(No Model.) 2 Sheets—Sheet 1.

C. B. SESSIONS & B. C. VAN EMON.

WATER WHEEL REGULATING APPARATUS.

No. 518,282. Patented Apr. 17, 1894.

Fig. 2.

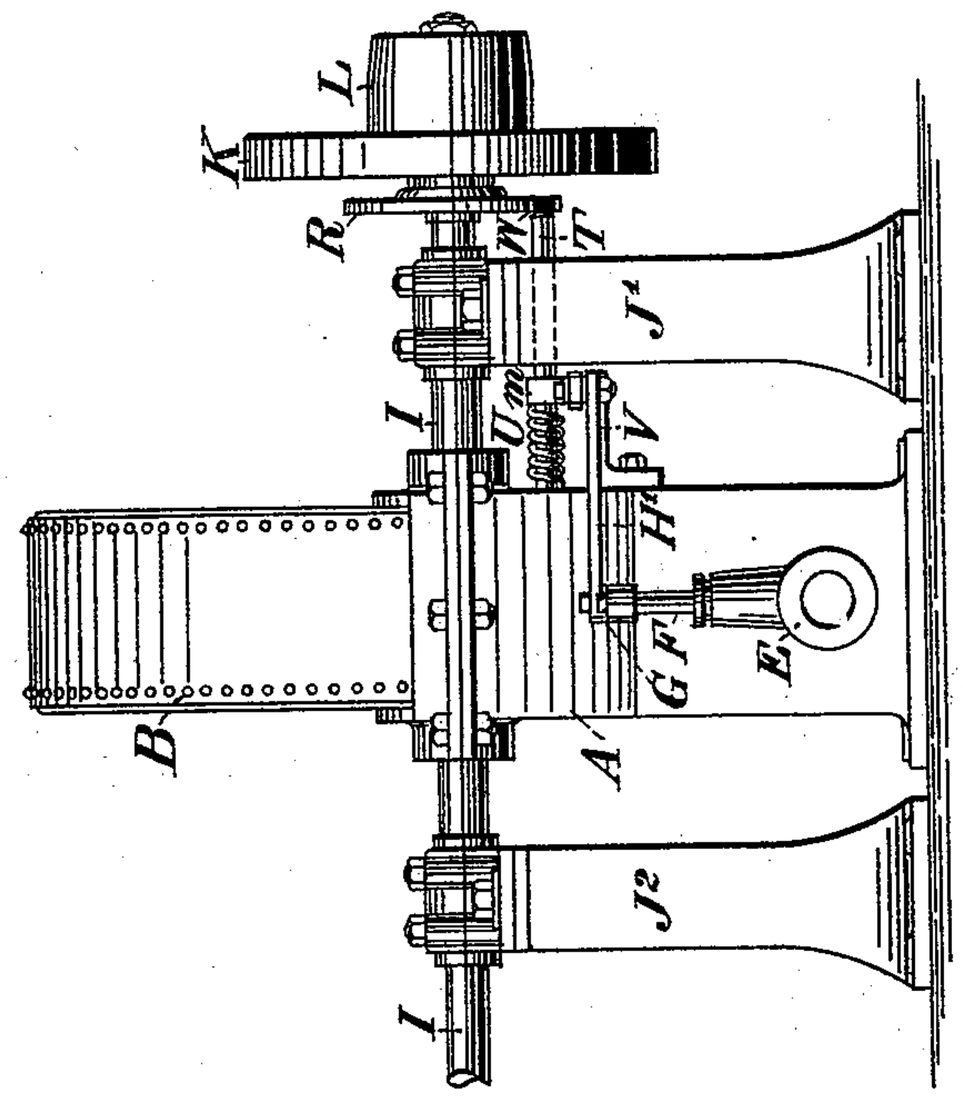

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

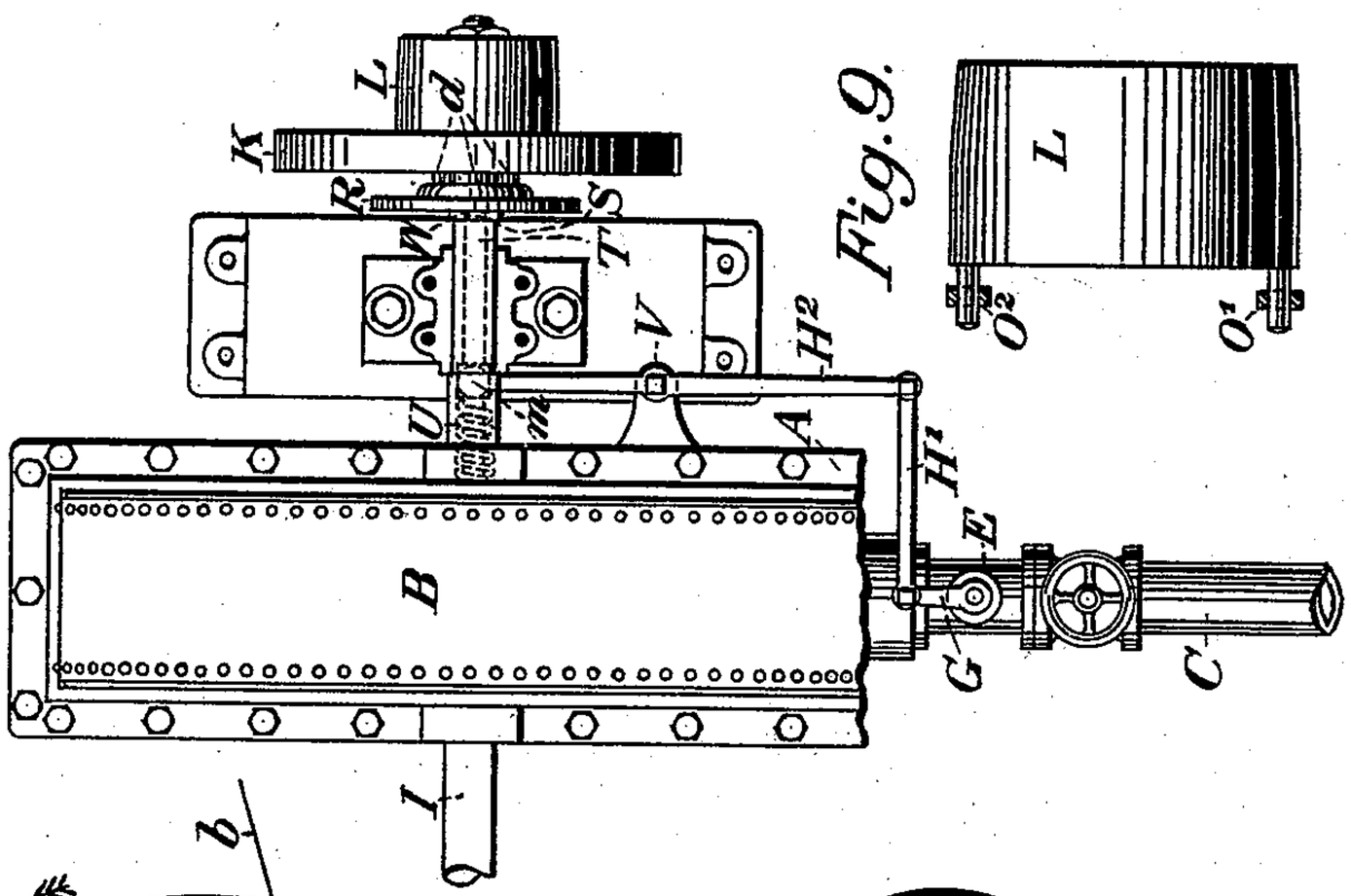


Fig. 9.

Fig. 4.

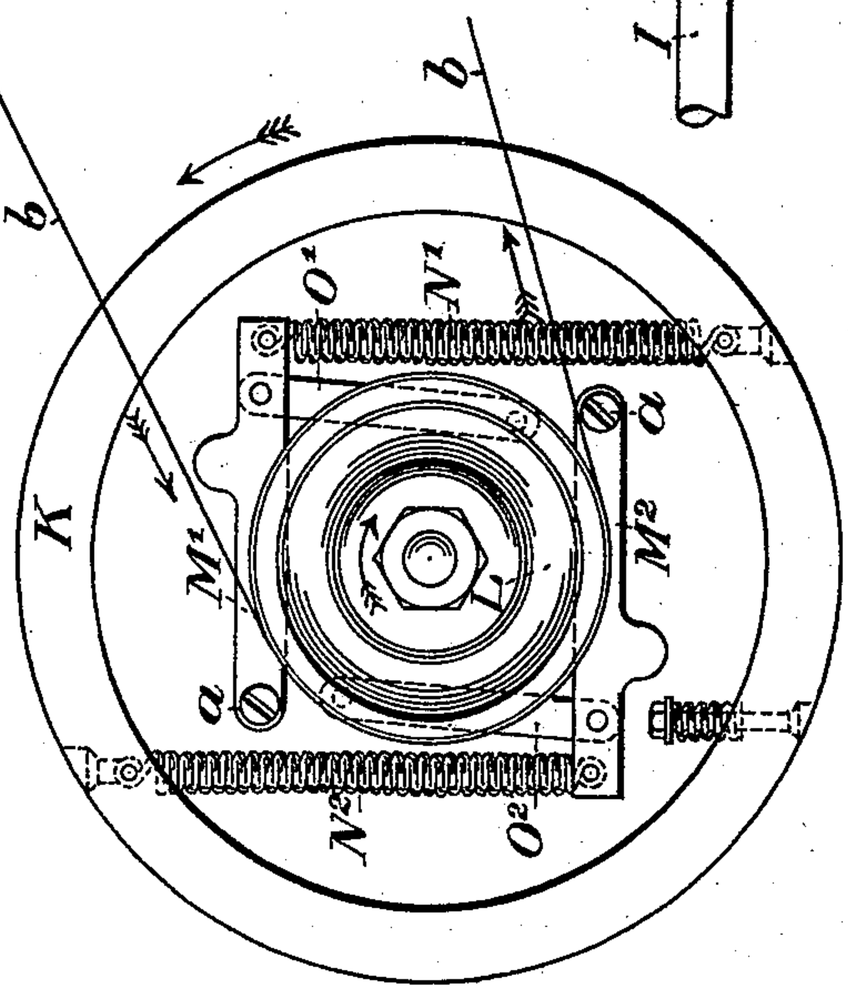


Fig. 8.

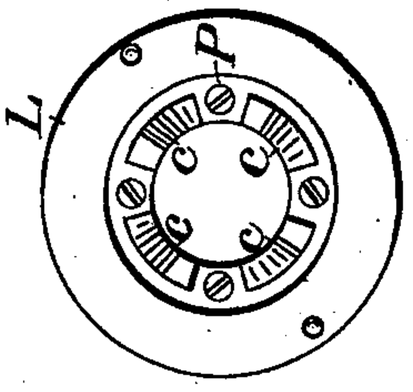


Fig. 7.

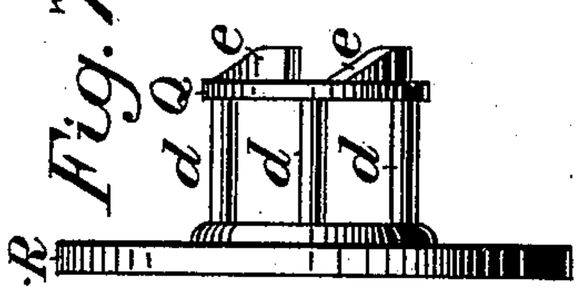


Fig. 5.

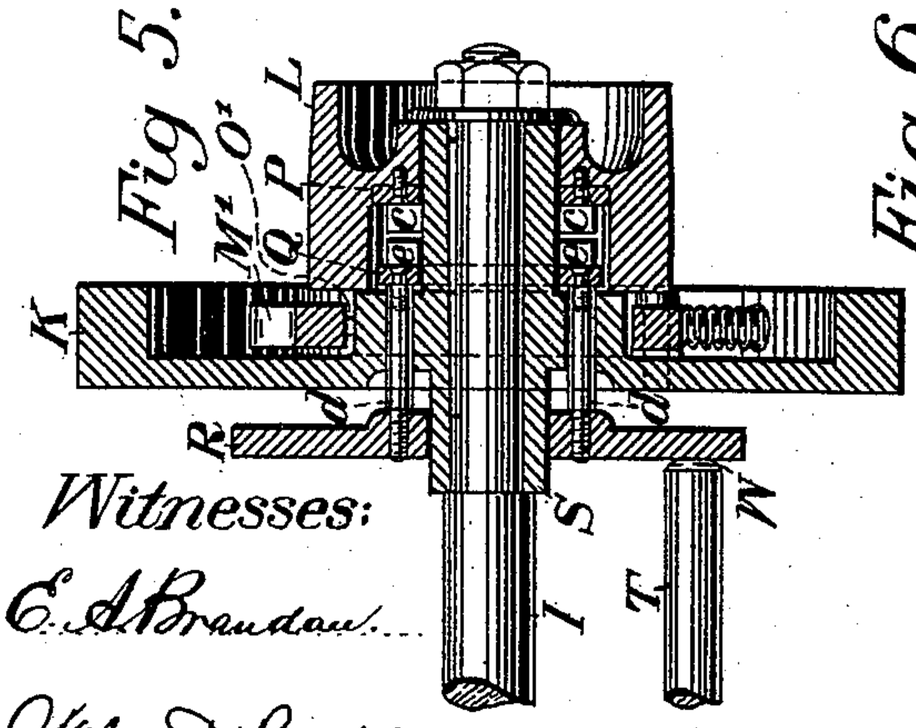
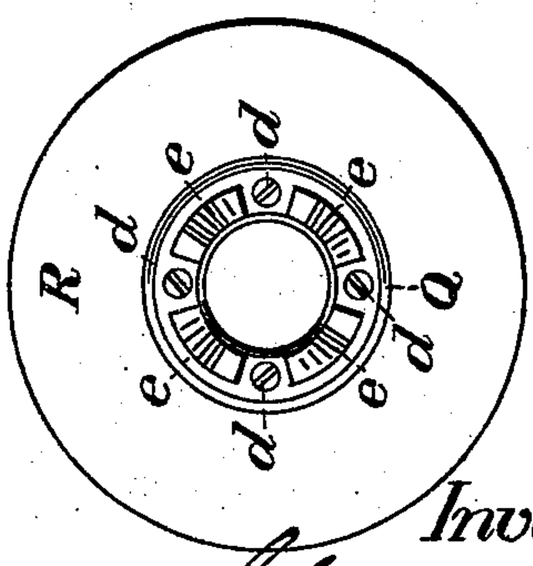


Fig. 6.



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UNITED STATES PATENT OFFICE.

CHARLES B. SESSIONS AND BURTON C. VAN EMON, OF SAN FRANCISCO, CALIFORNIA.

WATER-WHEEL-REGULATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 518,282, dated April 17, 1894.

Application filed June 17, 1893. Serial No. 478,010. (No model.)

To all whom it may concern:

Be it known that we, CHARLES B. SESSIONS and BURTON C. VAN EMON, citizens of the United States, residing in the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Water-Wheel-Regulating Apparatus, as set forth in the following specification and drawings herewith, which we declare to be a full, clear, and exact description of our invention, the manner of constructing the same, and its application to use.

Our invention relates to what are called impulse or tangential water wheels that are driven at high speed, requiring regulating apparatus of instantaneous action, and to the employment of centrifugal force, in combination with the torque or driving force of the wheel, as elements in the speed-governing apparatus for such water wheels.

Our invention consists of levers, or levers and weights, mounted on or within a disk or wheel fastened to the water wheel shaft, also connected to a pulley, gear wheel, or other means of transmitting power, mounted loosely on the water wheel shaft, so that increase or decrease of resistance or work will instantly act upon the water wheel regulating apparatus, in combination with, or independent of the centrifugal force of the levers, or levers and weights, and centrifugal elements, as either the speed or resistance are increased or diminished.

The object of our invention is to attain by means of these two independent forces, namely: the speed of the water wheel and the resistance thereto, and certain relations between these forces, as the rate of revolution may determine, and thus attain instantaneous, or nearly instantaneous, control of the water jet that drives the wheel, and thus maintain a more uniform speed of the latter than is possible with centrifugal governors acting alone.

Another object of our invention is to constitute, as far as possible, the regulating apparatus an integral portion of the water wheel, operated directly from the axis thereof, and without the intervention of gearing subject to derangement or accident.

Referring to the drawings forming a part of this specification, figure 1 is a side elevation of an impulse or tangential water wheel driven by a jet, and fitted with our improved regulating apparatus. Fig. 2 is a reverse or edge view of Fig. 1 in the opposite plane. Fig. 3 is a plan view of Figs. 1 and 2. Fig. 4 is an enlarged side view of the governing apparatus, mounted on or connected to the water wheel shaft. Fig. 5 is a longitudinal section through the same. Fig. 6 is an end view of the clutch plate that imparts lateral movement from the governor to the mechanism controlling the water jet. Fig. 7 is an edge view of the same. Fig. 8 is an end view of the pulley from which power is transmitted, showing the bevel faces thereon to provide lateral movement. Fig. 9 is a side view of the same pulley.

Similar letters of reference are employed to designate like parts in the different figures of the drawings.

In the construction and operation of tangential or impulse water wheels which are driven at high speed, the momentum of the wheels and tardy action of centrifugal apparatus acting on the water jet, has prevented uniform motion, such as is required in driving electric generating machines, and in other cases. In our invention we overcome these impediments by a combination of two forces acting on the water jet, and also to some extent acting on the momentum of the water wheel, as will now be explained by reference to the drawings.

A is a casing or main frame in which is mounted a tangential water wheel of the usual construction, driven by a nozzle attached to the inner end of the supply pipe C.

B is a removable cover or housing to permit access to the wheel.

The construction of the water wheel and nozzle not forming any part of our present invention, these do not require to be shown separately in the drawings, or further described.

In the supply pipe C is placed a stop valve D, and between this and the main casing A, is a wing valve E, operated in the usual manner by a stem F, crank G, and link H′ con-

necting to the regulating mechanism by means of a lever H^2.

The water-wheel shaft I is supported in two brackets or pedestals J' J^2, and at one end, outside of the bearings J', is fastened a wheel K, fixed to the shaft and recessed on one side to receive the main elements of the regulating apparatus, to be hereinafter described. Beyond this is loosely mounted on the same shaft, a pulley L from which the power of the water wheel is transmitted by a band, which is the most common means of transmission for water wheels of this class.

Inside the recessed wheel are mounted two levers or weights M' M^2, pivoted at *a a* on the wheel K, and free to swing outward by centrifugal force, except as resisted by the springs N' N^2, and also by the links O' O^2 attached to the pulley L, as shown in Fig. 4. The weight of these levers M' M^2, and the element of centrifugal force is so arranged in respect to the driving resistance and the rate of revolution, to suit varying degrees of speed and power of the wheels to which the regulating apparatus is applied.

Referring further to Fig. 4, and supposing the water wheel shaft and the wheel K to be driven in the direction indicated by the arrow at the rim, and power to be transmitted by a band represented by the lines *b b*, then the resistance or turning moment of the work will fall in a reverse direction on the pulley L, and tend to resist or revolve it as indicated by the arrow thereon. This would tend to draw the levers M' M^2 inward in the same direction as the springs O' O^2 are acting, so that both these forces act against the outward centrifugal strain on the levers M' M^2. In this manner it will be seen that while the centrifugal force tends to move the weights or levers M' M^2 with a strain in proportion to the rate of revolution, there is a still more active and instant force derived from the variations of resistance offered by the driving band *b*, the latter force acting independent of the speed of the water wheel, but commonly with a direct relation thereto. To make this method of operating more plain, if the links O' O^2 were removed, and the pulley L was fixed to the shaft I, then the action of the levers M' M^2, opposed by the centripetal springs N' N^2, would correspond to a common shaft centrifugal governor, such as is applied to steam engines, or if the centripetal springs N' N^2 were removed, then the position of the levers and weights M' M^2 would be determined by the driving strain on the band *b b*, and opposite torsional strain on the pulley L.

Having thus explained the nature of the forces set up in our regulating apparatus, we will now proceed to describe the method of transmission and application to the water jet and to regulation of the speed of the water wheel. On the inner face of the pulley L are beveled circular ledges *c c c c* made integrally with a collar or plate P, set into the face of the wheel as shown in Fig. 8, and in the section, Fig. 5. Opposite to these, and meshing therein, are another set of similar beveled cylindrical ledges *e e e e* formed on a plate Q, so that when the pulley L and this plate Q are turned relatively, in opposite directions, the angular faces of the ledges *c* and *e* move the plate Q laterally with respect to the wheel K and the shaft I. The lateral movement of this plate Q is communicated through the wheel K by means of the sliding studs *d d d d*, which are attached to another plate R on the outside of the wheel K, sliding loosely on the projecting sleeve S. As this disk or plate R is moved outward it presses on the end of the bar T, which slides loosely through the bracket J', or other suitable support, and is resisted by a coil spring U seen in Fig. 2, so as to maintain contact between the end of the bar T and the disk R at W. The lever H^2 is attached to the bar T at *m*, and is mounted on a fulcrum V attached to the main frame A, so that any lineal movement of the bar T is, by means of the lever H^2, link H', and crank C, communicated directly to the wing valve E, opening or closing the same as the speed of the wheel, and also as the resistance of its work may demand. The lateral movement of the disk R acts only one way on the bar T, the return movement, or opening action on the valve E is performed by the spring U, the force of the latter being made sufficient for that purpose, but not strong enough to resist the centrifugal and turning strains of the regulating elements hereinbefore described. These devices for transmitting to the valve E the centrifugal and torsional forces of the regulating apparatus, can be varied to suit the various conditions of construction, the purpose being to communicate to the regulating valve E, the changes of the relative positions of the pulley L and shaft I, and the resultant position of the levers or weights M' M^2, as changes of either speed or strain may determine.

Having thus described the nature and objects of our invention and the method of applying the same, what we claim as new, and desire to secure by Letters Patent, is—

1. In a water wheel governor or regulating apparatus, the combination with the main water-wheel shaft, of a pulley loosely mounted thereon, a fixed disk likewise thereon, centrifugally-acting weighted levers pivoted on the disk, spring connections between said levers and the disk, a link connection between them and the loose pulley, and suitable connections consisting essentially of a laterally-movable disk having an engagement with the loose pulley by means of beveled cylindrical ledges whereby the actions of the aforesaid parts may control the valve in the water supply pipe, substantially as described.

2. In a water wheel regulating apparatus, the combination of the main shaft, a loose pulley thereon, a fixed disk likewise thereon, centrifugally-acting levers pivoted on the

disk, spring connections between the free ends of said levers and the periphery of the disk, link connections between said levers and the loose pulley, the water supply pipe and the valve therein, the laterally-movable disk operated by the aforesaid mechanism and the beveled cylindrical ledges for connecting or disconnecting said disk with the loose pulley, and leverage connections actuated by said disk so as to control the water supply valve, substantially as described.

3. In a water wheel regulating apparatus, the combination of the main shaft, a loose pulley and a fixed disk thereon, together with centrifugal levers on the disk and spring and link connections between them and the disk and pulley, and a laterally-movable sliding disk operated by the aforesaid mechanism through the engaging ledges or teeth and the sliding studs together with a lever acted on endwise by said disk for the purpose of imparting motion through suitable connections to control the water supply valve, substantially as described.

4. In a water-wheel regulating apparatus, the combination of the water wheel shaft, a pulley loosely mounted thereon, a fixed disk thereon, weighted levers pivoted on the disk, spring connections and link connections between the ends of said levers and the disk and the pulley, a collar on the pulley having beveled ledges, a sliding plate having also beveled ledges which engage the ledges on the pulley, another laterally movable disk, the sliding studs attached thereto and operated in consequence of the engagement of the said ledges so that it will be shifted for the purpose of operating suitable leverage connections between it and the water supply pipe, so as to control the valve in the latter, substantially as described.

5. In a water wheel regulating apparatus, the combination of the main shaft, a loose pulley and a fixed pulley thereon, together with centrifugal levers pivoted on the fixed pulley and spring and link connections between said levers and the pulleys, all arranged substantially as described and beveled ledges on the inner face of the loose pulley, a disk opposite thereto having likewise beveled ledges which engage the other ledges, another laterally movable disk having sliding studs which are attached likewise to the ledge provided disk, a rod which is operated upon endwise by the sliding disk and suitable connections between it and the water supply valve whereby the latter is controlled so as to regulate the water supply, substantially as described.

6. In a water wheel regulating apparatus, the combination of the water wheel shaft, a pulley loosely mounted thereon and provided with beveled circular ledges on its inner face, a fixed disk likewise mounted upon the main shaft, centrifugal weighted levers pivoted on said disk, spring connections between the free ends of said levers and the disk, link connections between said levers and the loose pulley, a plate adjacent to the loose pulley having beveled cylindrical ledges thereon which engage the ledges on the loose pulley, another laterally movable disk on the main shaft having sliding studs which are attached to the ledge-provided plate, all arranged so that when the two sets of ledges engage with each other, the sliding studs may shift the disk, together with the leverage mechanism whereby said disk operates to control the water supply valve, substantially as described.

In testimony whereof we have hereunto affixed our signatures in the presence of two witnesses.

CHARLES B. SESSIONS.
BURTON C. VAN EMON.

Witnesses:
ALFRED A. ENQUIST,
WILSON D. BENT, Jr.