A. PFAU.

WATER WHEEL.

APPLICATION FILED JULY 25, 1907.

978,335.

Patented Dec. 13, 1910.

2 SHEETS—SHEET 1.

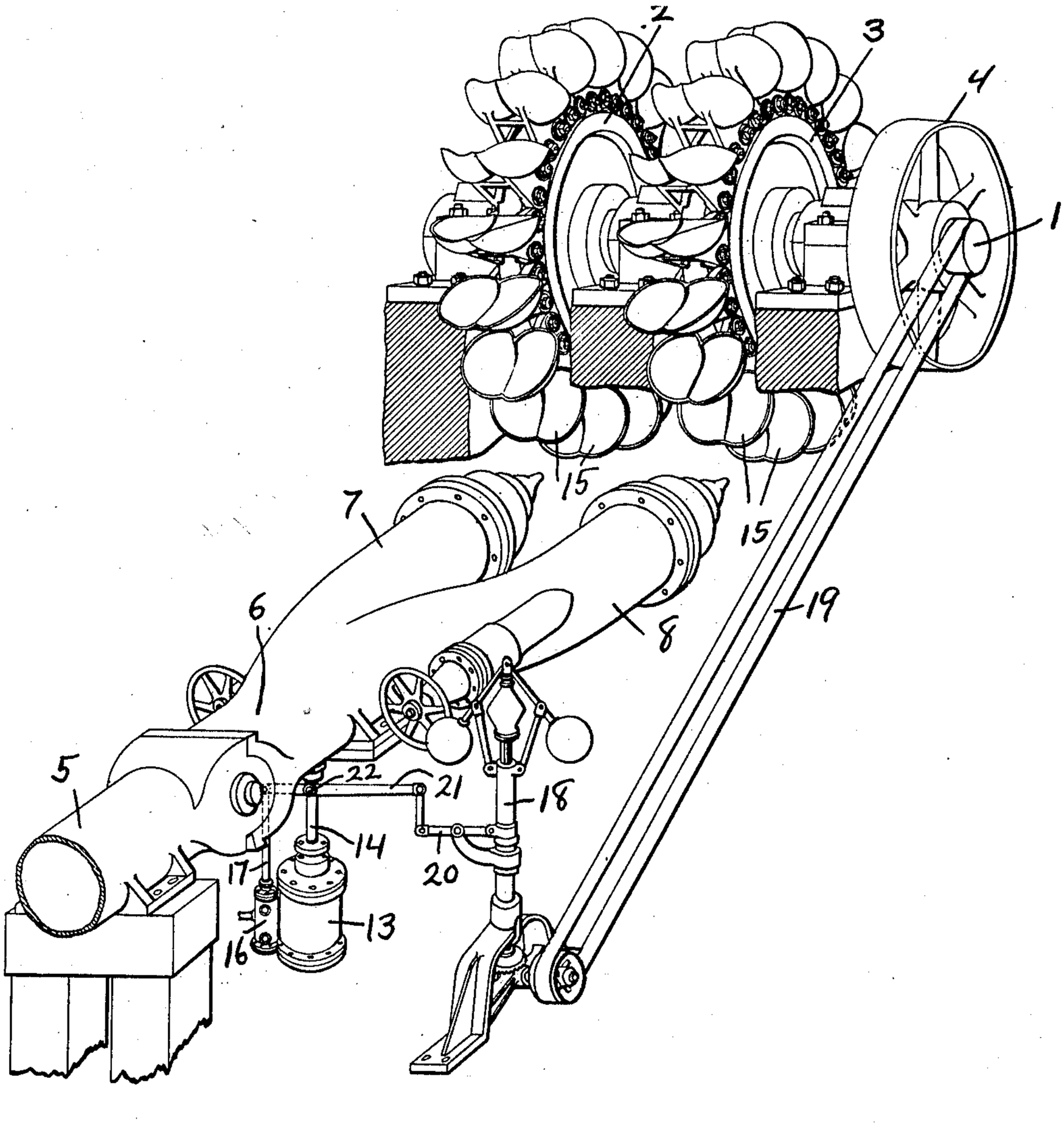

Fig. 1.

WITNESSES:
John C. Rennie
Frank E. Dennett

A. Pfau INVENTOR

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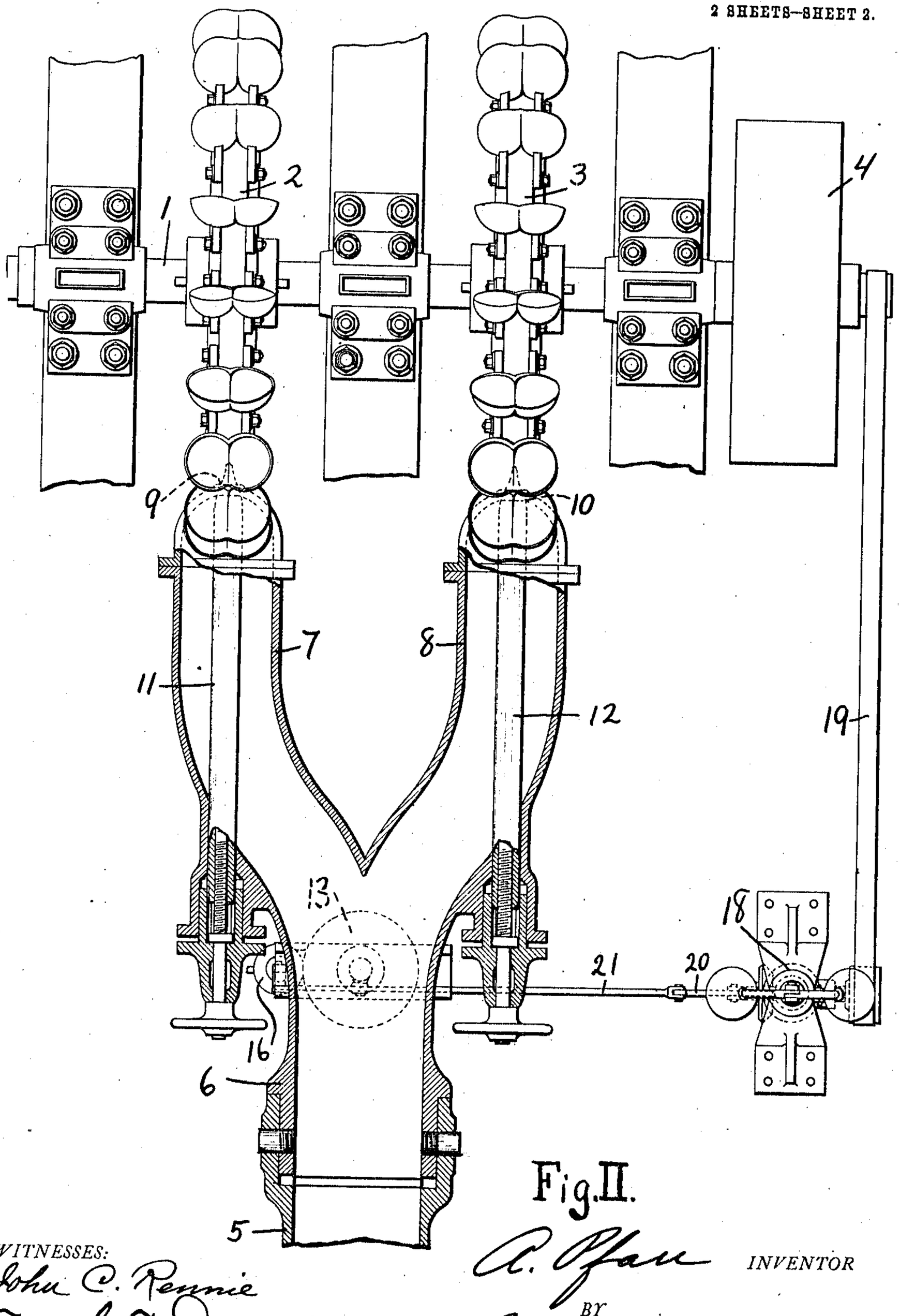

Fig. II.

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UNITED STATES PATENT OFFICE.

ARNOLD PFAU, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO ALLIS-CHALMERS COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF NEW JERSEY.

WATER-WHEEL.

978,335. Specification of Letters Patent. Patented Dec. 13, 1910.

Application filed July 25, 1907. Serial No. 385,404.

To all whom it may concern:

Be it known that I, ARNOLD PFAU, a citizen of the Republic of Switzerland, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Water-Wheel, of which the following is a specification.

This invention relates to water wheels and specifically to water wheels of the type known as impulse or impulse and reaction wheels, by which the energy of a moving jet of water is utilized, and more specifically the invention relates to a combination of apparatus for effecting a regulation of such wheels according to the load imposed upon them or the power which is being consumed.

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 wherever they may appear in each of the several views, and which drawings disclose an embodiment of this invention,—Figure 1 is a perspective of a water wheel apparatus embodying this invention; Fig. 2 is a plan view of the apparatus shown by Fig. 1, parts being shown in section.

On the drawings the numeral 1 designates a shaft which is suitably supported by proper bearings, and upon this shaft are keyed the water wheels 2 and 3 and the pulley 4.

The numeral 5 designates the water supply pipe to which the nozzle 6 is hinged so as to be movable in a vertical plane, the nozzle 6 being provided with the two branches 7 and 8 through which the water is directed respectively to wheel 2 and to wheel 3, each of these branches being provided with an orifice 9 and 10 adapted to be controlled respectively by the manually adjustable valves 11 and 12.

The numeral 13 designates a power or relay cylinder provided with a piston (not shown) and piston rod 14, the piston rod being secured to nozzle 6 and being adapted to move said nozzle up or down whereby the water issuing from the orifices of the nozzle is directed against the buckets 15 of the wheels, or is delivered below said buckets without impinging thereon, the movements of said piston and piston rod being caused by a fluid under pressure, preferably water, which may be taken from the pipe 5, and which is admitted into one or the other end of the cylinder 13, through the valve chest 16, by means of any suitable valve mechanism actuated by the valve stem 17.

The numeral 18 designates any suitable or preferred type of governor, the specific type shown being an ordinary fly ball type which is actuated from shaft 1 by the belt or equivalent motion transmitting mechanism 19, the governor being connected by the levers 20 and 21 with the valve rod 17, the lever 21 being also connected by the pivot 22 with the piston rod 14, this specific arrangement of parts being an ordinary type of relay mechanism rendering the governor static in its operation. In other words, the piston rod 14, when it moves causes the admission valve connected to valve stem 17 to be seated, whereby a step by step movement of the piston rod 14 results as the speed of rotation of the shaft 1 decreases or increases.

The operation of the apparatus is as follows: Two or more wheels being secured to the same shaft and the number of branches of the nozzle 6 corresponding with the number of wheels, if the valves controlling the orifices of said branches be open, the power developed on shaft 1 will be proportional to the number of wheels, assuming that the water acts with constant velocity resulting from a constant head. If, now, the work required and the power taken from shaft 1 is the full power which can be developed by the wheels when all are at work, the speed of rotation of the shaft 1 will remain constant; but if less power is required, the speed of said shaft will increase, the governor balls will diverge and the jets of water will be deflected more or less from the buckets of the wheels, resulting in a great waste of water. If, however, one of the valves be now closed, the speed of the wheels will be diminished providing the jets are impinging against the buckets at all, with the result that the remaining jets or jet will be directed more on to the buckets until the power developed is equal to the power consumed, when the speed of rotation of the shaft 1 will again become constant. This combination of a plurality of wheels and a plurality of jets gives a wide range of regulation running from a fraction of a single jet acting upon a single wheel, up through

all increases of power to the point where all jets are acting at full capacity upon all the wheels.

What I claim is,—

The combination with a shaft, of a plurality of water jet actuatable wheels thereon, a pipe for supplying water to said wheels, a branched nozzle hinged to said pipe at a single connection with the hinge axis at an angle to the pipe conduit at the single hinge connection, the number of branches of said nozzle corresponding to the number of wheels upon said shaft, each of said branches being provided with a valve for controlling the flow of water therethrough, a governor responsive to the changes of speed of said shaft, and a single regulating means controlled by said governor for raising and lowering said branched nozzle.

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

ARNOLD PFAU.

Witnesses:
H. C. Case,
Frank E. Dennett.