W. F. UHL.

TURBINE.

APPLICATION FILED MAY 27, 1907.

922,216.

Patented May 18, 1909.

3 SHEETS—SHEET 1.

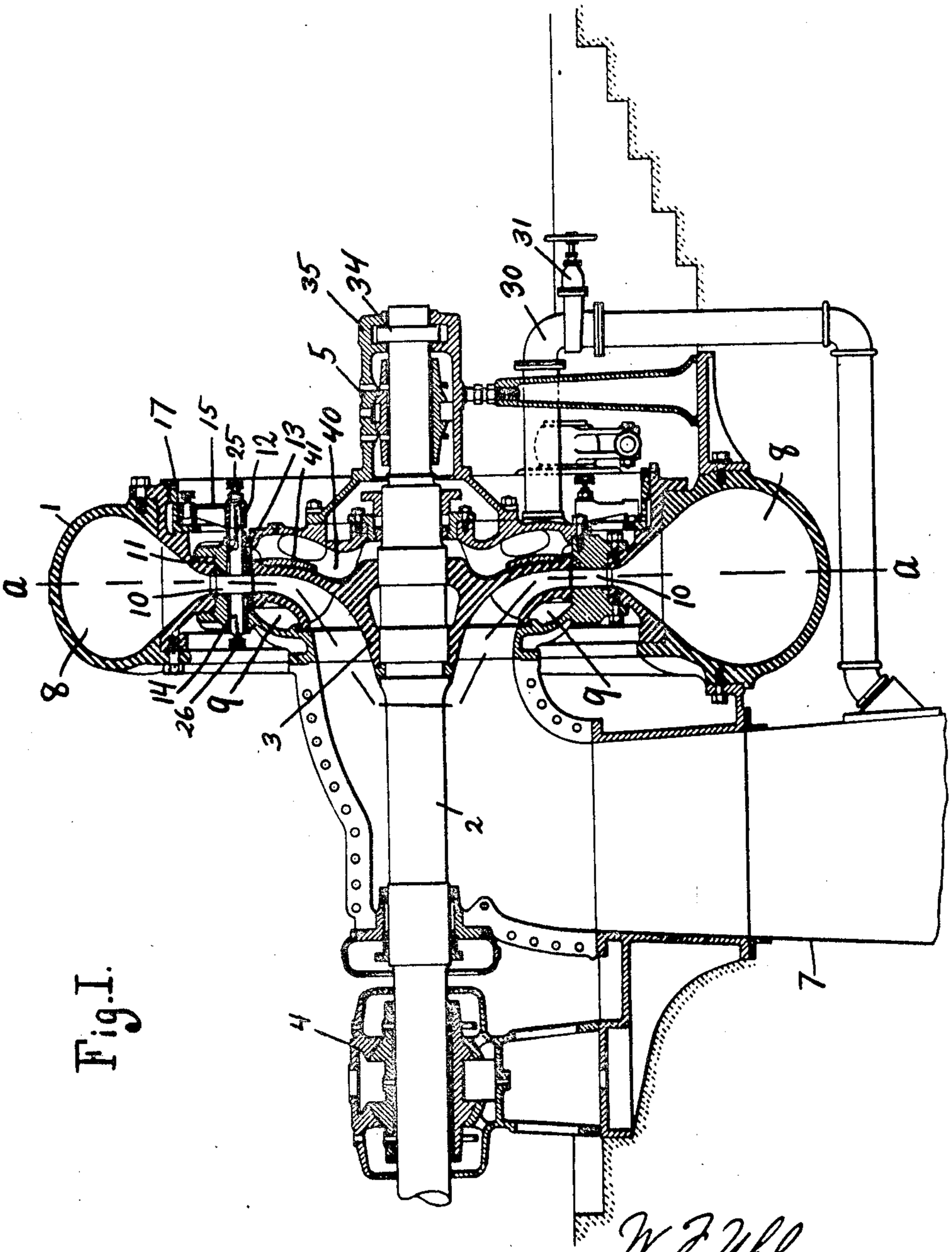

Fig. I.

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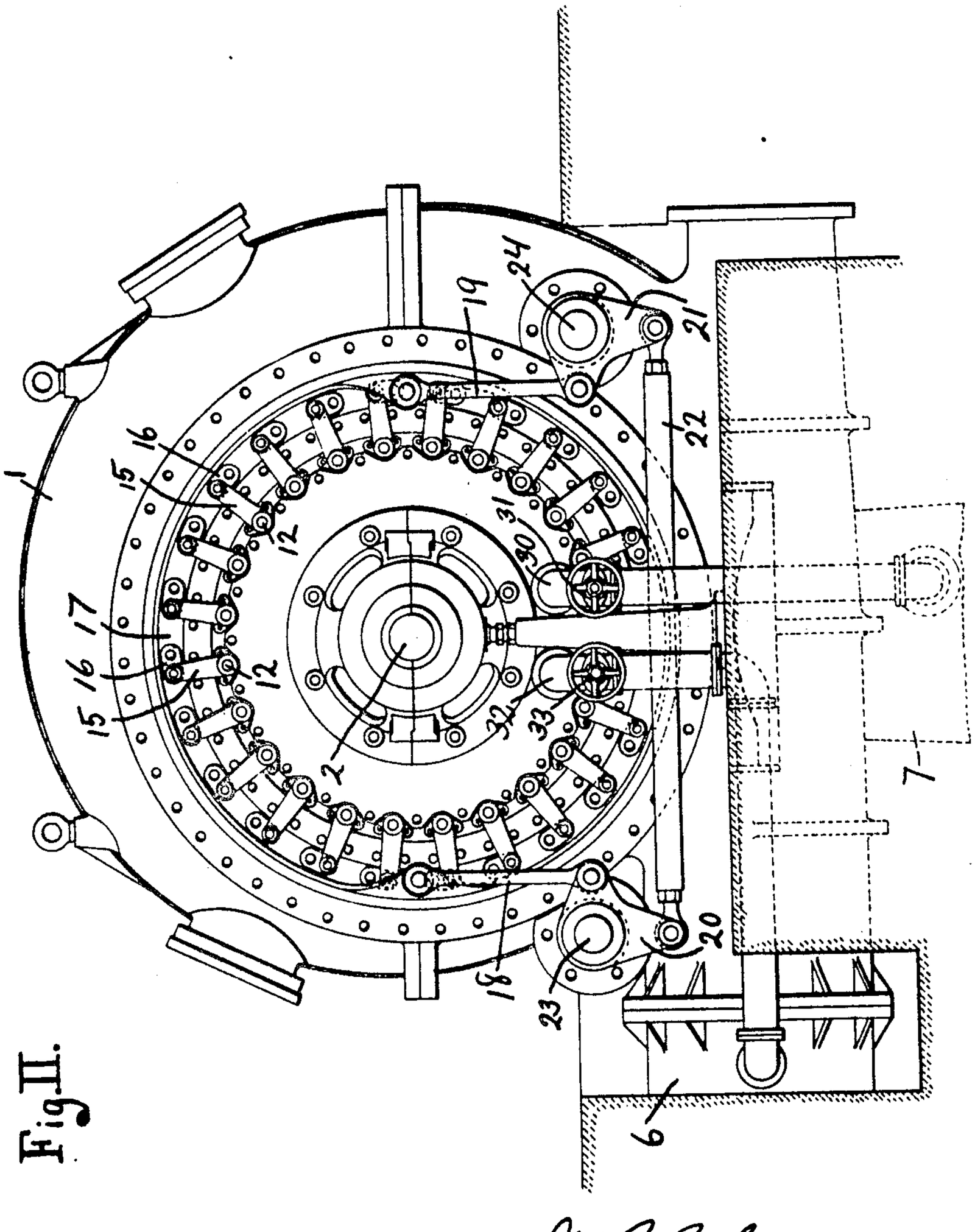

Fig II.

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3 SHEETS—SHEET 3.

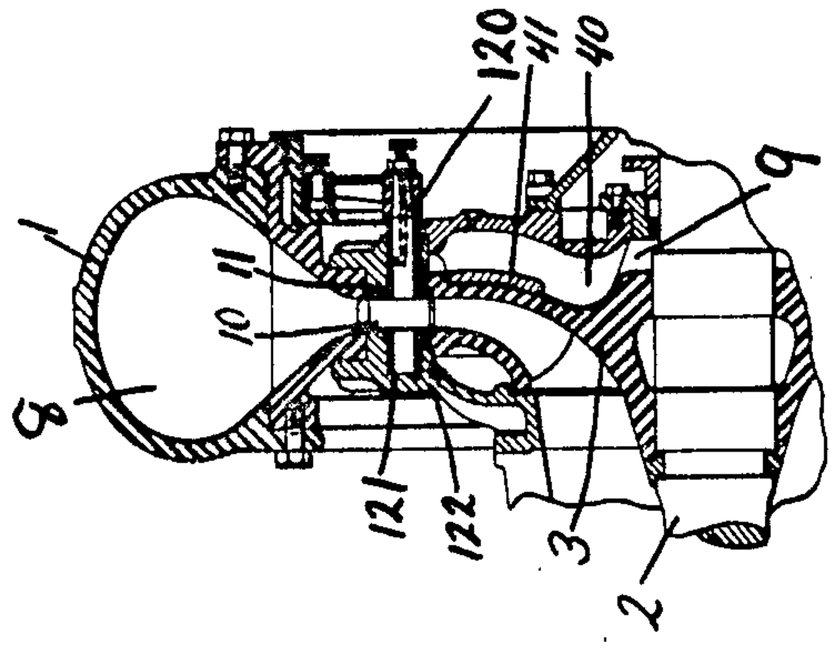

Fig. IV.

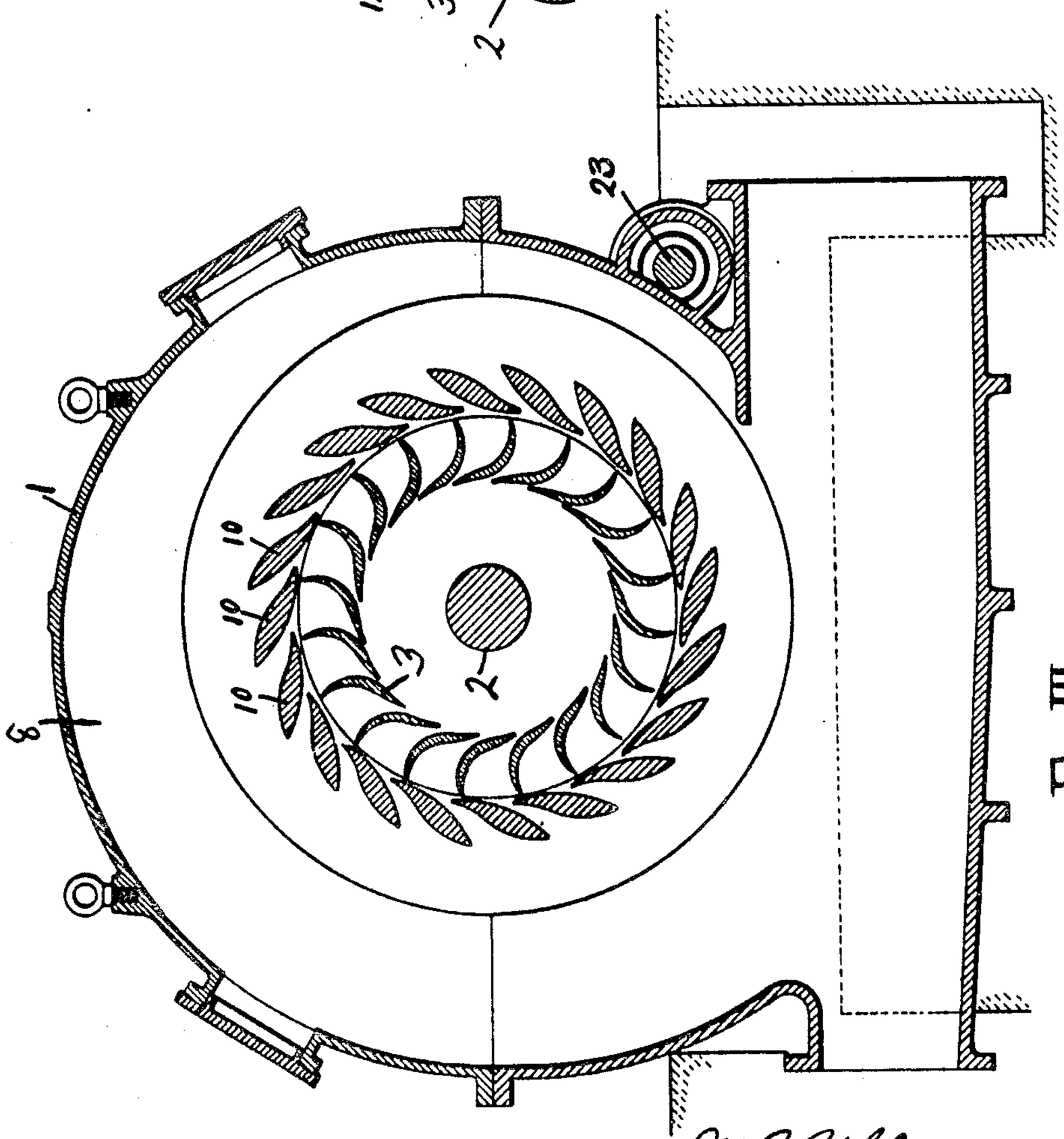

Fig. III.

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UNITED STATES PATENT OFFICE.

WILLIAM FRANK UHL, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO ALLIS-CHALMERS COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF NEW JERSEY.

TURBINE.

No. 922,216. Specification of Letters Patent. Patented May 18, 1909.

Application filed May 27, 1907. Serial No. 375,786.

To all whom it may concern:

Be it known that I, WILLIAM FRANK UHL, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Turbine, of which the following is a specification.

This invention relates to hydraulic turbines and is designed to provide a construction of turbine especially adapted for use with water under high heads, though not necessarily restricted to use with high heads, and the invention relates to the controlling and guiding mechanism for the water.

Prior to this invention two general schemes were employed for utilizing the energy of water in motion,—one scheme employed well known forms of turbines, these turbines being suitable for use with comparatively low heads, not exceeding say forty to sixty feet, a pit or penstock being provided within which the turbine mechanism was placed, or the water was conducted to the turbine by means of a pipe and casing. The other scheme involved the use of so-called impulse or impulse and reaction wheels, the water being led to the vicinity of the wheel through a penstock or pipe line and discharged through a nozzle against buckets carried by the wheel. Each scheme has its own special advantages and in actual construction and operation of water power plants that scheme was adopted which best fulfilled the requirements demanded by the particular location of the plant.

This invention relates to the type of water wheels generally designated as turbines and adapts such turbines for use with heads of water varying from the lowest head available for such wheels to the highest heads available for the so-called impulse wheels.

In all water wheel and turbine structures prior to this invention a system of guides and water controlling gates, or a system of water controlling gates which also served as guides, was employed, the individual gates of the system being provided with common actuating mechanism and either the whole or a part of this mechanism was located inside of the casing of the turbine and exposed to the water therein impeding its flow and causing whirls, eddies and other disturbances which prevented the proper delivery of the water to the wheel and diminished the efficiency of the turbine. Such structures become impracticable when the head of water under which the turbine must operate becomes great, and this invention has overcome the defects of prior turbines by providing a structure in which the gates only are exposed to the water, the operating mechanism being located outside of the casing and outside of the water spaces thereof.

Referring to the drawings which accompany this specification and form a part thereof and on which the same reference characters are used to designate the same elements in each of the several figures, and which drawings illustrate an embodiment of this invention,—Figure 1 is a vertical axial section of a turbine. Fig. 2 is an end elevation of a turbine. Fig. 3 is a vertical section taken on the line *a*—*a* of Fig. 1. Fig. 4 is a fragmentary section illustrating a modification.

Referring to the drawings, the numeral 1 designates a snail casing of a turbine which is provided with the shaft 2, with the runner 3 secured thereon, said shaft being extended out of the casing and supported by the bearings 4 and 5. The numeral 6 designates the penstock or pipe line, and the numeral 7 the draft tube, all of which parts may be of any usual or preferred construction. The snail shell casing is provided with two chambers, to one of which, 8, the water is ordinarily admitted at all times, while the other chamber, 9, contains the wheel or runner to which water is only admitted when it is desired that the turbine shall operate.

In the specific embodiment of the invention illustrated, a clear passageway or exit is provided around the interior of the ring-like chamber 8, through which the water is freely discharged except as controlled or interrupted by the combined guides and gates 10. Each of these gates 10 is so shaped that in conjunction with the adjacent gates on either side of it the water will be properly guided to act upon the runner of the turbine and they are also so constructed that adjacent gates can contact so as to prevent water issuing from the chamber 8 into the runner of the turbine. The outer periphery of each gate is continuous and comprises solely a working surface whereby no obstruction is encountered to produce eddies and consequently a high efficiency is attainable. As clearly shown by Fig. 1 of the drawings, each of these gates fits closely within the exit

11 from chamber 8, and each gate is provided with a spindle or axle 12, preferably formed integral therewith and extended from both sides thereof, which spindle is adapted to be received within suitable bushings 13 and 14, or to be supported in any equivalent way, by which they are retained in their proper position and water is prevented from passing out from the casing thereby.

To an end of each spindle which projects through the casing is secured a lever or crank 15, and each of these cranks is connected by links 16 to an actuating ring 17, which is adapted to be rotated by the links 18 and 19 connected with the bell crank levers 20 and 21, which in turn are for convenience also connected by the link 22, any ordinary or suitable means being employed to actuate one or both of the shafts 23 and 24 to which the bell crank levers 20 and 21 are secured.

The spindle 12 shown by Fig. 1 of the drawings is extended at each end through the casing, this structure being adopted for the reason that tallow can be forced by the grease cups 25 and 26 through holes in the spindle to lubricate the bearings of the spindle in the bushings, this construction being essential where the turbine is intended to be worked under very high heads.

The spindle 120 in the modification shown by Fig. 4 is extended through only one side of the casing and is seated in a recess 121 on the opposite side of the casing, a drip aperture 122 being provided to afford an exit for any water which might leak by the spindle and into the recess 121, in order that no end pressure may be exerted against said spindle 120.

It will be seen that the structure disclosed by this specification and the drawings accompanying the same is very simple and very efficient and that the only parts of the water-controlling apparatus which is exposed to the water or which is located in the path of flow of the water are the guides or gates 10.

In the operation of the turbine more or less water will accumulate in the chamber 9 by leakage past the circumference of the wheel or runner, and if this water were allowed to accumulate it would completely fill said chamber and would exert a pressure against the side of the runner away from the draft tube, which would tend to force the runner toward said draft tube according to the size of the turbine and the amount of head.

Heretofore it has been common to provide drainage means for the chamber 9 by which the water accumulating in said chamber might flow out therefrom and the drawings illustrate such drainage means, viz., the pipe 30 provided with the controlling gate 31, said pipe for convenience being tapped into the draft tube, whereby any water accumulating in chamber 9 may flow out into the draft tube, and whereby the diminished pressure on the front or draft tube side of the runner may be utilized in said chamber 9.

The numeral 32 designates a pipe provided with a gate 33, said pipe being also in communication with chamber 9 and with a supply of water under pressure, as for example, with the water in the penstock or pipe line 6. By means of this pipe, the pressure due to the head of the water may be utilized in chamber 9 to overcome or oppose an end thrust upon the shaft 2, and by proper adjustment of the two gates 33 and 31 the water from the penstock may be utilized to exert any required pressure within chamber 9 to oppose end thrust on the shaft 2 that may be desirable, the limits of power available varying from that due to the maximum head of the water to that due to the greatest diminution of pressure resulting from the action of the draft tube.

The numeral 34 designates an ordinary thrust collar adapted to engage with thrust bearing 35 to positively position the shaft and runner and to care for any slight excess of thrust in either direction.

If water be present in chamber 9, owing to the high velocity of the rotating runner, it will be thrown outward by centrifugal force and will create a pressure due to its centrifugal force at the circumference of the runner. In order to avoid any such occurrence, the casing is provided within the chamber 9 with radially disposed partition plates 40 which extend closely adjacent to the rear side of the runner, and these plates may be connected by ribs 41 to strengthen them. These partitions 40 oppose the water which is set into motion by the runner and prevent its acquiring any considerable velocity and generating centrifugal force.

What I claim is,—

In a turbine, the combination of a casing having two chambers connected by an annular passage having continuous plane sides, a wheel in one of the chambers having its passage alining with said annular passage, and a gate in said annular passage having a spindle entering ports in the sides of said annular passage one of the ends of said spindle extending through said casing for operating said gate and the outer periphery of said gate being continuous and comprising solely the working surface.

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

WILLIAM FRANK UHL.

Witnesses:
G. F. De Wein,
Frank E. Dennett.