(No Model.) 2 Sheets—Sheet 1.

# C. E. DOOLITTLE.

## VALVE CONTROLLING MECHANISM FOR WATER WHEELS.

No. 533,004. Patented Jan. 22, 1895.

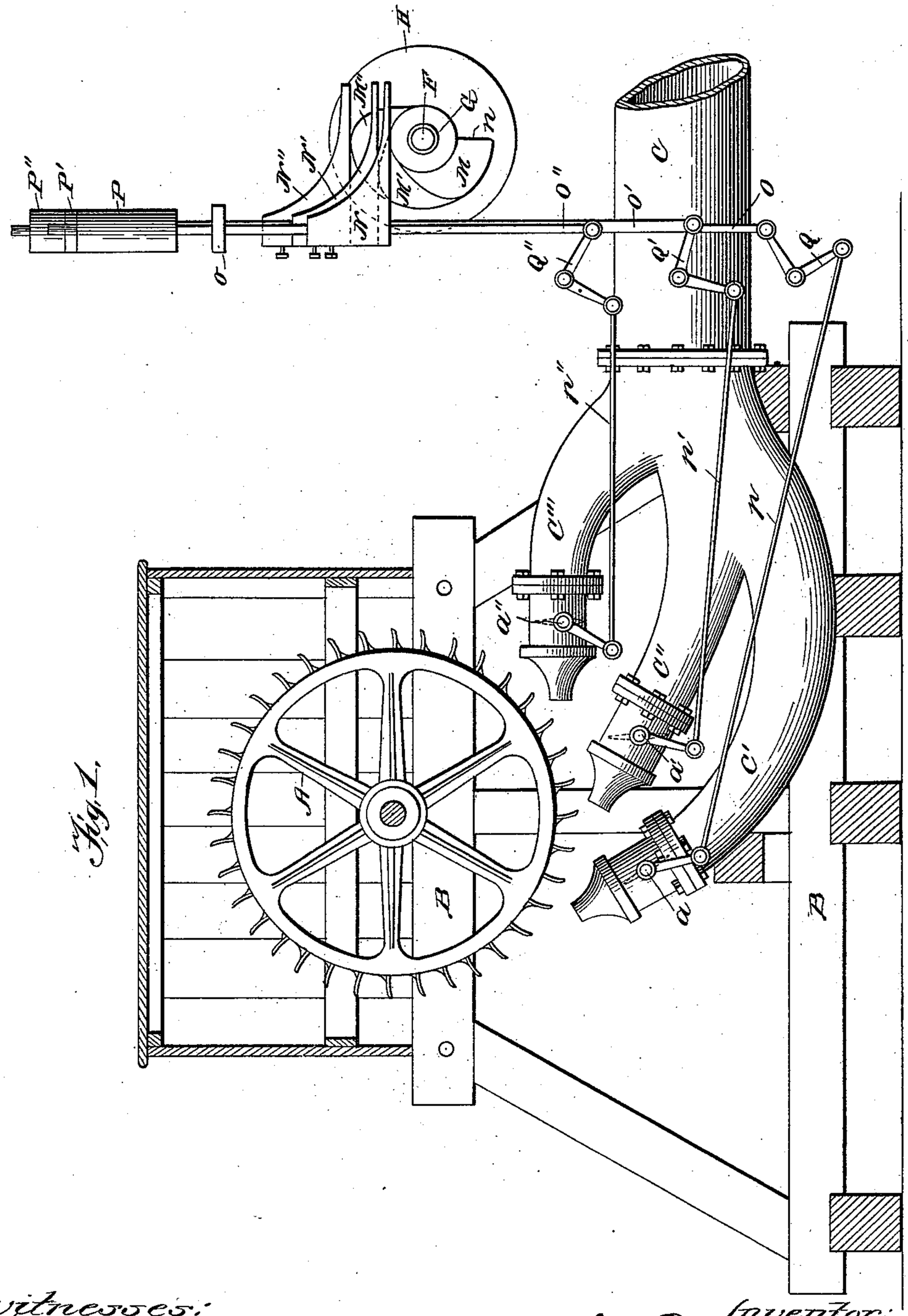

Fig. 1.

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

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## VALVE CONTROLLING MECHANISM FOR WATER WHEELS.

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Fig. 4.

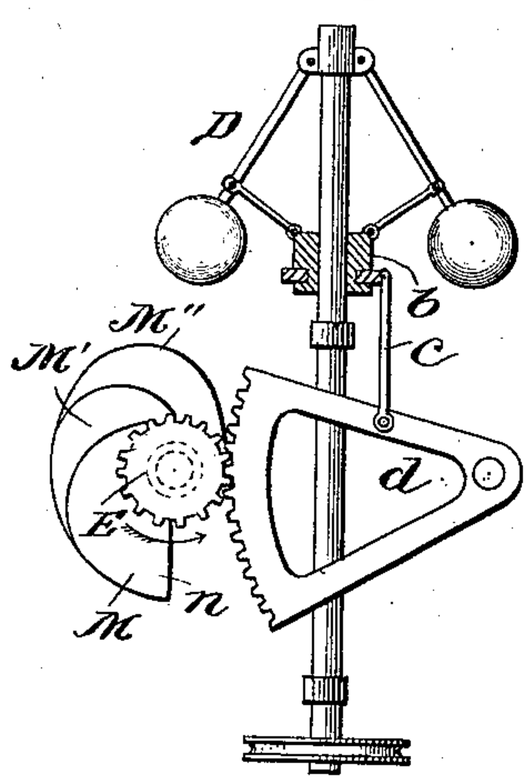



Fig. 2.

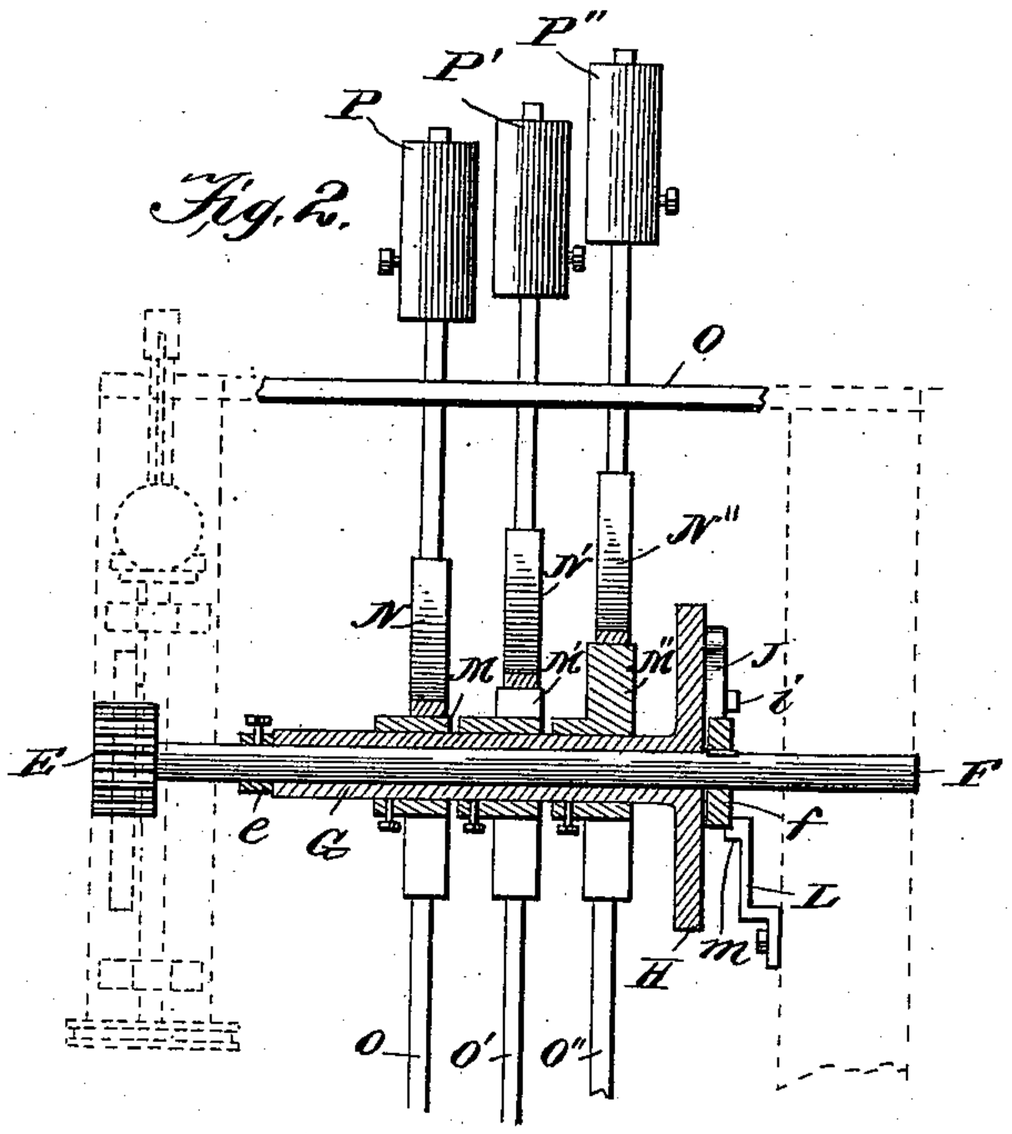



Fig. 5.

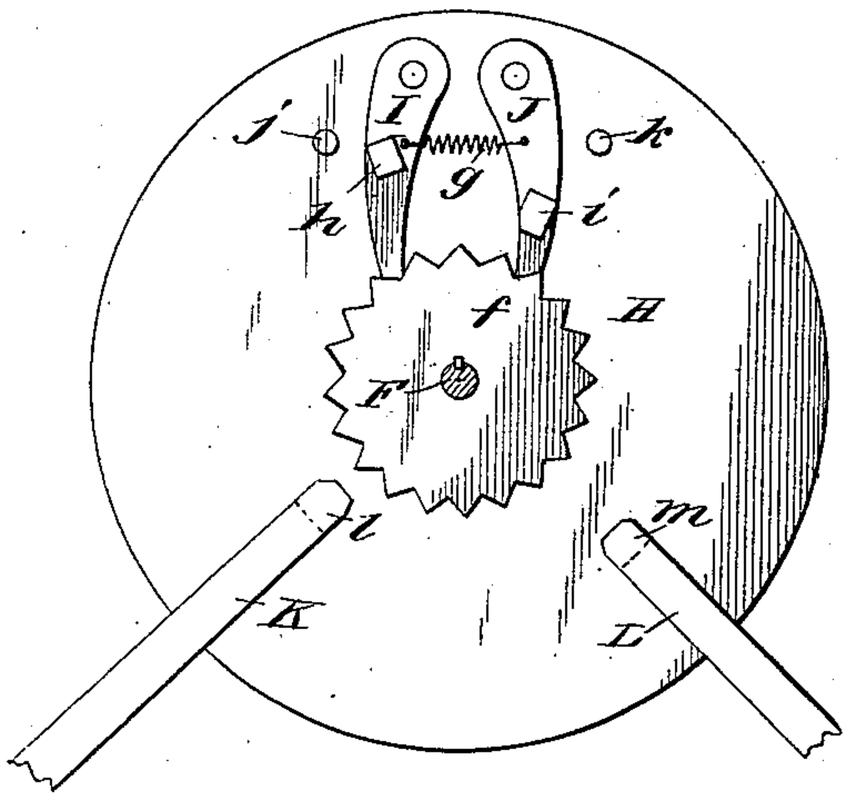
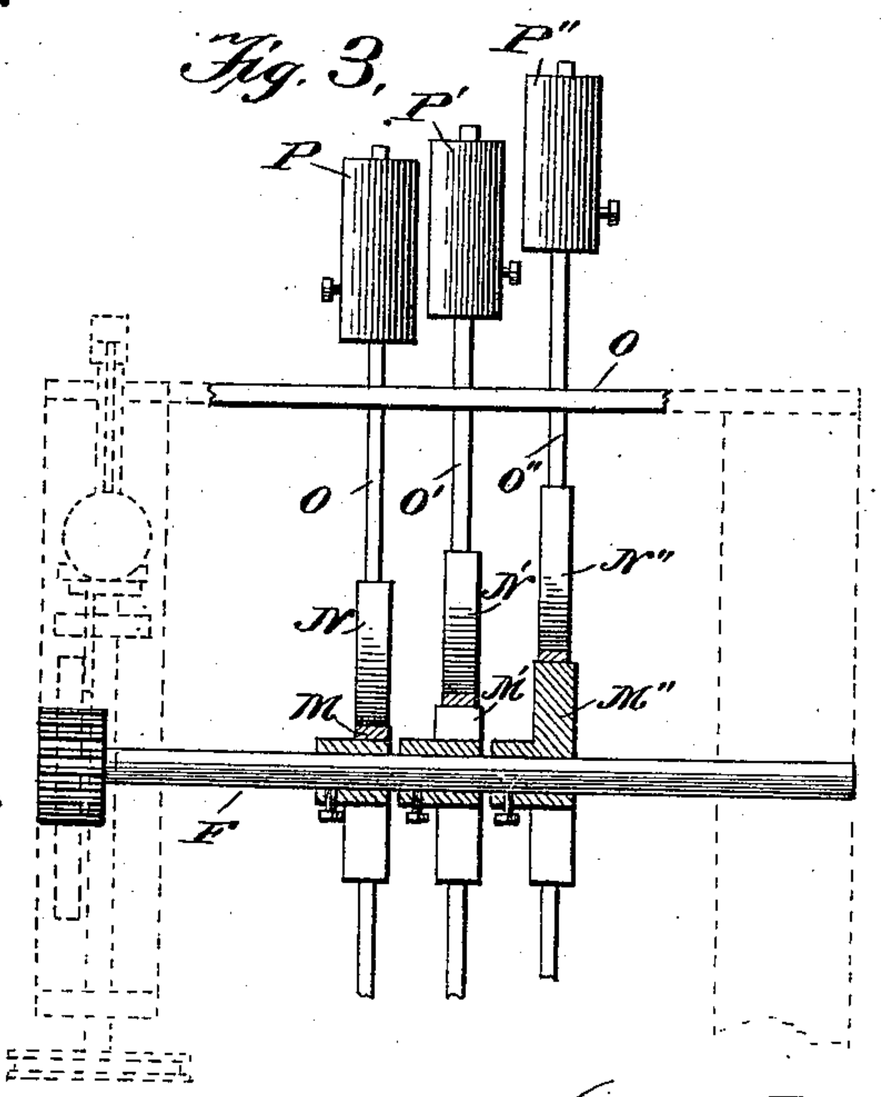



Fig. 3.

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# UNITED STATES PATENT OFFICE.

CLARENCE E. DOOLITTLE, OF ASPEN, COLORADO, ASSIGNOR OF ONE-HALF TO JAMES H. DEVEREUX, OF SAME PLACE.

## VALVE-CONTROLLING MECHANISM FOR WATER-WHEELS.

SPECIFICATION forming part of Letters Patent No. 533,004, dated January 22, 1895.

Application filed November 18, 1894. Serial No. 491,345. (No model.)

*To all whom it may concern:*

Be it known that I, CLARENCE E. DOOLITTLE, a citizen of the United States, residing at Aspen, in the county of Pitkin and State of Colorado, have invented certain new and useful Improvements in Valve-Controlling Mechanism for Water-Wheels; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to jet or reaction water wheels and has special reference to that class employing multiple discharge nozzles, in which regulation of the several water supplies or jets has heretofore been attended with much difficulty and loss of power.

My present invention has for its object the production of means whereby a throttling and consequent waste of water supply is obviated, and the several streams of a multiple discharge are automatically and successively controlled in such manner that the efficiency of the wheel is maintained at all times regardless of the work imposed upon it.

The invention will be hereinafter particularly described and pointed out in the claims.

In the accompanying drawings which form part of this specification, and in which like letters of reference indicate like parts wherever employed: Figure 1, represents a side elevation of my invention, partly in section; Fig. 2, a vertical central section of valve controlling mechanism interposed between the governor and the discharge nozzles; Fig. 3, a similar view of parts last above mentioned, showing a modification thereof; Fig .4, a side elevation of one form of governor adapted for use in connection with my invention, and Fig. 5, is a detail view representing an end elevation of a stop mechanism.

Reference being had to the drawings and letters thereon, A, represents an ordinary reaction water wheel, and B the frame upon which it is supported.

C indicates a main water supply pipe, and C′, C″, C‴, communicating discharge nozzles through which water may be applied in as many streams to the wheel A; the amount of water flowing from said nozzles being controlled by "butter-fly" or other form of valves *a*, *a″*, *a″*, located therein, said valves in turn being operated by mechanism interposed between them and the governor, as will hereinafter appear.

D is a pendulum ball governor belted on to the axis of wheel A, in the usual manner, adapted to rise or fall in accordance with the accelerated or decreased speed of the water wheel, and to communicate such motion through a slide *b*, link *c*, and sector-shaped rack *d*, to a pinion E keyed to the horizontal operating shaft F.

On the shaft F is loosely mounted a sleeve G, having at one end a disk H formed integral or otherwise secured thereto, a longitudinal movement of the sleeve G being prevented in one direction by collar *e* and in the opposite by a ratchet wheel *f* keyed to said shaft as shown. To the face of disk H, are journaled dogs I, J, connected by a spring *g* and provided with lugs *h*, *i*; said lugs being located upon their respective dogs at points of unequal distance from center of the operating shaft F, about which they are thus adapted to rotate in different circles. The free ends of dogs I, J, each rest upon a tooth of the ratchet wheel *f*, and are limited in an upward or side movement by pins *j*, *k*, secured in the disk H.

In conjunction with dogs I, J, and their lugs *h*, *i*, are stops K L, of unequal length, having angular ends *l*, *m*, projecting in the path of the lugs *i h* respectively, and pivoted to the frame B, as shown by Fig. 2.

On the sleeve G intermediate of disk H and collar *e*, are adjustably secured independent cams M, M′, M″, which when properly adjusted have a common starting point *n*, but differ in degree of eccentricity; while immediately above the cams and normally resting thereon are toes N, N′, N″, the latter being attached to valve rods O, O′, O″, respectively, upon which they are vertically adjustable. Rods O are supported above toes N, in an apertured member *o* of frame B, whereby they are guided in their vertical movement, the upper end of each being provided with a weight P, P′, P″, if desired, and their lower ends being pivoted upon fixed bell-crank levers Q, Q′,

Q'', said rods and levers serving to control valves *a a' a''* through the medium of interposed links *p, p', p''*.

This being substantially the construction of my invention, I will now proceed to describe its use and operation, for which purpose it will be supposed that the wheel A is working under a full load, in which event the toes N, N', N'', are elevated to their highest position upon their respective cams M, M', M'', and the valves *a*, *a'*, *a''*, are consequently wide open, thus permitting water from each of the nozzles C', C'', C''', to be discharged with full force tangentially upon the base floats of wheel A. Being now further supposed that one-third of the load is accidentally or otherwise thrown off, the governor must then automatically operate to close one of the valves *a*, this being accomplished in the following manner: The accelerated speed of wheel A, operating through a belt or shaft driven governor, as D, its vertically moving slide, as *b*, a link as *c*, a rack as *d*, and a pinion E, keyed to the main operating shaft F, serves to rotate said pinion and shaft in the direction of the arrow shown in Fig. 4. The effect of such movement is to partially rotate ratchet wheel *f* keyed to and moving with shaft F, and through the dog I operate in like manner upon disk H, with its cam-carrying sleeve G, turning the latter sufficiently to lower cam M. This having been accomplished the toe N, riding on said cam M, descends under influence of weight P, carrying with it valve rod O'', the latter communicating its movement through bell-crank lever Q'', and its connecting link *p''*, to valve *a''*, which is thereby closed, reducing the volume of water applied to wheel A, in exact accordance with the work of which it was relieved. One, two or more such discharge valves having been thus automatically, successively, and independently closed, we will now suppose on the contrary, additional work imposed on the wheel A with a consequent demand for more power. The valves *a*, *a'*, *a''*, will then be successively opened in reverse order as follows: The speed of wheel A being reduced, the centrifugal-force of pendulum balls D, will be proportionately less with the result of lowering rack *d*, and imparting to pinion E, shaft F, and ratchet wheel *f*, a motion the reverse of that heretofore described, which motion is transmitted through dog J, to disk H and its sleeve G. This forward rotation of sleeve G has the effect of elevating cams M, M', M'', in reverse order from that named, and in accordance with their respective positions on said sleeve, or their degrees of eccentricity, such motion serving to open valves *a* in the same manner and by the same mechanism as that already described in connection with the reverse movement of said parts, with the desired effect of bringing more water into action upon wheel A. If after all the water has been turned on, the load on wheel A is still so great that its speed is less than normal, the shaft F, sleeve G and connecting parts may continue to turn without elevating the toes N, N', N'', further, until lug *i* on dog J comes in contact with the end *l* of stop K, projecting in its path, when said dog will be lifted out of engagement with ratchet wheel *f*, the disk H and sleeve G thus being brought to a stand still. This, however, does not prevent shaft F and ratchet wheel *f* from further revolution under influence of the governor should it be required, in which event the dog I, simply slips on the teeth of ratchet wheel *f* as they pass from it, thus preventing injury to the governor. Similarly on a reverse movement of these parts, if after most of the water has been cut off, the speed of wheel A should be greater than the normal the parts last above mentioned may continue to turn until lug *h* on dog I is lifted out of engagement with ratchet wheel *f*, by stop L, when, as before, if necessary, shaft F and ratchet wheel *f* may continue to revolve, dog J, jumping the teeth of ratchet wheel *f*, as they pass from it.

It will be observed that the parts H, I, J, K, L, and *h, i, j, k, l, m*, constitute a stop mechanism, which co-operates with the valve actuating mechanism, and at the same time is possessed of a certain amount of independence, the function of said stop mechanism being not only to aid in actuating the supply valves *a*, *a'*, *a''*, but also to limit rotation of the valve-actuating cams M, M', M'', with relation to the main operating shaft F. It will be observed also, that my invention is applicable to all systems employing a multiple discharge, regardless of the number of individual nozzles; that it is equally as well adapted for use on several distinct wheels having but one shaft, or upon as many wheels mounted upon separate shafts, provided they are so geared as to be controlled by a governor common to all; that the greater the number of streams employed, the greater will be the efficiency of my improved system; and further it will be seen by inspection of the drawings, that cams M, M', M'', may be secured directly to the operating shaft F if desired—as per modified Fig. 3—thus dispensing with the sleeve G, and the stop mechanism.

This being a description of my invention, I by no means limit myself to the precise construction and arrangement of parts set forth, as many minor changes may be made and substituted for those herein shown without in the least departing from the spirit of my invention, which having been thus described,

What I claim is—

1. The combination with a water wheel, of a plurality of supply nozzles, a valve for controlling each of said nozzles, a governor, cams controlled by the governor, connections whereby said cams control their respective valves, and means for actuating the cams in reverse directions by operation of the governor, substantially as described.

2. The combination with a water wheel, of a plurality of supply nozzles, each containing

a valve, a main operating shaft, a sleeve mounted on the shaft, suitable mechanism between said shaft and sleeve for controlling their relative rotation cams secured to the sleeve, valve rods interposed between the valves and their respective cams, toes secured to said rods and riding on the cams, and a governor for rotating the shaft, sleeve and cams in both directions, substantially as described.

3. The combination with a water wheel, of a plurality of supply nozzles, each containing a valve, a main operating shaft, a sleeve mounted on the shaft, suitable connections between said sleeve and shaft, cams secured to the sleeve, valve rods interposed between the valves and their respective cams, and a governor for rotating said shaft, sleeve and cams, in reverse directions, substantially as described.

4. The combination with a water wheel, of a plurality of supply nozzles, their valves and valve rods, of weights attached to said rods, a main operating shaft, a sleeve mounted on the shaft, a pawl and ratchet connection between said sleeve and shaft, cams secured to the sleeve, toes adjustably attached to the valve rods and riding on the cams, and a governor for rotating the shaft in both directions, substantially as described.

5. The combination with a water wheel, of a series of supply nozzles, a governor, a main operating shaft controlled thereby, cams actuated by the shaft, supply valves operated by the cams, and a stop mechanism for limiting rotation of the cams with relation to their operating shaft, substantially as described.

6. The combination with a water wheel, of a series of supply nozzles, a governor, a main operating shaft controlled thereby, a sleeve loosely mounted on the latter, cams moving with the sleeve, supply valves actuated by the cams, a ratchet wheel keyed to the operating shaft, and a dog or dogs interposed between said sleeve and ratchet wheel, substantially as described.

7. The combination with a water wheel, of a series of supply nozzles, a governor, a main operating shaft controlled thereby, a sleeve loosely mounted on the shaft, cams adjustably secured to and a disk rigidly fixed upon said sleeve, supply valves actuated by the cams, a ratchet wheel keyed to the operating shaft, and dogs journaled upon said disk and in engagement with aforesaid ratchet wheel, substantially as described.

8. The combination with a valve controlling mechanism for water wheels, of a stop mechanism consisting of a ratchet wheel keyed to the main operating shaft, a disk loosely mounted on said shaft and connected with the valve mechanism, dogs interposed between said ratchet and disk, and suitable arms projecting in the path of said dogs for disengaging them from the ratchet wheel at predetermined periods, substantially as described.

9. The combination with a valve controlling mechanism for water wheels, of a stop mechanism consisting of a ratchet wheel keyed to the main operating shaft, a disk loosely mounted on said shaft and connected with the valve mechanism, spring pressed dogs, each bearing a lug interposed between said ratchet wheel and disk, and fixed arms projecting in the path of said lugs for disengaging their dogs from the ratchet wheel, substantially as described.

10. The combination with a valve controlling mechanism for water wheels, of a stop mechanism consisting of a ratchet wheel keyed to the main operating shaft, a disk loosely mounted on said shaft and connected with the valve mechanism, dogs journaled upon the disk engaging the ratchet wheel and connected by a spring, projections for limiting the movement of the dogs upon their journals, lugs on the surface of the dogs at points of unequal distance from center of said disk, and fixed arms for engaging the lugs at predetermined periods, substantially as described.

In testimony whereof I subscribe my signature in presence of two witnesses.

CLARENCE E. DOOLITTLE.

Witnesses:

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C. H. REUTER.