

No. 812,506.

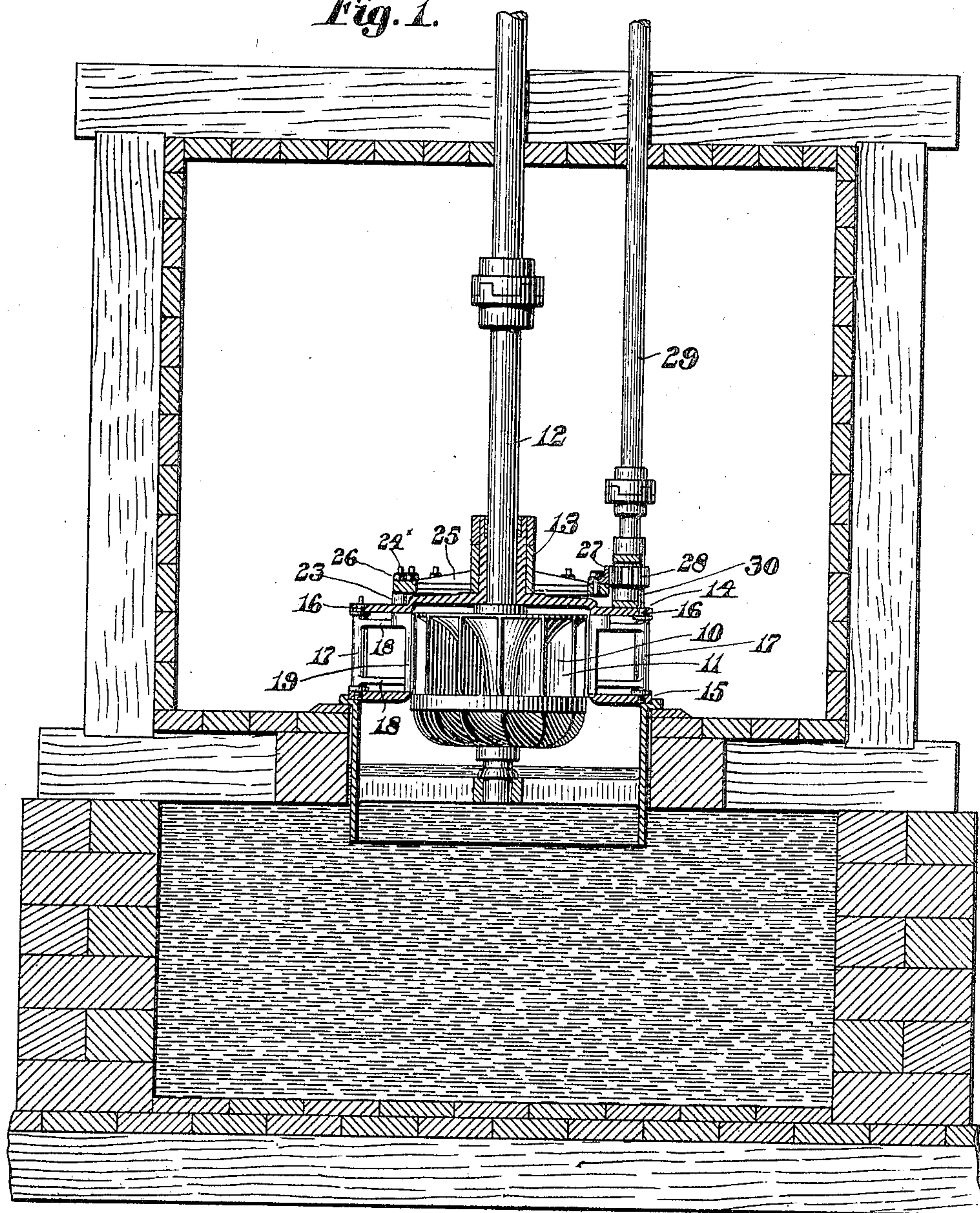
PATENTED FEB. 13, 1906.

N. LOMBARD.
GATE MECHANISM FOR TURBINES.

APPLICATION FILED APR. 3, 1905.

3 SHEETS—SHEET 1.

Fig. 1.



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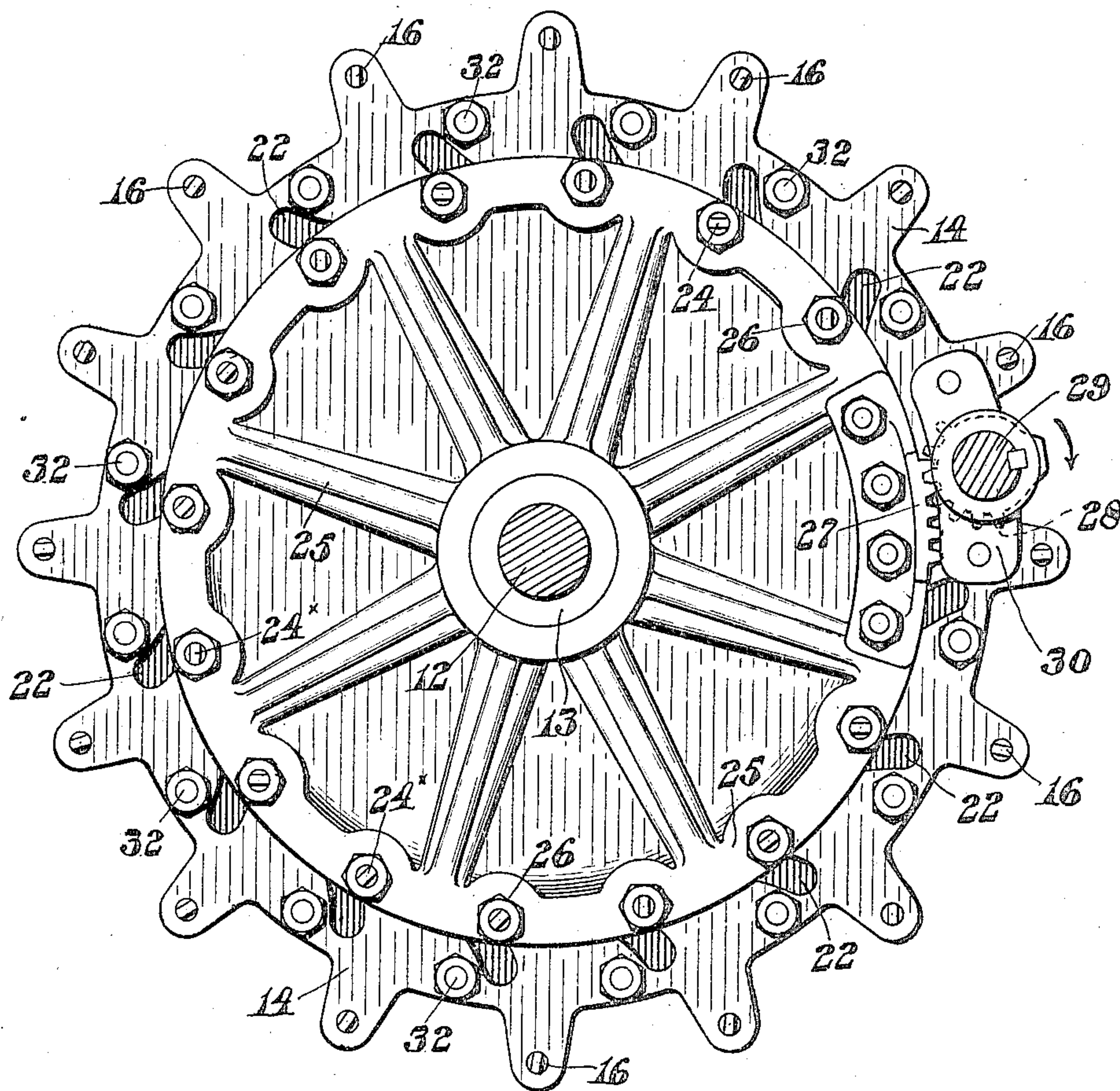
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3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

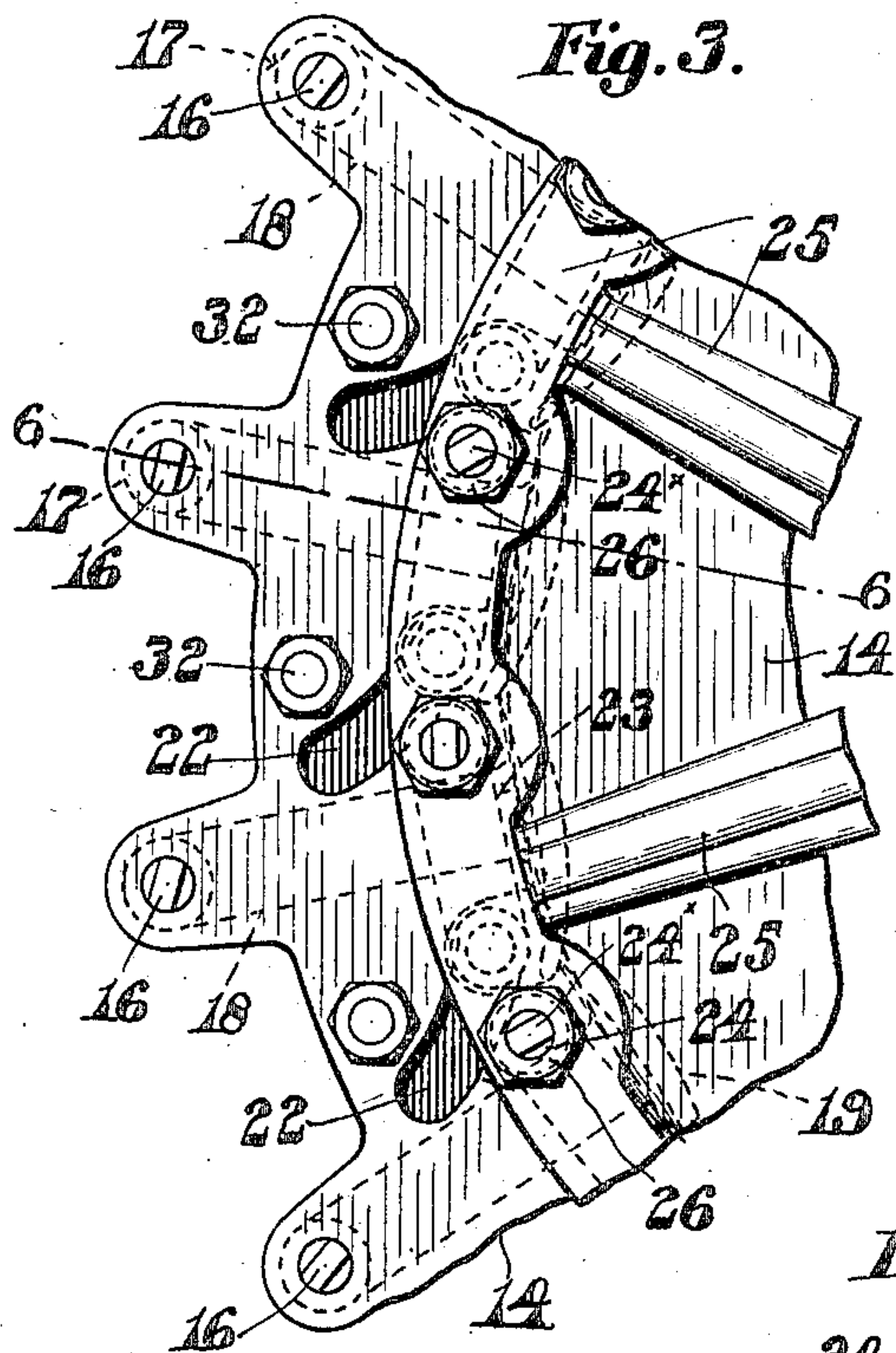


Fig. 3.

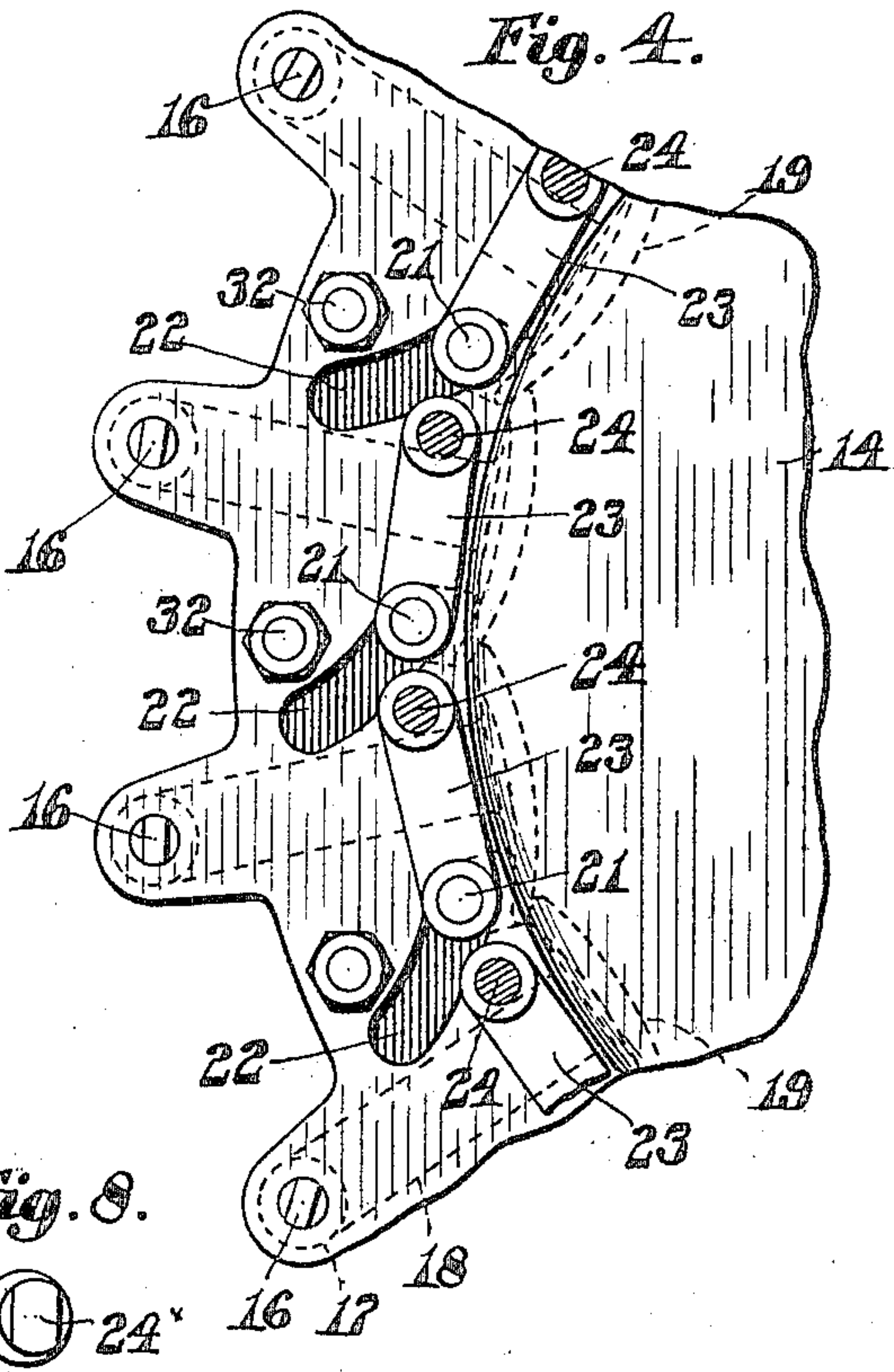


Fig. 4.

Fig. 8.

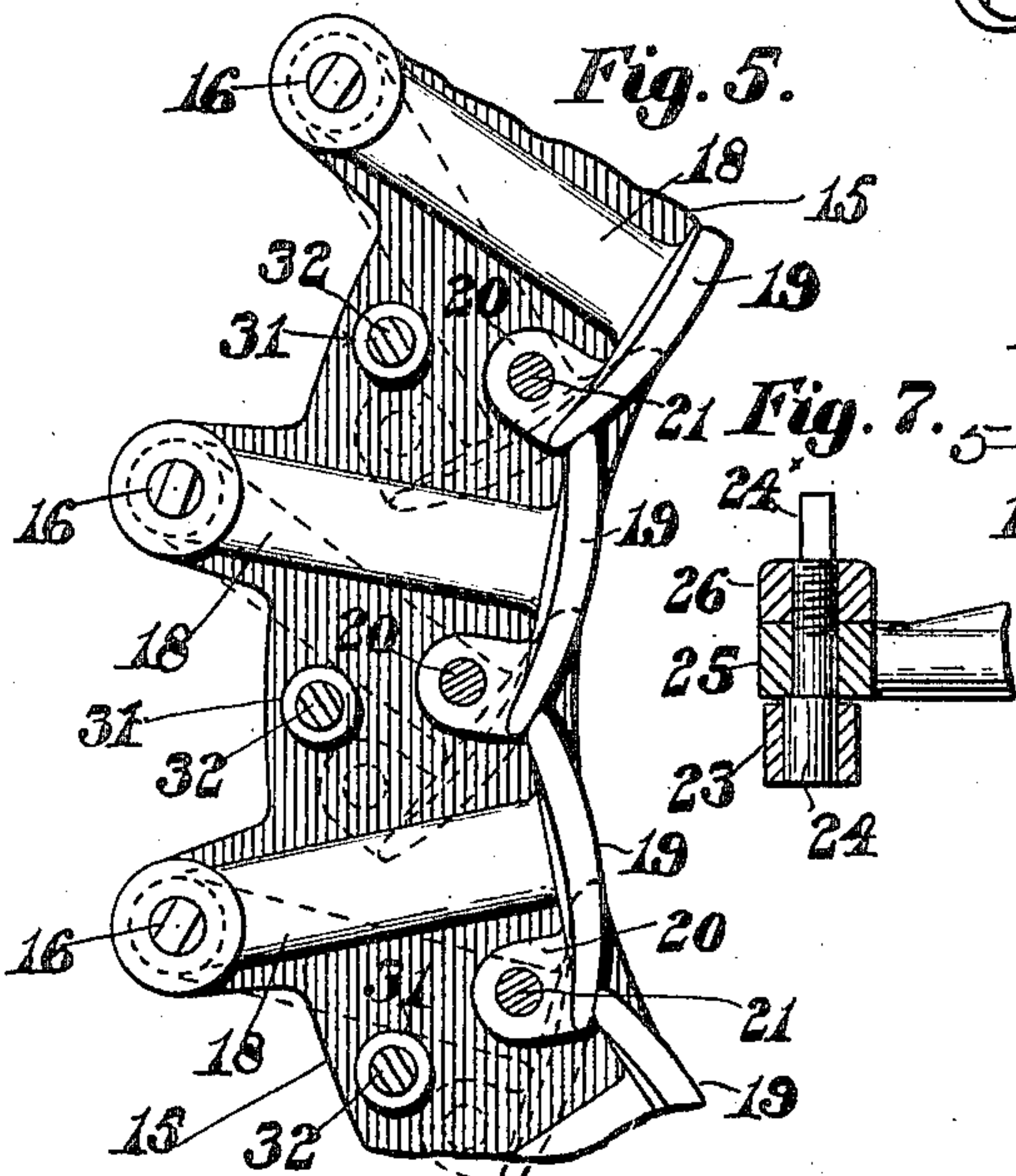


Fig. 5.

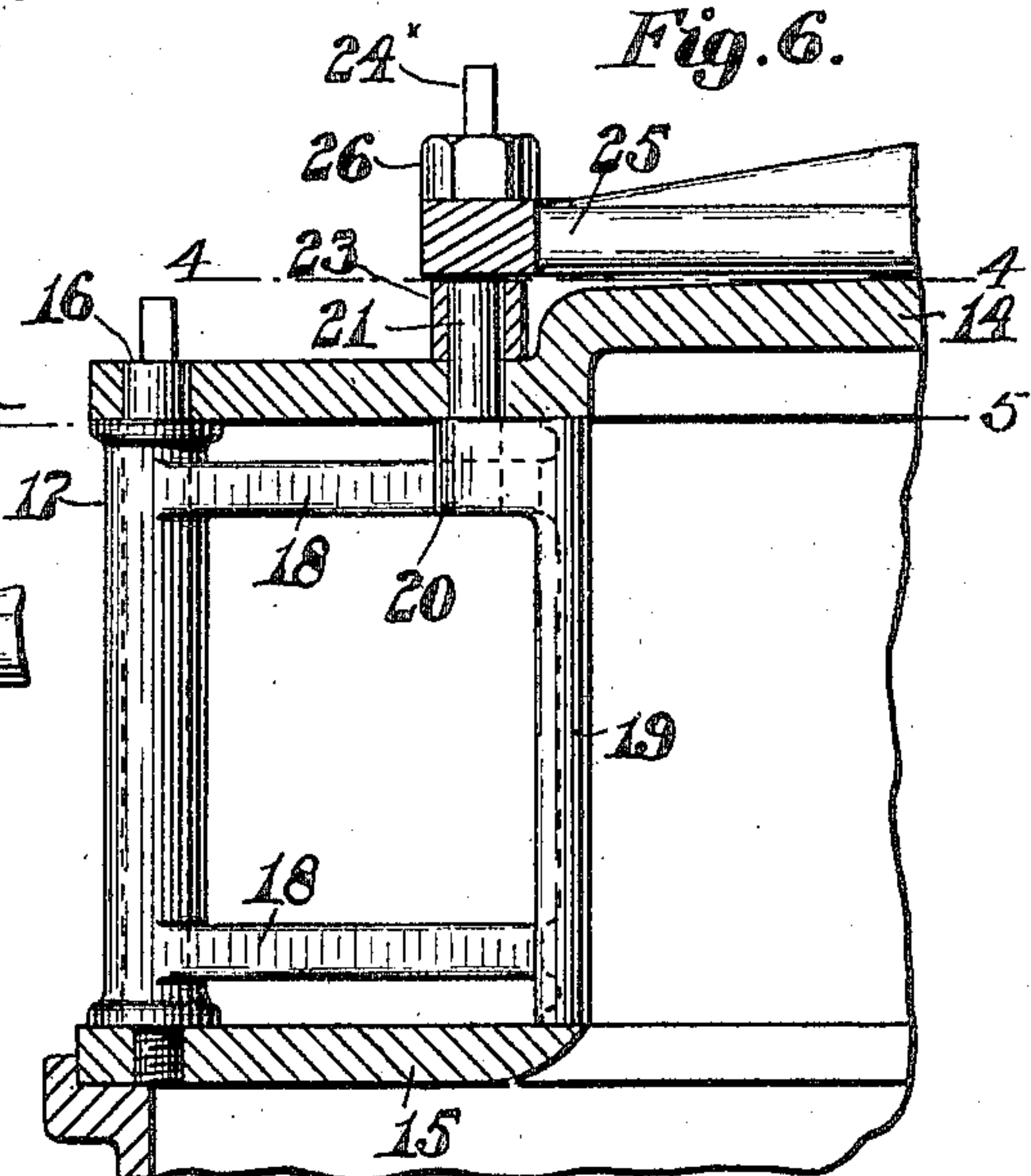


Fig. 6.

Fig. 7.

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UNITED STATES PATENT OFFICE.

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GATE MECHANISM FOR TURBINES.

No. 812,506.

Specification of Letters Patent.

Patented Feb. 13, 1906.

Application filed April 3, 1905. Serial No. 253,472.

To all whom it may concern:

Be it known that I, NATHANIEL LOMBARD, a citizen of the United States of America, and a resident of Worcester, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Gate Mechanism for Turbines, of which the following is a specification.

This invention relates to gate mechanism for turbines; and it has for its object the production of a balanced gate having a vent which directs the water at all positions of the gate tangentially into the buckets of the runner and at a point where the maximum efficiency will be secured.

It consists in certain novel features of construction and arrangement of parts, which will be readily understood by reference to the description of the drawings and to the claims to be hereinafter given.

Of the drawings, Figure 1 represents a vertical section of a turbine embodying the features of this invention. Fig. 2 represents a plan view of the same. Fig. 3 represents an enlarged plan of a portion of the same. Fig. 4 represents a horizontal section of the same on line 4 4 on Fig. 6. Fig. 5 represents a horizontal section of the same on line 5 5 on Fig. 6. Fig. 6 represents a vertical section on line 6 6 on Fig. 3. Fig. 7 represents a detail of the eccentric adjusting-stud, and Fig. 8 represents a plan of said stud enlarged.

Similar characters designate like parts throughout the several figures of the drawings.

In the drawings, 10 represents an ordinary runner of a turbine water-wheel having the usual buckets 11, to which water is admitted to rotate the same, transmitting the power to a shaft 12, mounted in bearings 13, integral with the top plate 14. Mounted between the top and bottom plates 14 and 15 at intervals are short vertical shafts 16, upon each of which is pivotally mounted between said plates 14 and 15 a hub 17, at either end of which and integral therewith are horizontal arms 18, upon the opposite end of which at a right angle to a line radial to said pivot is a curved gate 19, upon the top of which are lugs 20, to which a vertical stud 21 is secured, said stud passing through a curved slot 22 in the top plates 14. To control these T-shaped gates 19 simultaneously, there is pivotally mounted upon the free end of the stud 21 one end of a link 23, the opposite end of which is pivotally connected to a stud 24, said

stud having a reduced eccentric upper portion passing through a spider 25, the large portion forming a shoulder abutting against said spider 25 and secured thereto from rotation by a check-nut 26. The spider 25 is rotatably mounted upon the hub 13 of the top plate 14. The spider may be rotated in any well-known manner, as shown in Figs. 1 and 2 of the drawings, by mounting upon the spider 25 a sector of a gear 27, meshing with a pinion 28 upon a controlling-shaft 29 in a bearing 30, secured to the top plate 14.

The inner faces of the gates 18 are concentric to the pivot 16 and are so arranged relative to the water-wheel that when the wheel is in operation the said faces or an imaginary prolongation of said faces will always maintain the same angle to a line radial to the axis of said wheel. These curved inner faces of the gates 18 form one of the side walls of the passage through which the water is admitted to the wheel, and the water passing there-through is directed against the curved inner working faces, which, being concentric to said pivot, causes the water directed thereagainst to pass through the vent caused by the opening of said gates always substantially at the same angle without regard to the degree of opening of said gates.

To secure the proper spacing between the plates 14 and 15, at intervals between said plates are placed tubular separators 31, through which are passed bolts 32, provided with clamping means for securely clamping said plates 14 and 15 to the ends of said separators 31.

For the purpose of adjusting the gates at the installation of the mechanism the check-nut 26 on the eccentric studs 24 may be released, and by means of a wrench on the flattened portion 24* a partial rotation thereof may be given in the desired direction to effect the proper adjustment of the eccentric studs to secure the desired relative coöperation of all of the gates. Said studs are then clamped in position by tightening the nuts 26.

The movement of the gates is limited in one direction by the members 19, contacting with each other, while the separators 31 serve as stops in the opposite directions.

The operation of the invention is as follows: The shaft 29 is connected in any suitable manner to a governor or controlling mechanism for the purpose of operating and is turned in the direction of the arrow, as shown in Fig. 2, setting in motion through its pinion

28 and sector 27 the spider 25, thereby causing the link 23, through the stud 21 in the slot 22, to swing the gate around its pivot 16, thereby causing the vent to open to any desired degree and direct the water at a constant tangential angle to the runner 10. In this adjustment of the gates 18 a perfect balance is accomplished, enabling the gates to be more easily operated under a comparatively smaller amount of power than the present type of gates, which present an obstructing-surface in the direction of the flow of water.

As will be noticed from an inspection of Fig. 5 of the drawings, the inner and outer sides of adjacent gates when opened to any degree are so curved as to give the mouth an unobstructed vent, the passage between said gates being the shape of the vena contracta, said vena contracta thus directing the maximum theoretical amount of water to the buckets of the runner 10 for that opening of vent and at an angle which is at all times constant and tangential to that part of the turbine which will give the maximum efficiency. Having thus described my invention, I claim—

1. The combination with a water-wheel, of a plurality of gates each of which is provided with a curved inner face constructed and arranged to form a side wall of one of the inlets to said wheel, said face being concentric to the axis of said gate and interposed between said axis and the axis of said water-wheel.

2. The combination with a water-wheel, of a plurality of pivoted gates each provided with a member at right angles to a line radial to said pivot and interposed between said pivot and the axis of said water-wheel, each member being adapted to overlap another adjacent member and having a curved inner face concentric to its pivot, said face constructed and arranged to form a side wall of one of the inlets to said gates.

3. The combination with a water-wheel, of a plurality of pivoted gates each provided with a member at right angles to a line radial to said pivot and interposed between said pivot and the axis of said water-wheel, each member being adapted to overlap another adjacent member and having a curved inner face concentric to its pivot, said face constructed and arranged to form a side wall of one of the inlets to said gates, a rotatable member, and a link interposed between said rotatable member and each of said gates.

4. The combination with a water-wheel, of a plurality of pivoted gates provided with working faces concentric to the pivots thereof, the face of each gate being adapted in closed position to overlap the inner face of an adjacent gate, and means for moving said gates about their pivots.

5. The combination with a water-wheel, of a plurality of pivoted gates each having an inner working face concentric to its pivot adapted to serve as a side wall to direct the inflow at substantially the same point at all times.

6. The combination with a water-wheel, of a plurality of pivoted gates each having concentric to its pivot an inner working face constructed and arranged to form a side wall of the inlet to said wheel, and means for moving said gates simultaneously about said pivots.

7. The combination with a water-wheel, of two plates, studs interposed between said plates, a swinging T-shaped gate mounted upon each of said studs the cross member of which is adapted in closed position to overlap the cross member of an adjacent gate, and means for moving said gates about said studs.

8. The combination with a water-wheel, of two plates, studs interposed between said plates, a swinging T-shaped gate mounted upon each of said studs the cross member of which is adapted in closed position to overlap the cross member of an adjacent gate, means for moving said gates about said studs, a rotatable member above the top plate, and a link interposed between said rotatable member and each of said swinging gates.

9. The combination with a water-wheel, of a plurality of pivoted gates having members adapted to overlap each other when in closed position each of said members being provided with an inner working face concentric to the pivot of said gates constructed and arranged to form a side wall for an inlet to said water-wheel.

10. The combination with a water-wheel, of a plurality of gates each having a cross member interposed between its pivot and the axis of said water-wheel, said cross member being provided with an inner working face constructed and arranged to form a side wall to one of the inlets with said water-wheel, said inner face being curved on an arc which will cut a line radial to the axis of said wheel always at the same point.

11. The combination with a water-wheel, of a plurality of pivoted gates provided with overlapping members having inner faces concentric to the pivots of said gates, said concentric faces serving to direct the inflow substantially in the same direction at any opening of said gates.

Signed by me at Boston, Massachusetts, this 31st day of March, 1905.

NATHANIEL LOMBARD.

Witnesses:

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