No. 659,794. Patented Oct. 16, 1900.

W. A. DOBLE.

HYDRAULIC NOZZLE.

(Application filed Oct. 17, 1899.)

(No Model.)

Fig. I.

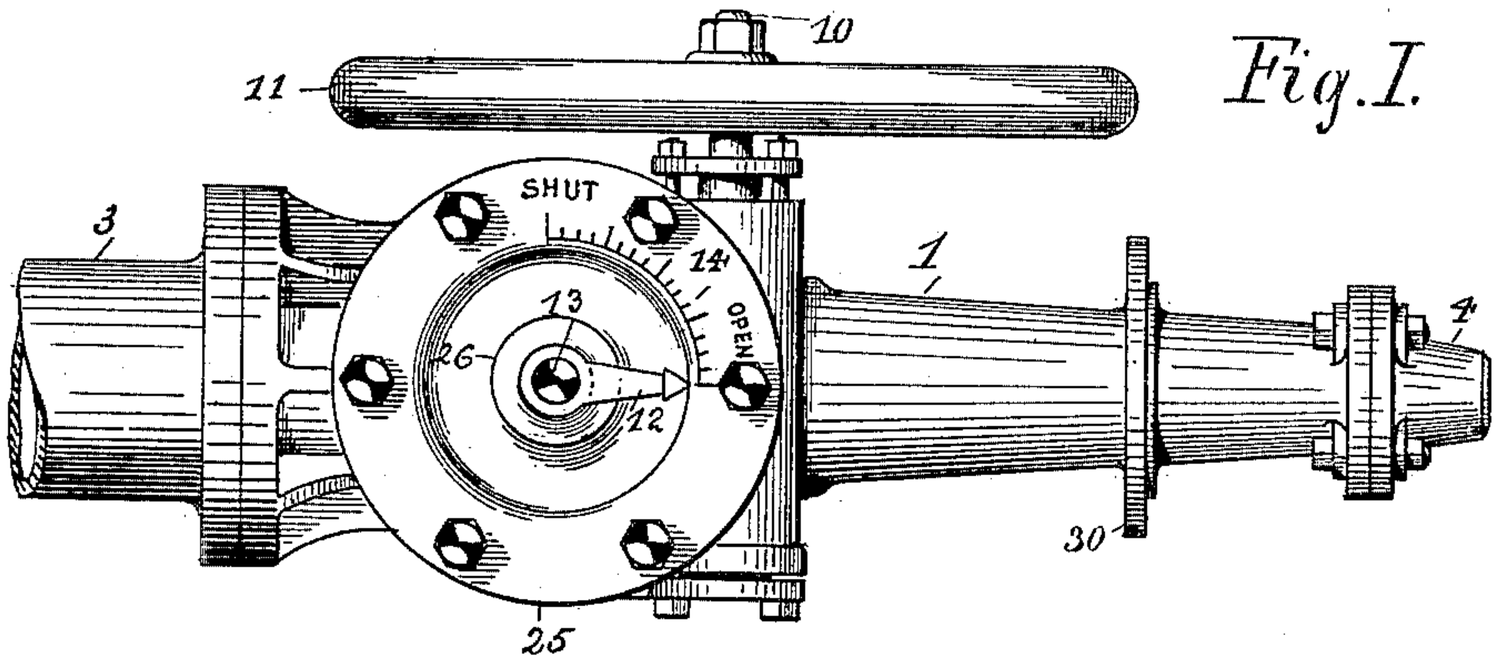


Fig. II.

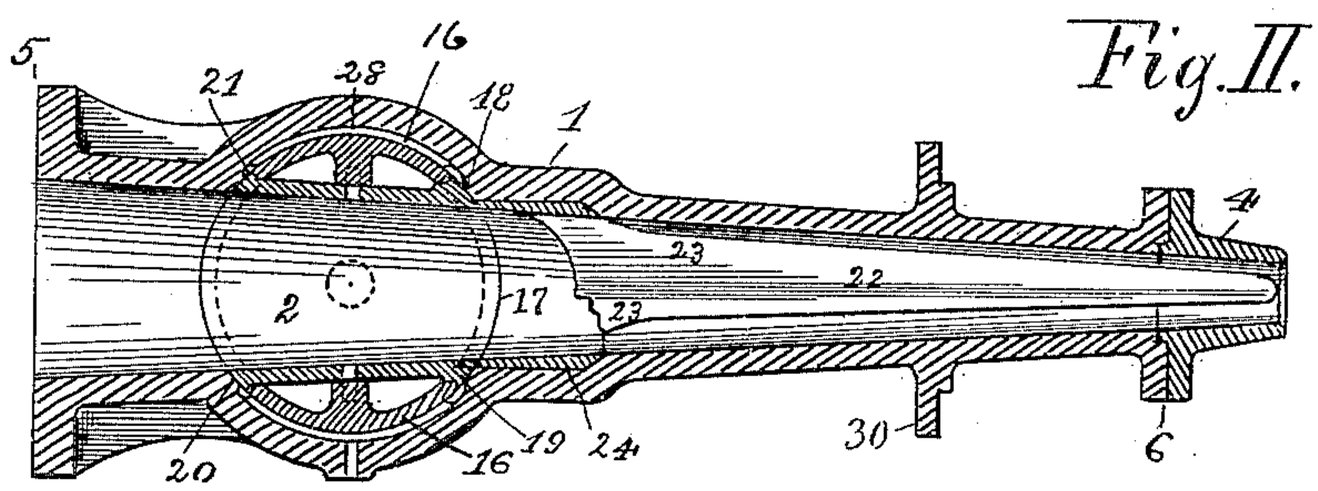


Fig. III.

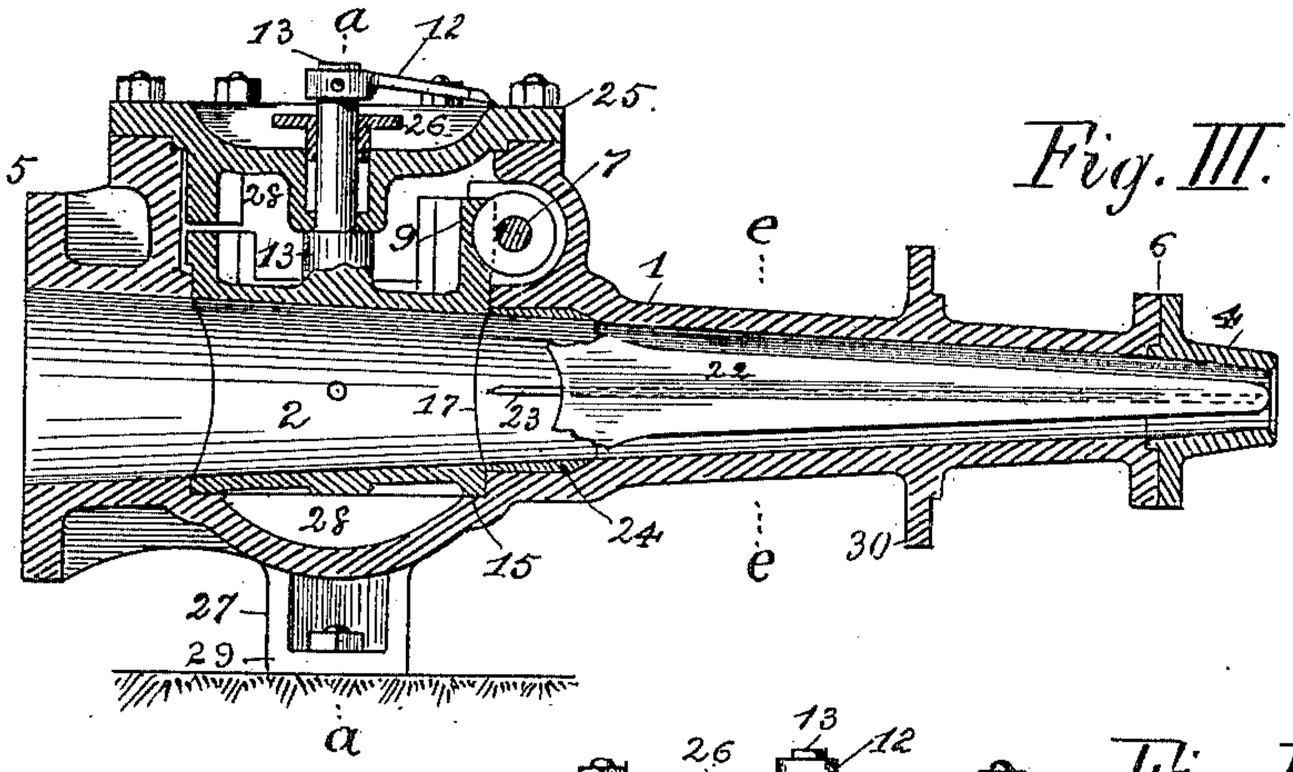


Fig. IV.

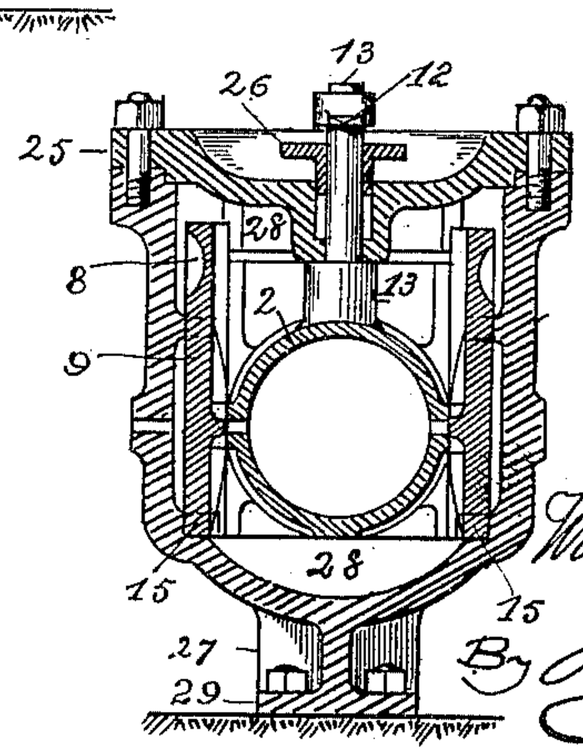
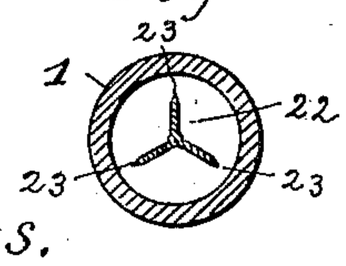


Fig. V.



Witnesses.

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HYDRAULIC NOZZLE.

SPECIFICATION forming part of Letters Patent No. 659,794, dated October 16, 1900.

Application filed October 17, 1899. Serial No. 733,855. (No model.)

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 hydraulic nozzles of fixed capacity for discharging water for power or other purposes and to certain improvements therein tending to direct the water in parallel course and render the jets or streams more solid and effectual.

My improvements consist in means to prevent a swirling motion of the water in the nozzles caused by the flow being at the sides of the nozzle oblique to its axis and converging beyond the point of discharge, in means to compensate or equalize retarding friction on the interior of the nozzle to permit more uniform velocity throughout the cross-section of the stream, and also in a peculiar gate or valve constructed as a constituent portion of such nozzles without affecting the symmetry of their bore and adapting such valves or cocks to receive a lubricant around their exterior, which improvements are hereinafter fully described and explained.

The objects of my invention are to maintain the integrity or solidity of such streams or jets of water up to the point of impingement when employed for impelling water-wheels and for as great a distance as possible in the case of quenching fire or for other purposes, thus utilizing in the fullest possible degree the energy and useful effect of water consumed. To this end I construct hydraulic nozzles as illustrated in the drawings herewith forming a part of this specification.

Figure I is a plan view of a nozzle constructed according to my invention for applying water to a tangential water-wheel. Fig. II is a horizontal section through the axis of the same nozzle. Fig. III is a longitudinal vertical section at a right angle to Fig. II. Fig. IV is a transverse section on the line *a a* in Fig. III, and Fig. V a similar section on the line *e e* in the same figure.

The efficiency of a jet of a water or the degree in which its energy can be utilized as a motive force and the distance to which a stream can be discharged without breaking or being converted to spray, especially under high pressure, is in a great degree dependent upon the construction of nozzles and the absence of internal disturbances that are obscure and determinable by experiments only. Such disturbances, so far as known, are caused by swirling action, change of course, by the convergence of tapering nozzles, retardation by friction against the inner surfaces of the nozzle, and the expansion of contained air, which disturbances disrupt and diffuse a stream at a short distance from the point of issue. They also exist throughout the whole length of a stream or jet in a greater or less degree. In view of these circumstances and to attain solid streams of water I construct hydraulic nozzles, as shown in the drawings now to be referred to.

Similar numerals of reference indicate corresponding parts.

The main body of the nozzle 1 I construct of iron for moderate and of steel for high pressures, and by preference in the case of water-wheel nozzles I provide as a portion thereof and in part integral therewith a valve or cock 2 to open and close the nozzle, so constructed as to constitute when open a symmetrical section of the nozzle's bore, as will hereinafter be more fully explained.

The proportions shown in the drawings are for a nozzle adapted for a tangential water-wheel to sustain pressures up to heads of fifteen hundred feet, 3 being the supply-pipe and 4 a detachable tip which can be renewed when worn by scour, also for different sizes. For fire purposes or when used with hose the construction of the nozzle, except as to its strength and method of attachment, is made the same, the valve or cock 2 being included or not, as the convenience of use may determine.

Referring to Figs. II and III, it will be seen that the main body of the nozzle from 5 to 6 has a uniformly-tapered bore, which taper is slightly contracted through the tip 4; also, that the cock or valve 2 when open or in the position shown in the drawings forms a symmetrical portion of this tapered bore. The valve or cock 2 is turned by any suitable device—such as a lever, spur-wheels, or tangent-gearing—as shown in the drawings, where a

tangent-screw 7 meshes into corresponding teeth 8, formed for a sufficient distance around the upper end of the main shell 9 of the valve. The screw 7 is mounted on a spindle 10, turned by the hand-wheel 11, an index-pointer 12 on the stem 13 indicating the position of the valve on the scale 14, as shown in Fig. I. This valve 2 bears at the bottom on the ledge at 15 and, as will be observed, is otherwise out of contact with the surrounding walls and in equilibrium in respect to water-pressure, except when one of the detachable faces 16 covers the bore at 17. The detachable faces 16 are preferably made of hard non-corrosive metal and carefully finished to fit the contour of the finished surfaces in the valve-chamber from 18 to 19 or from 20 to 21, as shown in Fig. II. The valve 2 is held concentric in its chamber by fitting in the circular seat 15 at the bottom and by the stem 13 at the top, the latter passing through the removable cap 25 and a packing-gland 26, as seen in Figs. III and IV. When the valve 2 is in place, the chambers 28 are filled, preferably, with a viscid oil which can flow all around the valve and being out of contact with the water remains in these chambers 28, causing the valve and its inclosed turning gearing to operate smoothly and with but little friction.

Referring next to the principal feature of my invention, the member 22 placed in the center of the nozzle and core of the stream of water, and this member is made, preferably, of tri-vane form and of thin section, as shown in Fig. V. The vanes 23 blend into and are made integral with a shell 24, that fits into a corresponding bored seat in the main tube 1, as shown in Figs. II and III, and in this manner holds the member 22 concentric in the nozzle. The object of these vanes being to create water friction and retardation in the core of the stream to compensate for the retardation effected at the circumference of the stream, they do not extend out fully to the walls of the nozzle, which would defeat their object, but extend only part way, as shown in Fig. V, thus presenting a retarding-surface in the core approximately equal to that of the annular surface around the stream. The function of this device 22 is threefold. It prevents circular or swirling action of the water, which invariably takes place in such nozzles when not prevented, compensates or balances the frictional retardation of the outer surface of the stream as it passes through the nozzle by causing in the center or core of the stream a similar frictional resistance, so that the relative velocities at the surface and center of the stream and over its whole cross-section will occur at a more uniform rate. It also directs the water in a straight course as nearly as this is possible. The member 22 can be cruciform or with any number of vanes, or may be larger in diameter, so that the surface will equal the perimeter of the bore in the tube 1; but the proportions shown give a good result and preserve the solidity of the stream for a considerable distance from the point of issue. The pedestal 27 sustains the weight of the nozzle, and the flange 30 is to connect it to a water-wheel housing or other structure and maintain alinement.

I have described my several improvements in connection with nozzles of a tapering form; but it will be understood that the results produced will be the same, but less in degree, if applied to nozzles of parallel bore or those varying from the proportions illustrated in the drawings.

Having thus explained the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a hydraulic nozzle, a main tube of tapering bore, a transverse circular chamber formed integral therewith adapted to receive a revoluble valve, the latter chambered or out of contact at its sides and ends, provided with removable faces to fit upon and close the bore of the nozzle toward the discharge end thereof and adapted to receive a lubricant around its exterior, in the manner substantially as described.

2. In a hydraulic nozzle, a main body or tube, a recessed cylindrical chamber transverse thereto and adapted to receive a revoluble valve, the latter provided with removable faces that open and close the bore of the waterways and confine a lubricant at the sides and ends of the valve, in the manner substantially as described.

3. In a hydraulic valve or cock, detachable faces adapted to open and close the issues to and from the valve, segmental or annular chambers at the sides of the valve communicating with chambers at its top and bottom adapted to contain a liquid lubricant out of contact with the fluid passing through the valve, substantially as specified.

4. In a hydraulic nozzle, a main tube with a tapering bore, a member 22 mounted concentrically therein, provided with thin radial vanes extending toward but not reaching the inner surface of the nozzle, and extending longitudinally near to or beyond the tip or point of issue, whereby the retarding-surface in the core approximates that of the surface surrounding the stream, substantially as specified.

5. In a hydraulic nozzle, a main tube having a tapering bore, the member 22 mounted concentrically therein provided with radial vanes of thin section and a cylindrical shell at the rear, the latter fitting into the main tube, said shell having an internal passage symmetrical with the bore of the main tube, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM A. DOBLE.

Witnesses:

ALFRED A. ENQUIST,

ELMER WICKES.