2 Sheets--Sheet 1.

W. READING.
Rotary Motors.

No. 149,248. Patented March 31, 1874.

Fig. 1.

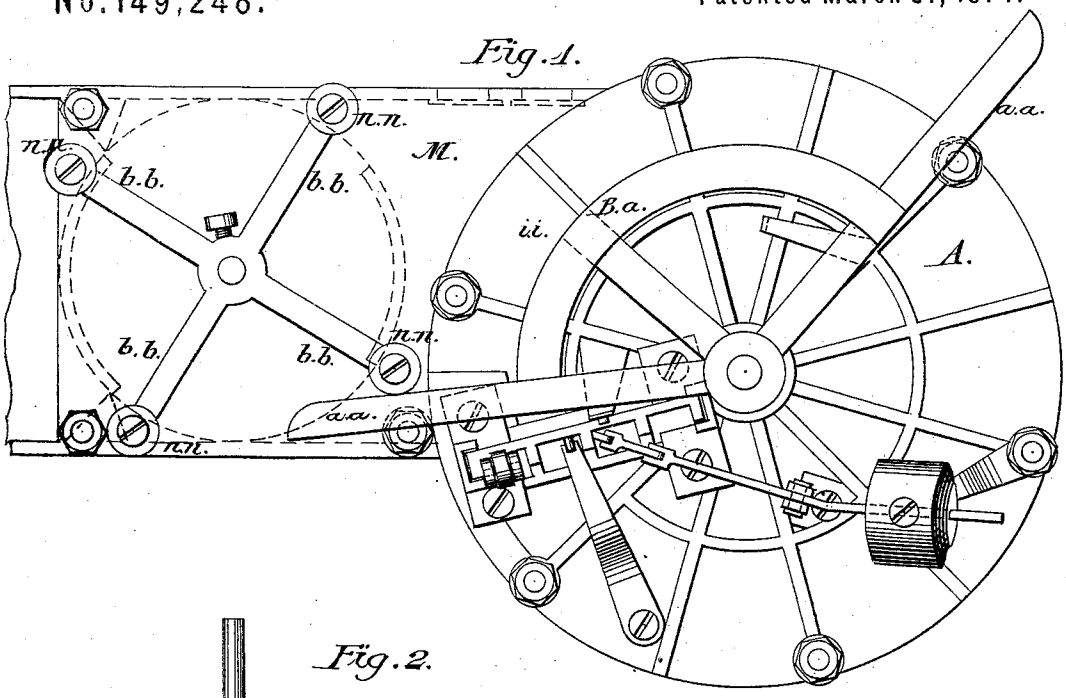
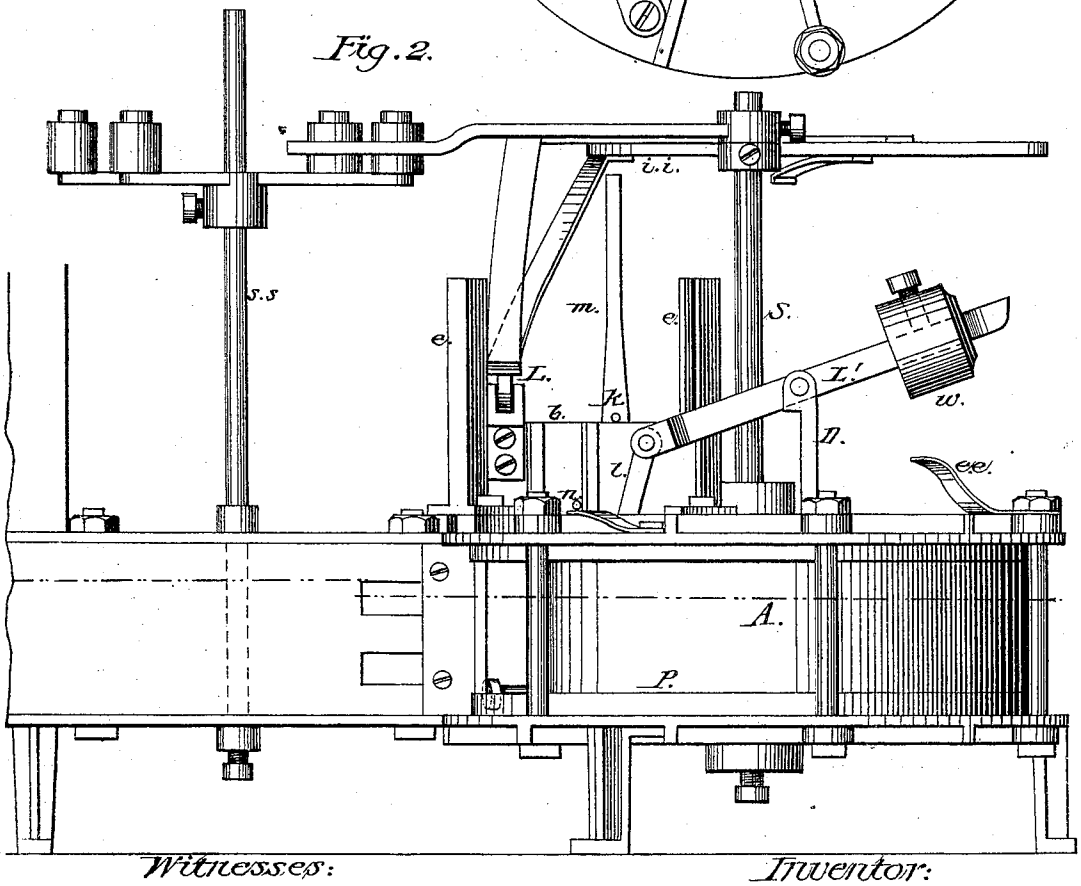


Fig. 2.



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Inventor:
William Reading

2 Sheets--Sheet 2.

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Fig. 3.

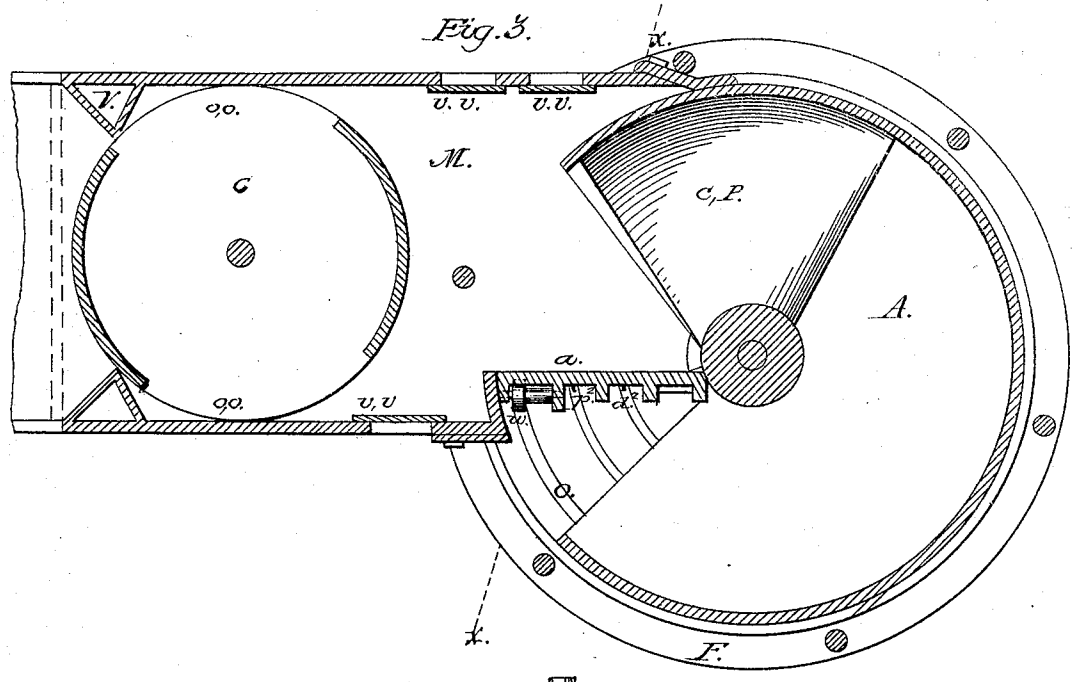
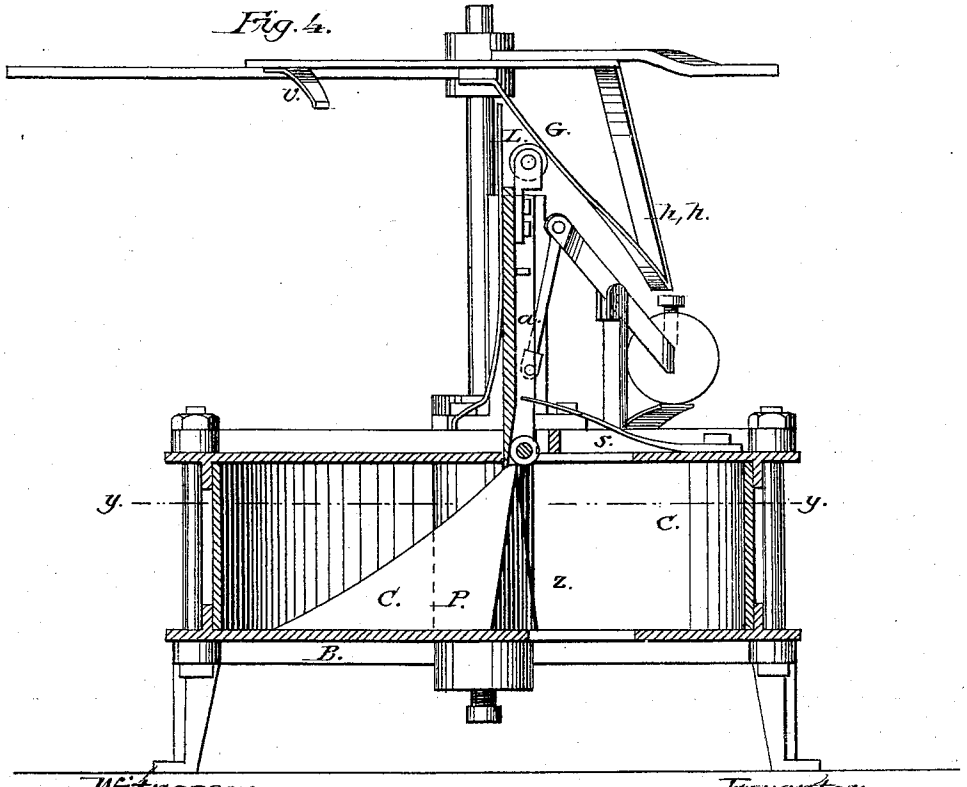


Fig. 4.



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William Reading

UNITED STATES PATENT OFFICE.

WILLIAM READING, OF GEORGETOWN, DISTRICT OF COLUMBIA.

IMPROVEMENT IN ROTARY MOTORS.

Specification forming part of Letters Patent No. **149,248**, dated March 31, 1874; application filed March 3, 1874.

To all whom it may concern:

Be it known that I, WILLIAM READING, of Georgetown, in the District of Columbia, have invented a new and useful Improvement in Rotary Motors, the same being constructed upon the general principle shown in the Letters Patent of the United States granted to me on the 23d day of April, 1872; and I hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, in which—

Figure 1 is a plan or top view; Fig. 2, a side elevation; Fig. 3, a horizontal section on the line of *x x;* Fig. 4, a transverse section on the line of *y y.*

In the construction of a motor of six feet diameter, to be propelled by water, I use a stationary case, A, of metal, as shown in Figs. 1, 2, and 3, and place it firmly in a horizontal position on three strong legs one foot high, or thereabouts. To be used under a head and fall of, say, sixteen to twenty-four feet, this casing has a twelve-ribbed bottom plate, B, Fig. 4, about three-eighths of an inch thick, with one extra rib about midway between its periphery and center running around it, and at right angles with the others, binding them all together, and giving great strength, which is required. The ribs are half an inch thick and four inches broad. In this plate an opening, O, Fig. 3, is made for the discharge of water. This opening should be about one-tenth the size of the plate. Upon its outer edge there is a six-inch horizontally-projecting flange, F, Fig. 3. On this flange there is placed an upwardly-projecting ribbed curb, C, Fig. 4, with corresponding flanges. This curb is in height about one-fourth the diameter of the motor. Through this an opening is made for the reception of the water-trunk M, Fig. 3, extending forward and nearly from the top to the bottom, and far enough around to form an area equal in size to the rear end of a cam-piston, C P, Fig. 3, soon to be described; and in said curb C, Fig. 4, another opening, P, Fig. 2, is made to discharge water. This should extend rearward from the water-trunk as far as the opening in the bottom plate B, Fig. 3. At its termination as well as at its beginning a strong vertical flange six inches wide should be cast on the curb to give it strength, the front one inclining a little rearward to furnish a fastening for the feeding-trunk M, Fig. 1. A shaft, S, Fig. 2, is stepped in the bottom of the case, and extends upward through the top of the case for any desired distance to a bearing. Upon that portion of the shaft which is in the case (being the lower part) there is firmly secured a hollow iron cam-piston, C P, Figs. 3 and 4, in height at its rear end corresponding with the aforesaid curb, and in length from front to rear on its bottom, and at its periphery about one-third more than its height, having a cover inclining forward from the top to the bottom of the case conforming to the circle, and forming a cam to assist in raising an abutment, *a*, Figs. 3 and 4, to be hereafter described. In a motor of six feet diameter this piston has a hollow hub one foot in diameter and the depth of the case of the motor, with heads near the top and bottom through which the shaft passes, and to which it is firmly secured, all of sufficient strength to bear the required strain. The rear vertical plate of the piston is half an inch thick, and well braced inside, and extends outward from the hub to the periphery of the casing, and from the bottom to the top of it. This plate may incline back a little from bottom to top, in order that the upward pressure of the water against it may carry some of the weight of the piston, the outer end of which is a thin circular pointed plate conforming to the periphery of the casing, its edges fitting it closely. On the hub of the piston against its rear plate there is a projection of one and a half inch thick, Z, Fig. 4, and extending back about three and a half inches at the bottom, running up to a thin edge at the top, forming an inclined plane for the before-mentioned abutment to slide down upon after being raised at each revolution of the piston, and also to give greater strength to the piston, which is left open at the bottom to prevent friction. A top stationary ribbed plate, A, Fig. 1, similar to the bottom plate, with flanges, is placed upon the curb C, Fig. 4, and the three parts of the case are secured firmly together by long bolts extending from top to bottom through the projecting flanges on them. Through the top plate an opening, Fig. 1, H, is made for the discharge of water of the same size as that in the bottom. In this open-

ing, seven inches from and parallel with a self-adjusting abutment, to be hereinafter fully described, there is inserted a strong rib four and three-eighths inches wide, and braces running back from it against the others, and supported by them. Upon the front of this rib are cast bearings for the ribs of the abutment to slide against as it rises and descends, and to sustain the rearward pressure of the abutment when stationary, there being, also, two or more broad and strong ribs running across the opening in the bottom plate, with holes through them, into which slightly-projecting bolts 2, Fig. 3, upon the rear (at the bottom) of the abutment enter when it descends, and secure it in there while the pressure is against it. At the front of the apertures in the top and bottom plates of the case—it being about eight inches in advance of the rear side of the feeding-trunk—the abutment A, Figs. 3 and 4, referred to, is placed. This extends from a groove in the periphery of the case to the hub of the piston; and from the bottom, above the top of the casing, as shown at *b*, Fig. 2, its edges running up into grooved guide-posts *e e*, Fig. 2, which stand eighteen inches high upon the casing. Upon the back of the abutment five ribs, *d*, Fig. 3, half an inch thick and six inches broad, are cast, those nearest the hub of the piston being narrowed to conform to its shape, and touch it when rising. Through the two outermost ribs of the abutment, and as near the periphery of the casing as may be, and near the bottom, an inch-iron pin, *p*, Fig. 3, is put, with a narrow bevel-faced wheel, *w*, Fig. 3, six inches in diameter, running upon it, under which the front of the cam-piston comes in its revolutions, and lifts the abutment while it passes under, being assisted by a balancing lever-weight and springs hereinafter described, viz., an iron post, D, Fig. 2, about eighteen inches high, is secured, on the top of the casing, obliquely in the rear of the abutment. Upon a pin near its top a lever, L, Fig. 2, is hung, having upon one end of it a long link, *l*, Fig. 2, reaching down between the ribs to the center of the abutment, and being there attached to it, while upon the other end a balancing-weight, *w*, Fig. 2, is secured, the two arms of the lever being nearly equal, and of sufficient length to raise the abutment just out of the casing, and to force it up the grooved guides, while the cam-piston assists and passes under it. To act in concert with the balancing-lever and cam-piston in raising the abutment, a spring, *s*, Fig. 4, is placed on the casing in the rear of the abutment, which spring bears up against a rearward-projecting pin, *n*, Fig. 2, upon the abutment, when stationary, and starts it upward just as the cam-piston approaches, it being then freed from a spring-latch, *m*, Fig. 2, which secures it down until just then. This latch springs at its lower end, being secured to the casing at the front side of the abutment, standing upright, having upon its rear side a small knob, *k*, Fig. 2, projecting slightly over the abutment when it is down close or stationary; but, when the top of the spring is forced back by a small cam, *v*, Fig. 4, attached to the front arm of the piston-shaft, the abutment rises, sliding up and down against the knob of the spring, which, as soon as it is entirely down and bolted, projects over it and secures it there until the piston approaches, when it is again freed by the operation of the cam *v*, Fig. 4. On the casing, beneath the balancing-weight upon the lever, is secured a spring, *e e*, Fig. 2, of steel or brass, and a rubber under, for said weight to lodge upon when it descends, to prevent a jar, and assist in sending it up and driving down the abutment, which is principally done by a spring-cam, G, Fig. 4, placed upon a short arm, *i i*, Fig. 2, near the connecting-band B *a*, Fig. 1, at its front end, and being secured at its rear end by a vertical bar, *h h*, Fig. 4, extending up to the rear arm of the piston-shaft. The before-mentioned water-trunk M, Figs. 1 and 3, is about three feet seven inches wide, and is secured to the casing on strong vertical and horizontal flanges cast there, and runs out from the case A in an oblique direction, its outer end inclining rearward, and in its center about six feet distant from the piston-shaft, and about one foot in advance of a line drawn parallel with the piston-shaft S, Fig. 2, and the abutment, a hollow cock, C, Fig. 3, with a shaft, *s s*, Fig. 2, secured through the center of its heads, is placed, turning in suitable boxes, the cock corresponding in height with the casing A, and in diameter three and a half feet. Through two sides of this cock *o o*, Fig. 3, an opening is made for the water to pass when supplying the motor. This opening should be equal in area to the rear end of the piston C P. The opposite or solid sides of the cock prevent the admission of the water while the abutment is being raised and driven down at each revolution of the piston, the cock being turned one-fourth of a revolution as each of two arms, *a a*, Fig. 1, on the piston-shaft, whose whole length is about five and one-half feet, come in contact with vertical pins with rollers *n n*, Fig. 1, on one of four arms, *b b*, Fig. 1, about two feet long, on the cock-shaft. The arms on the piston-shaft are so placed that the closing one shall have turned the cock-shaft just one-fourth of a revolution, and entirely cut off the water, nearly as soon as the cam-piston reaches the abutment, which is then raised by the piston and abutment-spring, while the feeding-arm is so placed that it will take effect just after the abutment is down and secured, and the piston is at the front of the feeding-aperture in the case A, and thus prevent the escape of the water. Stays, Fig. 3, placed in the trunk M, Fig. 3, at the feeding-aperture of the cock, prevent the water from the fountain from passing beside, over, or under it, although there should be a little space everywhere between the cock and trunk to prevent the pressure from bursting it; or, in other words, to equalize the pressure upon it when open. On the inside of the trunk, be-

tween the feeding-cock and the motor or casing, valves *v v*, Fig. 3, are placed to admit the dead water surrounding and covering the motor and trunk at all times. When the water is cut off from the fountain by the feeding-cock, these valves supply the motor, which is, by their assistance, enabled to commence labor at the instant any water through the cock is admitted, and prevent any disturbance of the discharging stream, which would otherwise seek to follow the piston, and flow against the descending abutment, preventing its easy adjustment, and produce a waste of power. On the top of the abutment, very near its outer guide, is placed a wheel, L, Figs. 2 and 4, some six inches in diameter, turning on a pin, on which the spring-cam before mentioned acts while forcing it down. This cam is made to spring when the abutment-wheel comes in contact with it, to prevent a jar, and to send it down quickly. The arms are secured to the shafts by set-screws, and those on the piston-shaft are fastened together by the iron band B *a*, Fig. 1, to give them strength. The arms on the cock-shaft should be free, and spring some, when brought in collision with those on the piston-shaft, to prevent a jar. Rubber bearings may also be used upon them. Attached to the feeding-trunk, just outside of the cock, upon a firm foundation, is a strong pen-stock, reaching up into the fountain, which should be three feet deep. This pen-stock should have an area at least two and one-half times as great as the opening through the cock and casing, and should extend a foot above the bottom of the fore-bay or fountain to keep out sand. Very near its top, a close-fitting sliding gate is inserted, to be used in starting, and stopping, and regulating the motor when in use. Above the arms and cams attached to the piston-shaft a driving beveled cog-wheel is secured to the shaft, which should gear with one of the same size secured on a horizontal shaft, and turn in suitable boxes, carrying upon it a fly-wheel of large diameter, one side of which should be a little heavier than the other, and so secured upon its shaft that the superior weight is descending while the abutment is rising and descending, and a little longer, in order that the piston may, by it, always be stopped in the proper place to receive the water, when, in starting, it is admitted into the pen-stock by the sliding gate, and to give a steady motion to the piston when running.

The operation of my improved motor is as follows: The gate in the pen-stock being drawn, and the water admitted, the motor starts slowly, and when it has nearly attained the desired speed the work is gradually put on. If it then inclines to move too fast, either increase the work or shut off part of the water at the sliding gate at the top of the pen-stock. If too slow, take off part of the work.

Twenty revolutions per minute is deemed to be a good speed for a motor of six feet diameter, rigged as described; but its motion should be governed with reference to the machinery to be driven, the amount of water at hand, and to the jar produced on the arms of the piston-shaft when brought in contact with the rollers on the arms of the cock-shaft, if run too rapidly.

Should the supply of water or other propelling agent warrant, and make it desirable to use a much greater speed, an intermediate shaft may be placed in or near the center of the feeding-trunk, and in or near the flange of the motor, and upon this shaft a cog or friction wheel be secured, one-half of whose diameter shall reach two-thirds of the distance from it to the cock-shaft, where one placed on that shaft of the proper size is to gear into it. On the under side of this large wheel, at the proper distance from its center to the piston-shaft, eight pins with rollers upon them are placed at equal distances apart. These rollers are acted upon by two short springing arms attached to the upper sides of the piston-shaft arms, of such length and so placed as that each of them will take effect at the proper time, and carry the large wheel exactly one-eighth of a revolution at each revolution of the piston-shaft, and consequently the cock-shaft will turn one-fourth of a revolution at each movement, which will admit and cut off the water the same as the first-described plan, with less than half the jar and strain upon the arms of the piston-shaft, when running at the given speed, which may, therefore, be increased.

If it be preferred to balance the abutment by a pulley and weight, a stand is placed upon the casing of the motor, close in the rear, at the center of the abutment, upon an iron bar secured on the casing for that purpose. The stand is of proper height to receive a grooved pulley-wheel, over which a chain passes, being fastened to the abutment near its bottom, while upon the other end a weight equal to the abutment is secured, which, in connection with the cam-piston, spring-cam, and abutment-spring, answers well.

Although the motor herein described is to be driven by water, it will readily be seen that one constructed substantially upon the same principle can be driven by steam, hot air, or gas, and placed in a vertical position, if desired so to use it, the size and strength being made to correspond with the propelling agent intended to be used.

Having thus described my improved motor, what I claim as my invention, and desire to secure by Letters Patent, is—

1. The cam-piston, substantially as described.

2. The cam-piston combined with a stationary casing, and placed one within the other, of such proportions, respectively, and so arranged as to leave only sufficient space between the two for the free revolution of the piston and to prevent the forward escape of the water or other propelling agent, substantially as herein set forth.

3. The arrangement of the casing and cam-piston, in combination with the self-adjusting abutment, forming a stationary resistance to the rearward escape of the impelling agent or fluid, while the piston is, by the momentum and pressure, driven forward and from the abutment to and past the discharging-apertures in the casing, where it escapes, substantially as described.

4. The feeding-cock and cut-off, and the arms to operate the same, in combination with the feeding trunk valves, whereby some of the dead water surrounding the motor is admitted into it at each revolution of the piston, and made to act immediately with it, and thus prevent any waste of water from the fountain or the disturbance of the discharging stream of the motor, substantially as set forth.

5. The combination of the balancing-lever or pulley and weight with the springs, cams, and rollers, all acting in concert upon the abutment, substantially as set forth.

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Witnesses:

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