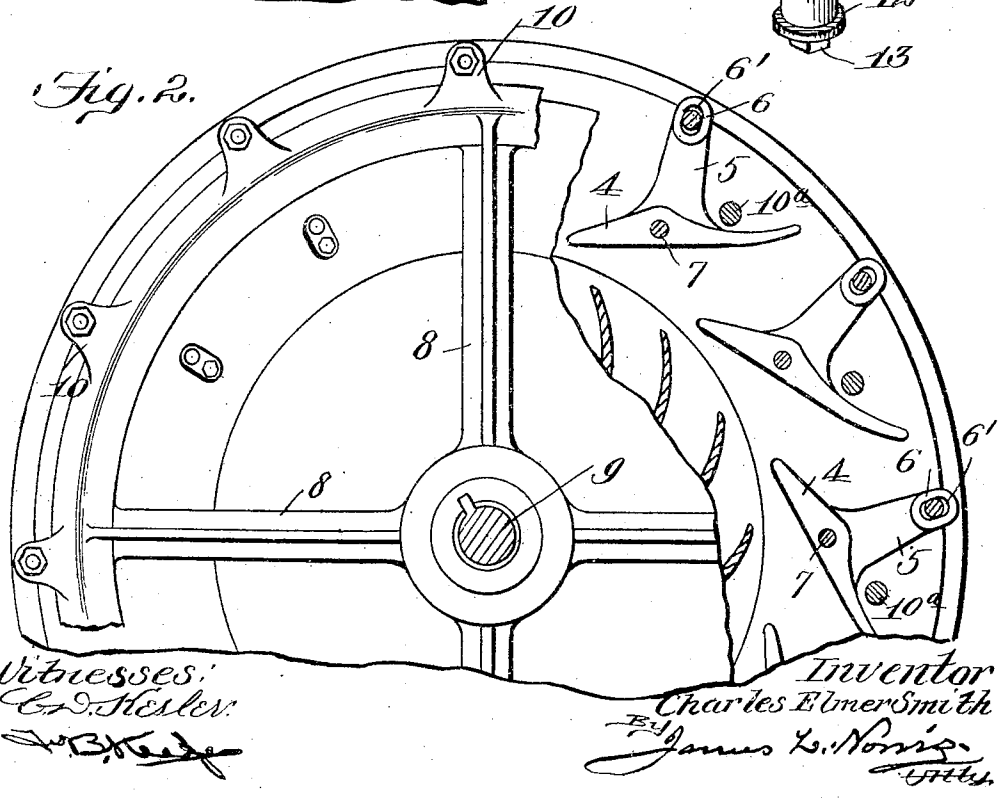



Fig. 2.

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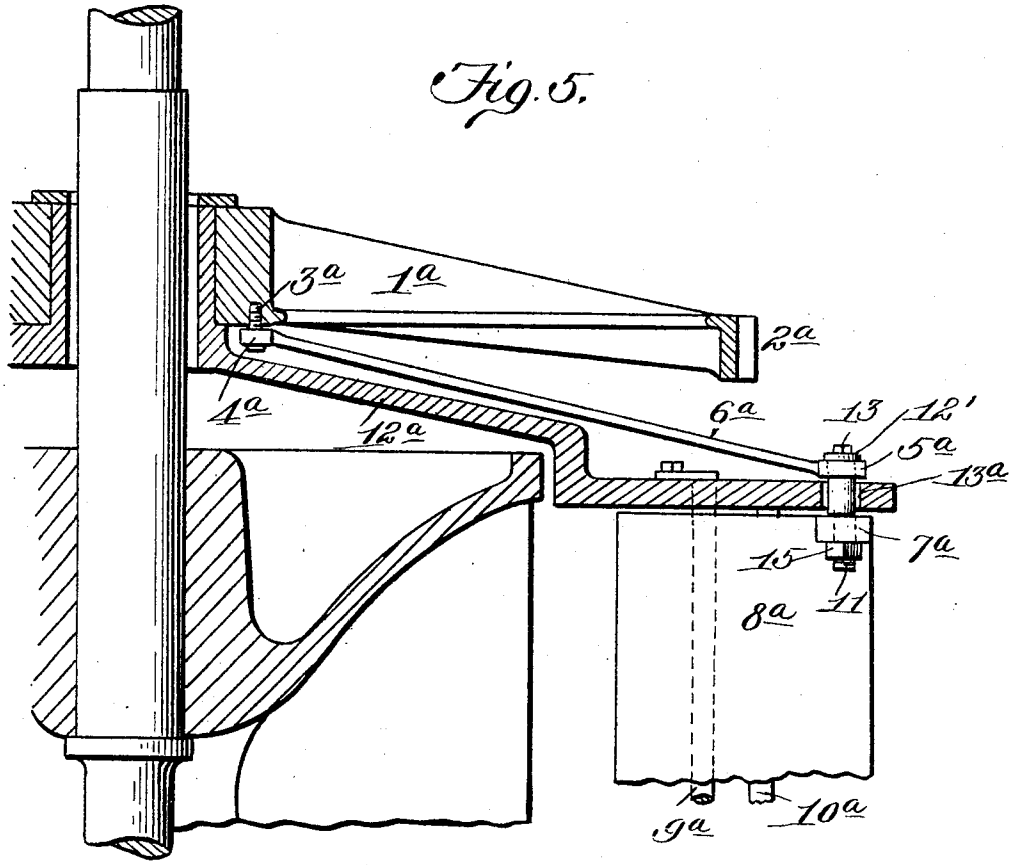
C. E. SMITH.

TURBINE.

APPLICATION FILED SEPT. 27, 1904.

2 SHEETS—SHEET 2.

Fig. 5.

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# UNITED STATES PATENT OFFICE.

CHARLES ELMER SMITH, OF YORK, PENNSYLVANIA, ASSIGNOR TO S. MORGAN SMITH COMPANY, OF YORK, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

## TURBINE.

No. 809,147. Specification of Letters Patent. Patented Jan. 2, 1906.

Application filed September 27, 1904. Serial No. 226,176.

*To all whom it may concern:*

Be it known that I, CHARLES ELMER SMITH, a citizen of the United States, residing at York, in the county of York and State of Pennsylvania, have invented new and useful Improvements in Turbines, of which the following is a specification.

This invention relates to certain new and useful improvements in water-wheels of the class known as "turbines," which receive water through a plurality of wicket-valves, commonly called "gates," placed between the crown and base plates and uniformly spaced around a circle of proper diameter to admit of their inner ends clearing the runner (wheel proper) when opened to the proper angle and area for delivering the water to the runner; and the object thereof is to provide a new and novel form of adjustable connecting means between the gates and their operating means by which the several gates, constituting a set when connected up, will open simultaneously and move in unison throughout their entire range of movement.

The invention further aims to provide a turbine of the class described with a certain new and novel form of adjustable connecting means for the gates which when employed will make it possible to drill the gate-hinge and column bolt-holes in both the crown and base plates, the gate pin-holes in the lugs on the periphery of the gate-operating ring, or in both ends of the gate-operating levers, as the case may be, so as to enable the gates, plates, levers, and ring to be interchangeable.

The invention further aims to provide an adjustable gate-connecting means for use in connection with turbines which shall be extremely simple in its construction and arrangement, strong, durable, efficient in its use, and comparatively inexpensive to manufacture.

With the foregoing and other objects in view the invention consists of the novel combination and arrangement of parts hereinafter more specifically described, illustrated in the accompanying drawings, and particularly pointed out in the claims hereunto appended.

In describing the invention in detail reference is had to the accompanying drawings, forming a part of this specification, and wherein like characters of reference denote corresponding parts throughout the several views, and in which—

Figure 1 is a sectional elevation of a portion of a turbine, showing a connecting device for the purpose set forth constructed in accordance with this invention. Fig. 2 is a sectional plan of a portion of a turbine, showing the arrangement of the connecting means for the gates as constructed in accordance with this invention. Fig. 3 is a detail of a gate-arm, broken away, showing the arrangement of the connecting means in relation therewith. Fig. 4 is an elevation of the gate-connecting means constructed in accordance with this invention and what is termed an "adjustable eccentric connecting member." Fig. 5 is a sectional detail showing the arrangement of the connecting means for the gates as applied between the gates and the operating-levers therefor.

Referring to Figs. 1 and 2 of the drawings, 1 denotes the crown-plate; 2, the base-plate; 3, the operating-ring for the gates; 4, the gates; 5, the gate-arms, provided with the lugs 6, having oval-shaped slots 6′; 7, the pivot-pins for the gates; 8, the spider or arms of the operating-ring for the gates, said spider or arms being supported upon the crown-plate 1; 9, the ordinary central shaft or arbor, and 10 radially-extending lugs formed on the ring 3 and provided with circular openings. The foregoing parts are of known construction in turbines, with the exception of the providing of the gate-arms 5 with the lugs 6, having oval-shaped slots 6′, and the providing of the ring 3 with the radially-extending apertured lugs 10, having circular openings. The lugs 6, which are a part of the gate-arms 5, are adapted when in position to be arranged under the apertured lugs 10.

Referring to Fig. 5 of the drawings, $1^a$ denotes an arm and a hub; $2^a$, a rack which is engaged by a pinion for operating gates; $3^a$, a tap-bolt which passes through the inner end of the gate-operating lever; $4^a$, a swell or lug on the inner end of the gate-operating lever through which the tap-bolt $3^a$ passes; $5^a$, a swell or lug on the outer end of the gate-operating lever through which the connect-

ing member hereinafter referred to passes; $6^a$, a gate-operating lever; $7^a$, a lug on the upper outside edge of the gate through which the connecting member hereinafter referred to passes, said lug $7^a$ having a circular opening; $8^a$, a gate; $9^a$, a hinge or gate-bolt on which the gate oscillates; $10^a$, column-bolts for separating and holding in position the base and dome plates of the turbine; $12^a$, the dome-plate, and $13^a$ the inclined oval-shaped slots formed in the dome-plate. The foregoing parts are of known construction in turbines. Only one gate-operating lever $6^a$ and gate $8^a$ is shown; but it will be understood that in a turbine as many gate-operating levers are employed as there are gates.

The adjustable connection according to this invention between the gates of the turbine and their operating means and which will enable the gates to open simultaneously and move in unison throughout their entire range of movement consists of an adjustable eccentric connecting member formed with a concentric portion 11, an intermediate portion 12, eccentrically connected at its upper end to the lower end of the concentric portion 11, a laterally-extending flange 12′ on one end of the eccentric portion 12, and a nip portion 13, extending from said eccentric portion 12 and which is adapted to be engaged by an instrument when adjusting said connecting member. The concentric portion 11 of the adjustable connecting member is screw-threaded, as at 14, and upon said screw-threaded end 14 is mounted a clamping-nut 15 for securing said member in position.

The manner in which the gates are connected to the operating-ring therefor, through the medium of the adjustable eccentric connecting member, is as follows: The gates are closed down until the opposing faces thereof abut in the known manner. The concentric portion 11 of the adjustable connecting member is inserted in the apertured lug 10. Said member is then turned until the eccentric portion 12 registers with the opening 6′. The adjustable member is then shoved home—that is to say, moved vertically until the screw-threaded portion 14 projects above the lug 10 and the flange 12′ abuts against the lug 6. The nut 15 is then mounted upon said portion 14 and screwed home, which securely retains the adjustable eccentric connecting member in position. Of course it will be understood that there is an adjustable eccentric connecting member for each gate. The concentric portion 11 is adapted, as before stated, to extend through the apertured lug 10, and when said member has been adjusted in a manner as hereinbefore referred to the shoulder 16, formed by the top of the eccentric portion 12, abuts against the lower face of the lug 10, so that when the nut 15 is screwed home it is evident that the adjustable connecting member is clamped or secured to the lug 10.

The manner in which the gates are connected to the operating-levers therefor, through the medium of the adjustable connecting member, is as follows: The connecting member is inserted down through the lug $5^a$ on the outer end of the lever $6^a$ through the slot in the dome-plate and the lug $7^a$ on the gate $8^a$, and said member is turned until the shoulder 16 rests on the top of the lug $7^a$. The nut 15 is then screwed home and which securely clamps the adjustable eccentric connecting member in position, the flange 12′ resting upon the top of the lug $5^a$ on the outer end of the lever $6^a$. When the connecting member is clamped in position, it cannot move in the lug $7^a$, but can move in the opening in the lug $5^a$ in the outer end of the lever $6^a$. The object of such an arrangement is that in the event of a gate breaking the flange 12′ cannot come down through the lug $5^a$ or the slot in the dome-plate, nor can the nut go up through the lug $7^a$. Hence a broken gate cannot pass into the runner-buckets and damage them.

In connection with the employment of the connecting member with the gate-operating ring it will be stated that the flange 12′ comes up under the lug 6 and the nut 15 on the threaded end of the eccentric member is screwed home on top of the lug 10, and by such an arrangement it is evident that a broken gate is prevented from passing into the runner-buckets to damage them.

It will be evident that the eccentrically-constructed connecting members used in a manner as hereinbefore described will enable the connecting up of the gates with the operating mechanism therefor if the openings for the pivot-pins and connecting members are formed in their respective parts in a slightly-irregular manner. Furthermore, the employment of the connecting members will permit of the various openings for the column-bolts, pivot-pins, and connecting members being bored through the medium of templets and jigs, consequently making such elements of the turbine interchangeable, so that if a part becomes damaged or broken it can be readily replaced.

It is thought the many advantages of an adjustable connecting device between the gates of the turbine and their operating mechanism, as constructed in accordance with the foregoing description, taken in connection with the accompanying drawings, can be thoroughly understood, and it will furthermore be evident that changes, variations, and modifications can be resorted to without departing from the spirit of the invention or sacrificing any of its advantages,

and I therefore do not wish to restrict myself to the details of construction as hereinbefore specifically described, and set forth in the annexed drawings, but reserve the right to make such slight changes, variations, and modifications that properly come within the scope of the protection prayed.

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

1. In a turbine, the combination with the gate-operating mechanism and a set of gates, of an adjustable connecting member between each of the gates and said mechanism, said member provided with concentric and eccentric portions, said concentric portion attached to said mechanism and said eccentric portion connected with a gate.

2. In a turbine, the combination with the gate-operating mechanism and a set of gates, of removable shouldered adjustable connecting members abutting against and attached to said mechanism and connected with the gates.

3. In a turbine, the combination with an apertured operating mechanism for the gates, and a set of gates each provided with a lug having an oval-shaped opening, of an adjustable connecting member between each of the gates and said mechanism, each of said members provided with a concentric and eccentric portion, said concentric portion adapted to extend in an aperture formed in said mechanism and said eccentric portion adapted to extend in the oval-shaped opening of the gate.

4. In a turbine, the combination with the gate-operating mechanism and a set of gates, of an adjustable connecting member between each of the gates and said mechanism, said member provided with a concentric and an eccentric portion, one of said portions attached to said mechanism and the other of said portions connected with the gate.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CHARLES ELMER SMITH.

Witnesses:
CHAS. A. OWEN,
A. J. GLOSSHEIMER.