

W. A. DOBLE.  
HYDRAULIC NOZZLE.  
APPLICATION FILED OCT. 17, 1903.

Patented June 22, 1909.

926,055.

Fig. I

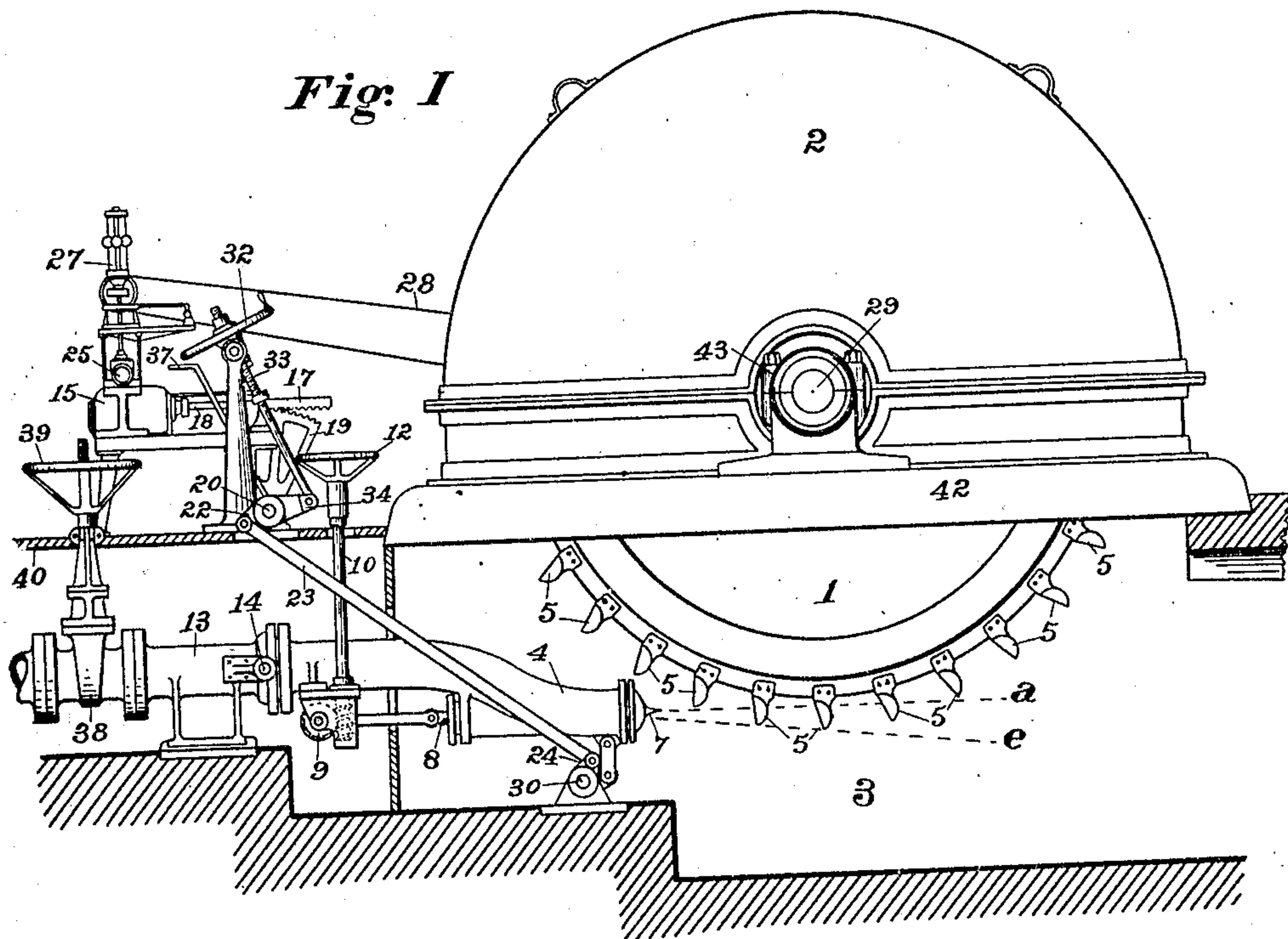
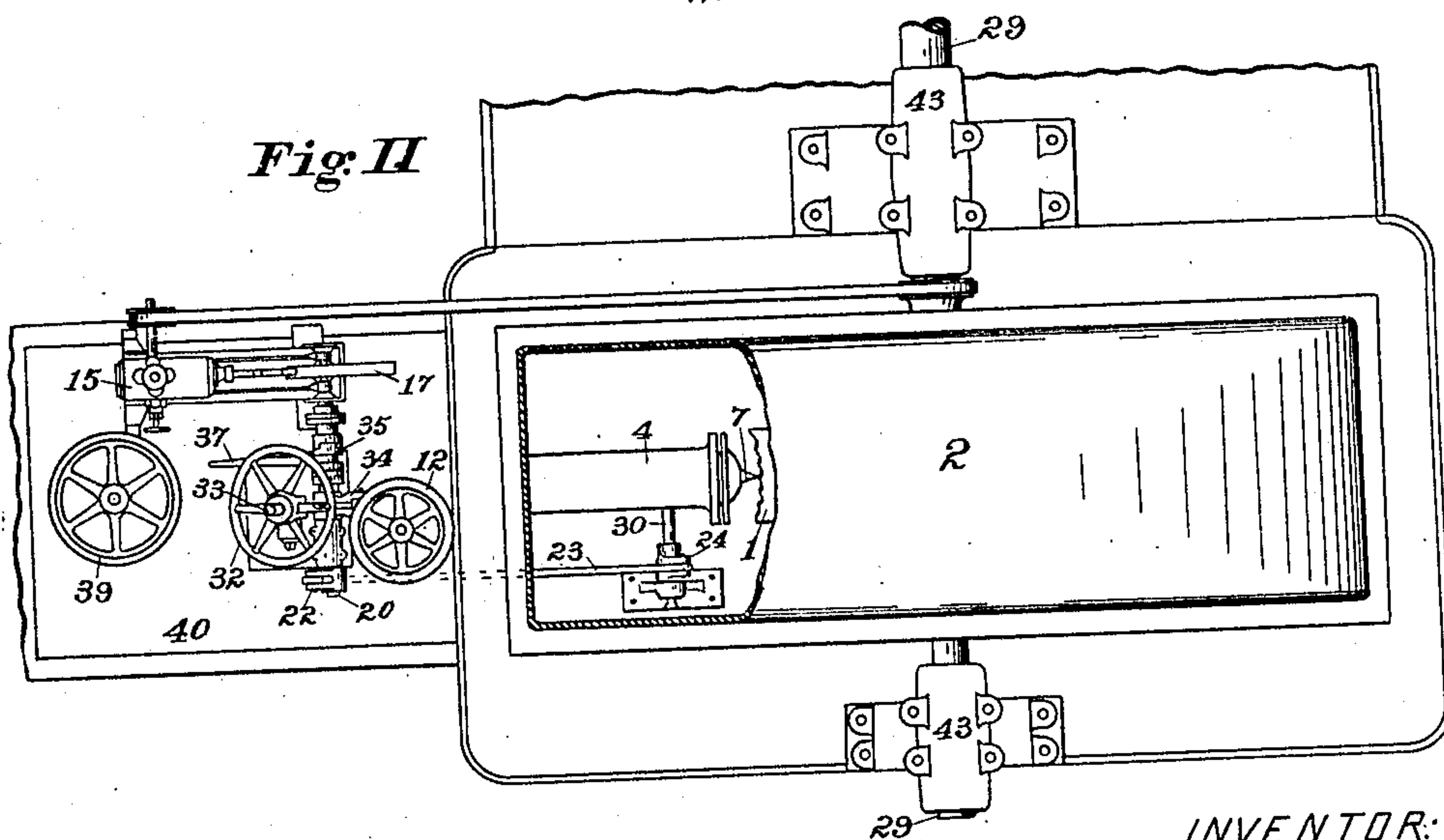


Fig. II



WITNESSES:

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# UNITED STATES PATENT OFFICE.

WILLIAM A. DOBLE, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO MAY E. DOBLE.

## HYDRAULIC NOZZLE.

No. 926,055.

Specification of Letters Patent.

Patented June 22, 1909.

Application filed October 17, 1903. Serial No. 177,447.

*To all whom it may concern:*

Be it known that I, WILLIAM A. DOBLE, a citizen of the United States, residing at San Francisco, county of San Francisco and State of California, have invented certain new and useful Improvements in Hydraulic Nozzles; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to improvements in that class of hydraulic apparatus where the motor power is the energy of a jet of water which is caused to operate upon the part to be moved, as for instance a bladed wheel, and has for its object to adapt the apparatus to certain varying conditions with the purpose of avoiding waste of water and interferences with the normal flow thereof to other stations when required.

Under some circumstances, as in certain States and Territories of the United States where the water supply is derived from small streams at high elevations, there are restrictions as to the use of such streams at a point that will interfere with the natural flow to a station below, such use being prohibited by law or custom; and there are natural variations resulting from the fact that during certain portions of the day the supply is abundant, while at other times it is greatly reduced. Under nearly all of the different conditions the water supply is more or less limited and requires to be used economically, and it is also further required to vary the energy or character of the stream used in proportion to the load.

In order to provide an apparatus adapted to these various conditions, I make use of a nozzle and means whereby the stream or jet therefrom may be so changed in relation to the wheel or other object driven thereby that the power applied to the driven object may be quickly varied by a change of the direction of the stream to compensate for the variations of the load; and I also provide means whereby the discharge outlet of the nozzle may be varied, either in accordance with the varying amount of the supply, or in accordance with the major variations of the load demanding a greater or less amount of energy in the actuating jet.

While my apparatus may be embodied in different constructions, I have shown in the drawing one form in which it may be effectively employed, wherein the tangential water wheel 1 is mounted in a casing 2 over a pit 3 and driven by water from a nozzle 4 the water from which impinges tangentially against the buckets 5. This nozzle 4 is provided with a core piece 7 approximately of spindle form as described in Letters Patent No. 660,789, granted to me on the 30th day of October, 1900, for an improvement in hydraulic regulating nozzles. This core piece 7 is operated by a stem 8, tangent wheel 9 and a screw on the end of the vertical shaft 10, as indicated in Figure I. By means of these last named devices and a hand wheel 12 at the top, the stem 8 and core piece 7 are advanced and drawn back, enlarging or contracting the escape orifice of the nozzle 4 so as to pass a sufficient quantity of water to operate the wheel 1 against its maximum load or resistance, or more than this quantity if required. These devices regulate the volume of water that passes through the nozzle and require infrequent adjustment so long as the water wheel is performing a nearly constant duty and the supply of water remains the same, but do not provide for regulation of speed of the water wheel or for fluctuations of its load, and could not do so because abrupt or sudden changes of the volume of water and flow in the supply pipe 13 is not practicable in the case of high pressures and long pipes such as are commonly employed for tangential water wheels.

To effect regulation of the speed and power of the wheel 1 the nozzle 4 is pivoted at 14 and has a spherical joint of the usual construction so the nozzle can be moved upward or downward to deflect the jet of water as indicated by the lines *a* and *e* in Fig. I. In this manner it will be seen that the impact is nearer to or farther from the center and that more or less of the section of the jet will impinge upon or within the buckets 5 and the remainder will pass on without effect, the volume of water and its rate of flow remaining the same when adjusted by means of the hand wheel 12 as before explained.

To move the nozzle 4 upward and downward I employ any suitable regulating or governing mechanism, preferably a hydrau-



lic cylinder 15 having a rack 17 attached to the piston rod 18 and operating a toothed sector 19 on the shaft 20, and on the end of this latter a crank 22 and a link 23 that extends to and operates the shaft 30 and toggle gearing 24 below and connected to the nozzle 4 as shown in Fig. I.

The distribution of water to the hydraulic cylinder 15 is performed by a balanced slide or piston valve at 25 of the usual construction, operated by a centrifugal governor 27 driven by a belt 28 from the water wheel shaft 29 or other mover positively connected thereto.

I do not particularly describe the construction of these regulating devices because they are well known as an article of separate manufacture, are commonly applied to water wheels and capable of modification to meet the requirements in different cases.

The toggle gearing at 24 is provided to equalize the resistance in moving the nozzle, also to provide room laterally for the link 23 by means of the shaft 30, as shown in Fig. II. To raise or lower the nozzle independently of the automatically acting devices just described I provide a hand wheel 32 and screw 33 attached to a loose crank 34 on the shaft 20. This crank 34 connects to the shaft 20 by means of a shifting clutch 35 operated by a lever 37 so as to be thrown into gear when required and detached when the regulator is in regular operation.

A stop valve 38 operated by a hand wheel 39 is placed in the supply pipe 13 and all the operating parts requiring adjustment are accessible from a platform 40. The present drawing is made to a scale of one in 15, and the example taken from a water wheel of 1300 horse power operating under a head of 1,900 feet.

The housing 2, main frame 42, journal bearings 43, and main shaft are of the usual construction and will be understood without description.

It will be seen that in order to properly operate the valve or control device, whatever it may be, that regulates the flow through the end of the nozzle, I have imparted a bend to the latter, so that the actuating stem of the said device may be carried through the side of the nozzle and thus avoid the necessity of obstructing the flow through the nozzle by devices within the latter for shifting the position of the valve.

I desire it to be understood that my invention is not limited to any particular form of mechanism or details of construction, but may be embodied in many different forms, the one described in the foregoing specification being considered the best form in which it may be embodied.

Having thus described the nature and objects of my invention what I claim as new

and desire to secure by Letters Patent, is:—

1. In a water wheel nozzle, devices to move or deflect the same so that the jet therefrom will impinge upon wholly, in part, or pass the water wheel buckets, and in combination therewith, devices separately adjustable within the nozzle to control the volume of water discharged therethrough, substantially as described.

2. In combination with a pivoted nozzle of the character described, means for adjusting said nozzle on its pivot, and instrumentalities for regulating the cross-sectional area of discharge from the nozzle, said instrumentalities being carried by and within the nozzle and free to move therewith whereby the same may be adjusted irrespective of the position of the nozzle, substantially as described.

3. In combination with an impact wheel and its buckets of a nozzle of the character described, primary means whereby an approximate adjustment may be given said nozzle to vary the position of the stream discharged therefrom, and secondary means within the nozzle for regulating the cross-sectional area of the stream to correspond with the adjustment of the stream's position.

4. In combination with a pivoted nozzle mounted to swing in a vertical plane and of the character described, automatic means for adjusting said nozzle on its pivot, and instrumentalities for regulating the cross-sectional area of discharge from the nozzle, said instrumentalities being carried by and within the nozzle and free to move therewith whereby the same may be adjusted irrespective of the position of the nozzle.

5. In combination with an impact wheel and its buckets of a single discharge nozzle of the character described, primary means whereby an approximate adjustment may be given said nozzle to vary the position of the stream discharged therefrom and secondary means within the nozzle for regulating the cross-sectional area of the stream to correspond with the adjustment of the stream's position, substantially as described.

6. The combination with an impact wheel and its buckets of a line of supply pipe, of a discharge nozzle movably connected thereto, automatic means for raising and lowering the nozzle in accordance with the load variations, and means adjustable within the nozzle whereby the outlet area for the stream ejected from the nozzle is varied to meet the requirements of the load or supply changes.

7. The combination with an impact wheel and its buckets and a nozzle, of means for raising or lowering the same proportionate to the load variations, and means within the nozzle for varying the stream's area in accordance with the variation of the water supply.



8. The combination with an impact wheel  
and its buckets of a hinged and bent nozzle  
and with means for automatically swinging  
said nozzle, of means within the nozzle for  
5 controlling the flow through the nozzle at  
a point beyond the curve thereof.

In testimony whereof I have signed my

name to this specification in the presence of  
two subscribing witnesses.

WILLIAM A. DOBLE.

Witnesses:

P. W. J. LANDER,

ALFRED A. ENQUIST.