(No Model.) 3 Sheets—Sheet 1.

P. MURRAY, Jr.

WATER MOTOR.

No. 363,534. Patented May 24, 1887.

Fig. 1.

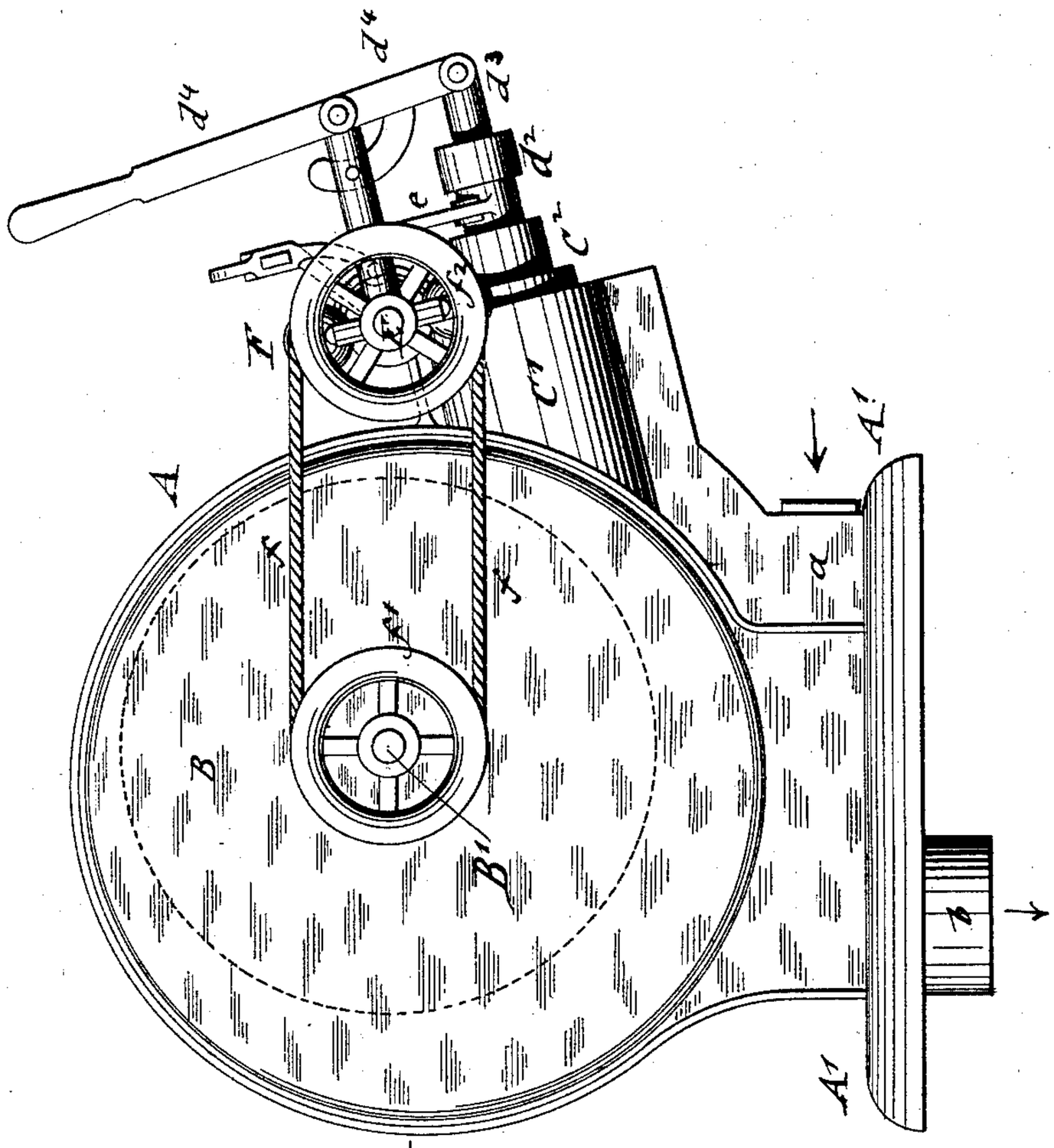
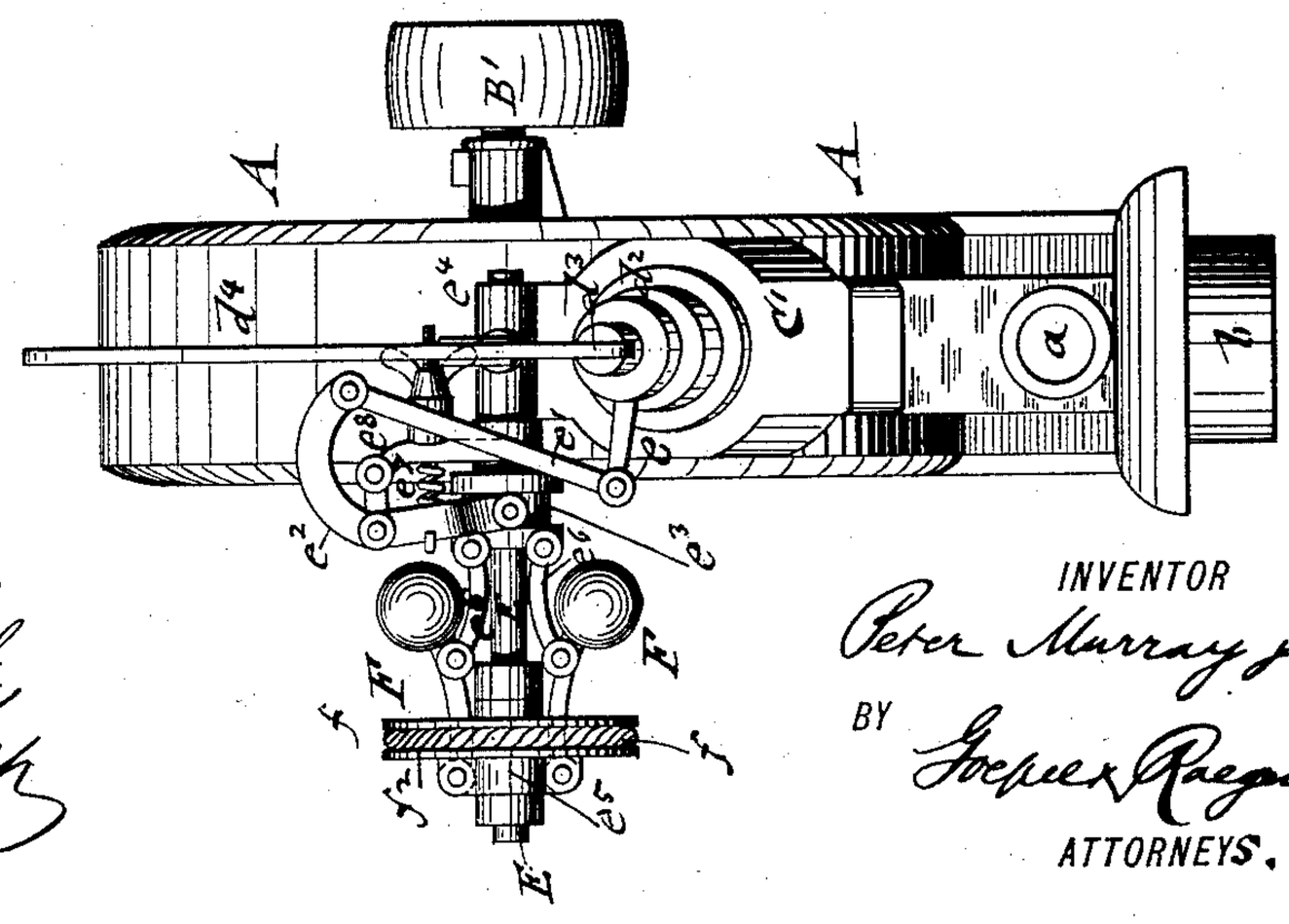


Fig. 2.



WITNESSES:
A. Schehl.
Carl Kayh

INVENTOR
Peter Murray jr.
BY Goepel & Raegener
ATTORNEYS.

(No Model.) 3 Sheets—Sheet 2.

P. MURRAY, Jr.

WATER MOTOR.

No. 363,534. Patented May 24, 1887.

Fig. 3.

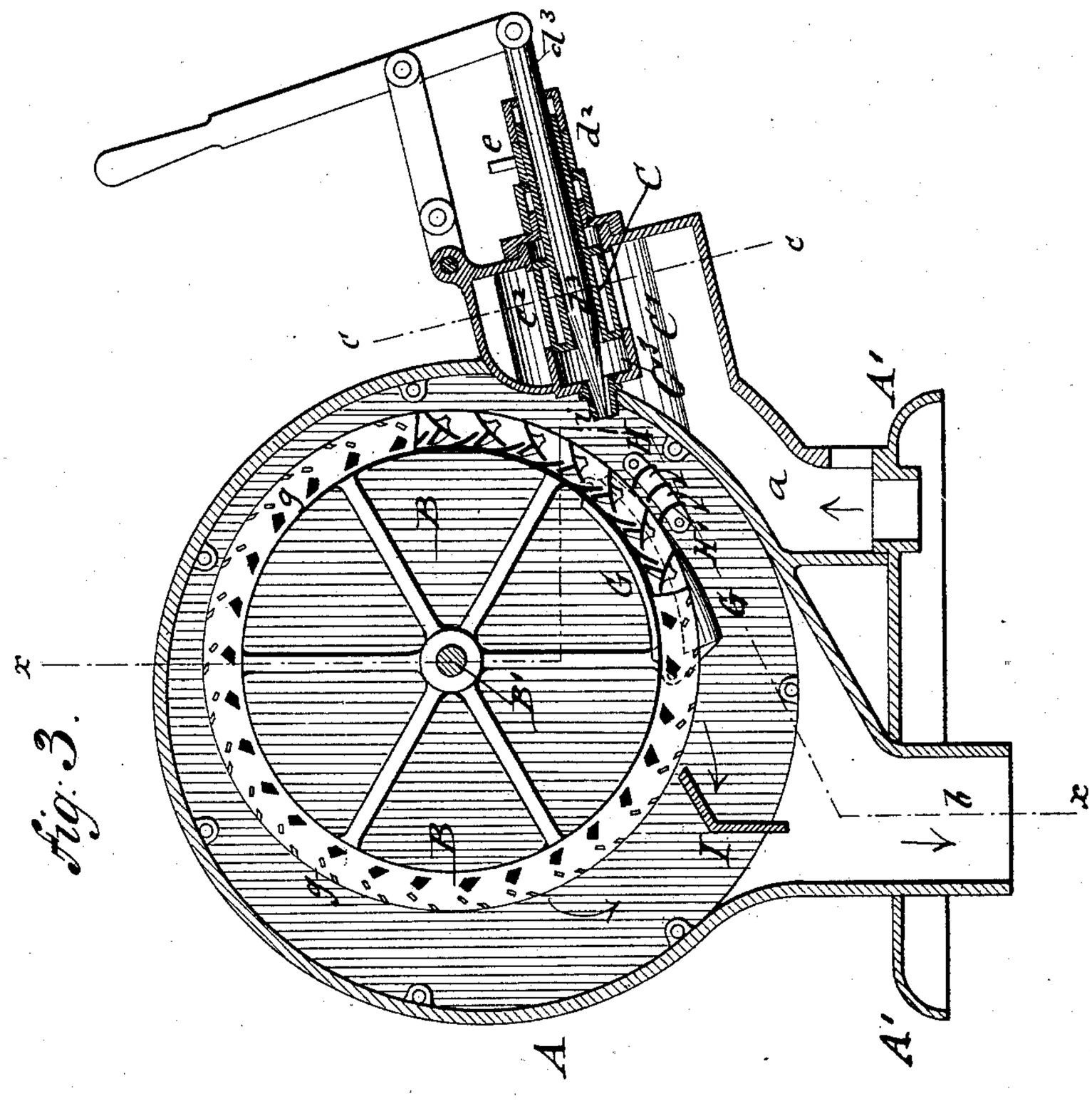
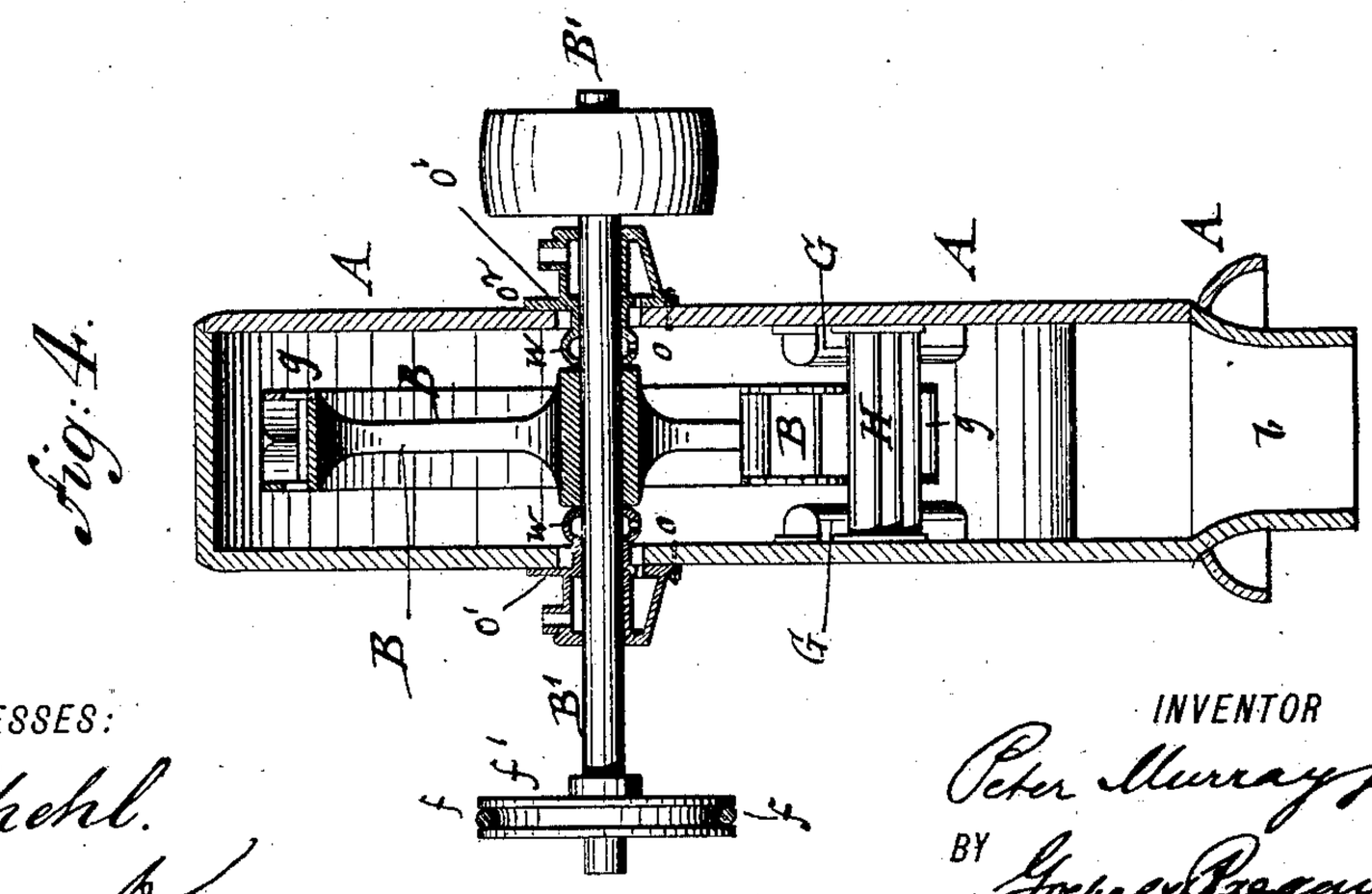


Fig. 4.



WITNESSES:

A. Schehl.

Carl Kapp

INVENTOR

Peter Murray jr.

BY Goepel & Roegner

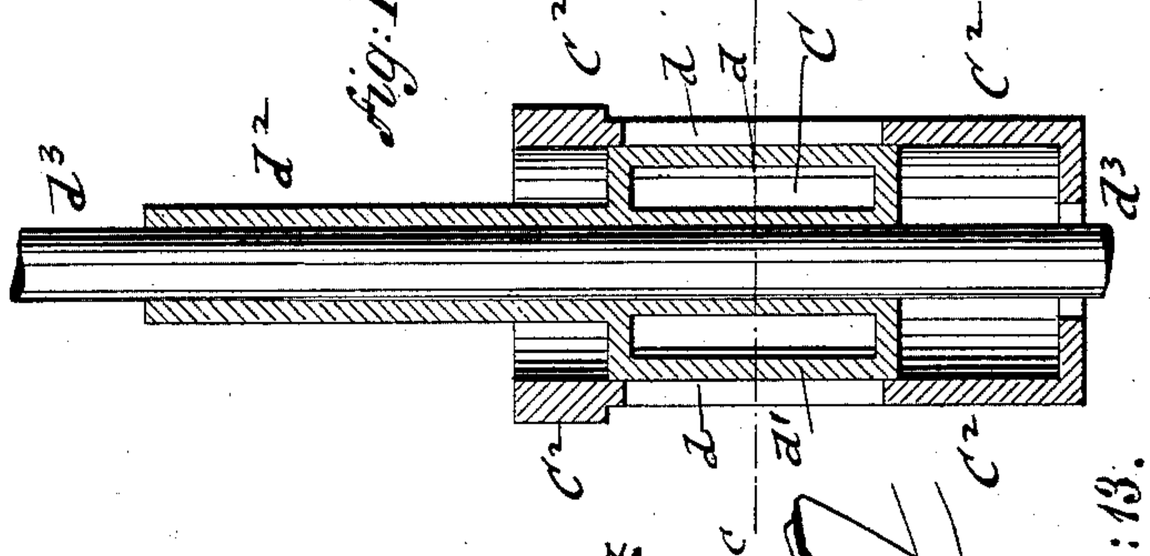
ATTORNEYS.

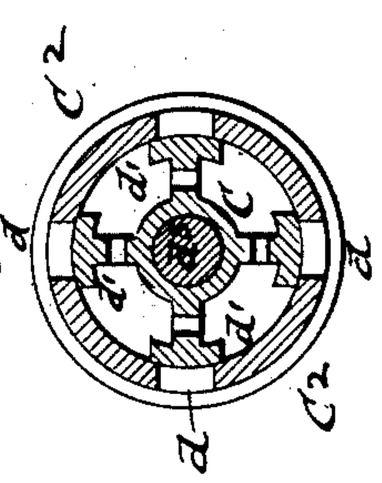
(No Model.) 3 Sheets—Sheet 3.

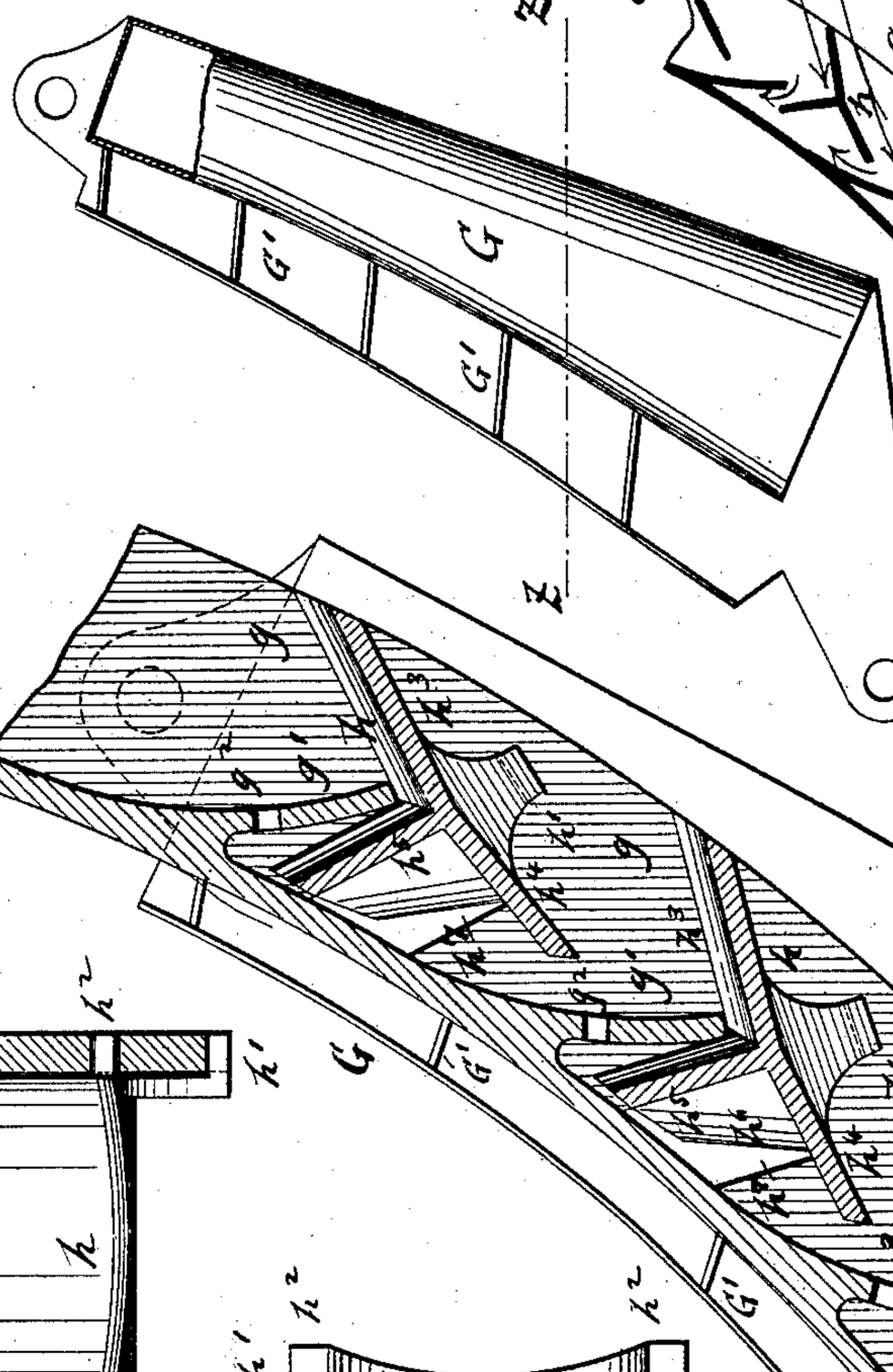
P. MURRAY, Jr.

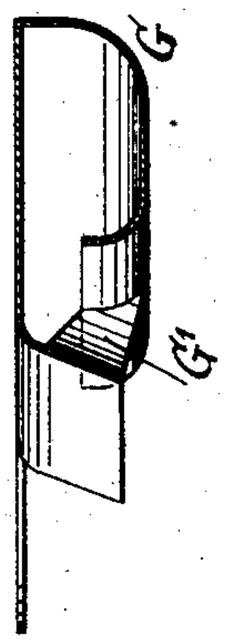
WATER MOTOR.

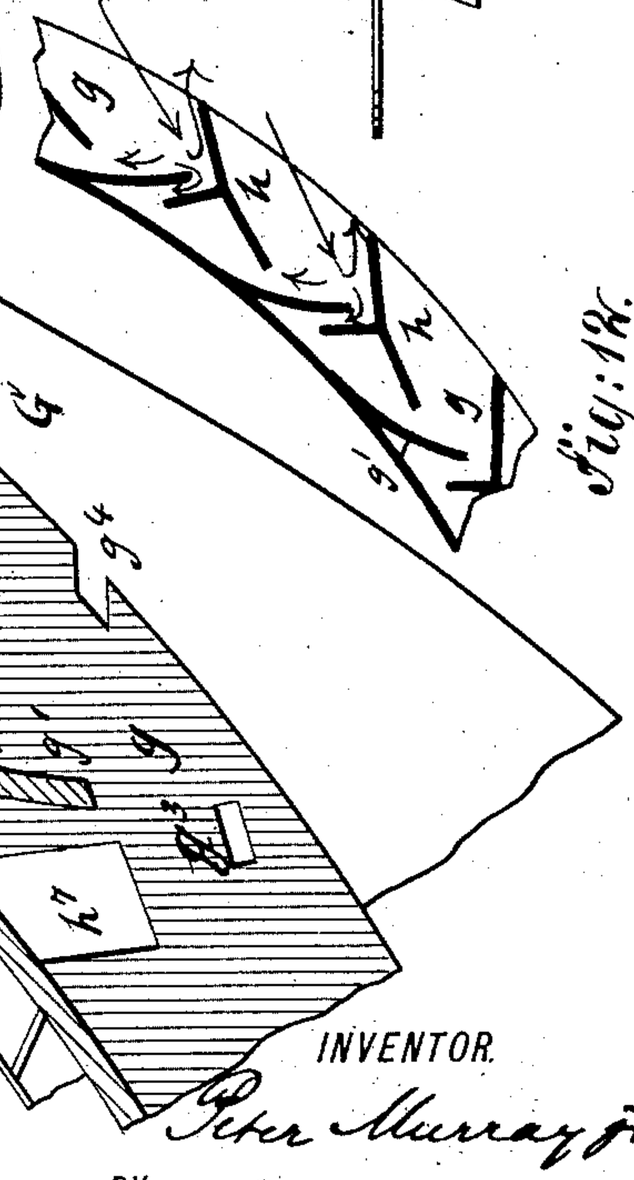
No. 363,534. Patented May 24, 1887.











WITNESSES:
A. Schenk.
Martin Petry.

INVENTOR.
Peter Murray jr.
BY
Jaquez & Raegener
ATTORNEYS.

UNITED STATES PATENT OFFICE.

PETER MURRAY, JR., OF NEWARK, NEW JERSEY, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE BACKUS MANUFACTURING COMPANY.

WATER-MOTOR.

SPECIFICATION forming part of Letters Patent No. 363,534, dated May 24, 1887.

Application filed March 6, 1886. Serial No. 194,256. (No model.)

To all whom it may concern:

Be it known that I, PETER MURRAY, Jr., of Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Water-Motors, of which the following is a specification.

This invention has reference to an improved water-motor of that class in which a water-wheel is rotated by the force of a stream of water supplied by a water-conduit, the water-wheel being constructed in such a manner that the force of the water is utilized to a high degree, and the motor provided with means for regulating the supply of water, and thereby the speed of the same.

The invention consists of a water-motor comprising a cylindrical casing with supply and discharge channels, a water-wheel in said casing, a supply-regulating valve having an injection-nozzle, a casing surrounding said regulating-valve, a needle-valve passing through the supply-valve, a fixed shaft, a governor on said shaft, mechanism for connecting the governor to the supply-valve, and a belt-and-pulley transmission from the shaft of the water-wheel to the governor. The water-wheel is provided with buckets of a novel construction.

The invention consists, next, of chutes attached to the casing at both sides of the water-wheel, said chutes having pockets for receiving and conducting off the water escaping through the side openings of the buckets of the water-wheel.

The invention consists, further, of concavo-convex deflectors located close to the circumference of the water-wheel below the line of impact of the stream of water supplied by the injection-nozzle of the regulating-valve.

The invention consists, further, of certain details of construction and combination of parts, which will be fully described hereinafter, and finally pointed out in the claims.

In the accompanying drawings, Figure 1 represents a side elevation of my improved water-motor. Fig. 2 is an end elevation of the same. Fig. 3 is a vertical longitudinal section, a part of the circumference of the water-wheel being broken away. Fig. 4 is a vertical transverse section on line *x x*, Fig. 3. Fig. 5 is a vertical section of a portion of the water-wheel, drawn on a larger scale, and showing the position of the buckets and of a chute at one side of the same. Figs. 6 and 7 are respectively a detail side view and a horizontal section on line *z z*, Fig. 6, of one of the chutes for conveying off the water from the buckets of the wheel. Figs. 8 and 9 are details of the buckets and their connection with the frame of the wheel. Figs. 10 and 11 are respectively a vertical central section and a horizontal section on line *c c*, Fig. 10, of the water-regulating supply-valve; and Figs. 12 and 13 are diagrams illustrating the action of the water on the buckets of the wheel.

Similar letters of reference indicate corresponding parts.

Referring to the drawings, A represents the shell or casing of my improved water-motor, which casing is made of cylindrical shape and supported on a suitable bed-plate, A′. The casing A is provided at one end with a supply-channel, *a*, and at the other end with a discharge-channel, *b*, of larger cross-section than the supply-channel.

At the interior of the casing A is arranged a water-wheel, B, the shaft B′ of which is supported in bearings arranged eccentrically to the casing and in such a manner that the wheel is closer to the supply-opening and farther from the discharge-opening, whereby a larger space is provided in the casing A at that point opposite to the inlet of the water, so that the water dropping from the buckets of the wheel has sufficient room and does not exert, together with the resistance of the air, a retarding action on the wheel B. The hub of the water-wheel B is keyed to the shaft B′, and the latter retained in position relatively to the casing by annular wipers *w*, (shown in Fig. 4,) which wipers are made integral with the shaft-bearings of the casing A and provided with openings *o* at their lower parts for returning the water that passes along the shaft B′ to the bearings to the lower part of the casing.

The shaft-bearings are provided with disk-shaped flanges at points next adjoining the outer surface of the side walls of the casing A, said flanges being bolted to said walls. These flanges also cover the openings in the side

walls of the casing A, through which the wipers are inserted when placing the shaft-bearings in position, said openings being of sufficient diameter to permit the introduction of the wipers.

The side walls of the casing A are provided with openings o' concentric to the axis of the water-wheel shaft, said openings being somewhat larger in diameter than the diameter of the wipers, so as to permit the ready insertion of the same. The openings o' are closed by disk-shaped flanges o^2, located outside of the casing and made integral with the shaft-bearings, said flanges being tightly applied to the casing, so as to close the openings o' and prevent any leakage of water through the same.

The supply-channel a communicates with the cylindrical casing C', that surrounds the supply-regulating valve C. The valve C is arranged in an inclined position, nearly tangential to the lower part of the water-wheel and fitted into a cylindrical shell, C^2, having openings or ports d, that communicate with the exterior casing, C'. The valve C is provided with radial slotted arms having T-shaped heads d', which latter open or close the ports d of the cylindrical shell C', so as to regulate thereby the supply of water to the interior of the casing A. The valve C is provided with a hollow shank, d^2, through which passes the shank of a needle-valve, d^3, the inner tapering end of which extends into an injection-nozzle, i, at the inner end of the shell C'. The outer end of the needle-valve d^3 is connected to a fulcrumed lever, d^4, by means of which the needle-valve d^3 may be moved forward into the injection-nozzle, so as to close the same, or moved back, so as to open the same, according to the size to be given to the jet of water.

Between the valve C and the nozzle i is arranged an annular chamber, C^3, of sufficient size to contain a body of water large enough to supply a solid unbroken jet of water to the nozzle. The hollow shank of the valve C, as well as the shank of the needle-valve D, extends through stuffing-boxes of the casing C' to the outside, so as to prevent the escape of water. The hollow shank of the valve C is provided at its outer end with a fixed crank-arm, e, that is connected by an intermediate pivot-rod, e', with the upper end of a fulcrumed lever, e^2, the lower forked end of which engages a grooved collar, e^3, that slides on a fixed horizontal shaft, E, which is supported in a socket, e^4, at the top of the casing C' of the supply-regulating valve C, as shown in Figs. 1 and 2.

A centrifugal governor, F, of any approved construction, is supported by a sleeve, e^5, on the fixed shaft E and connected by pivot-links e^6 to the sliding collar e^3. The governor F receives rotary motion by a belt-and-pulley transmission, $f f' f^2$, from the shaft B' of the water-wheel, and serves to impart, by the collar e^3, lever e^2, connecting-rod e', and crank-arm e, an axially-turning motion to the valve C, so as to open the same more or less, regulate the supply of water to the water-wheel, and rotate the same at a uniform speed.

The speed can be adjusted by regulating the tension of a spiral spring, e^7, interposed between the lever e^2 and a fixed arm, e^8, as shown in Fig. 2, whereby the governor has to overcome a greater or smaller resistance of the spring.

The jet of water is forced from the injection-nozzle in a line nearly tangential to the circumference of the water-wheel B, the jet forming impact with the buckets of said wheel, so as to impart rotary motion to the latter. The water-wheel B is provided with a flanged circumferential rim, g, of U-shaped cross-section, which rim is provided with a number of inclined lips, g', having openings g^2 near the apex of the angle formed by said lips with the circumference of the rim g, as shown in Fig. 5.

Below the edge of each lip g is arranged a bucket, h, which is attached by side and end lugs, $h' h^2$, to recesses g^3 and notches g^4 of the flanges of the rim, as shown in Figs. 5 and 8. Each bucket h is formed of a slightly-concave front part, h^3, that extends forward from the lip toward the circumference of the flanged rim, a rear part, h^4, that extends toward the next lip, g, and a middle part, h^5, that extends at right angles to the front part, said middle part being re-enforced by a central tapering rib, h^6, as shown in Figs. 5, 8, and 9.

Between the lip g' and the front part, h^3, of the bucket h a narrow space is left, through which the water can pass to the space between the lip g' and the middle part, h^5, of the bucket, so as to force the air through the hole g^2 in the lip g' and destroy thereby the air-cushion formed between the lip and front part of the bucket. The full force of the jet on the lip and bucket is thereby utilized without any impeding action exerted thereon by the air. The water then passes up along the front part of the lip g' and the rear part of the bucket in front of the lip, being divided by the tapering rib of the middle part and conducted through openings h^7 of the side flanges of the ring to chutes G, that are attached to the side walls of the casing A, one at each side of the water-wheel. The chutes G are divided by transverse partitions G' into pockets, which serve to receive the water that passes through the side openings, h^7. Each chute G is partly closed by a curved front wall, the upper end being closed, while the middle and lower parts increase gradually in width toward the lower end, so that the water is shed freely and without choking. By thus conducting the water from the buckets through the side openings of the rim to the chutes of the casing the buckets are relieved to some extent of the water, while the remaining water is discharged freely in front in the wider space formed in the casing below the water-wheel and at the side opposite to the inlet-nozzle, as shown in Fig. 3.

The relative position of the discharge-chutes G to the water-wheel is shown in Figs. 3, 4,

and 5, while one of the chutes is shown in detail in Figs. 6 and 7.

To prevent the water that has acted on the lip *g* and bucket of the water-wheel from being thrown or deflected into the line of the jet of water, a deflector, H, is attached to one side wall of the casing and provided with convexo-concave plates H′, that extend transversely across the buckets of the water-wheel close to the same, as shown in Figs. 3 and 4. The deflector-plates H′ take up the water deflected by impact with the bucket and convey it in downward direction toward the discharge-channel, as indicated by arrows in Fig. 3. By the joint action of the discharge-chutes and deflector-plates the full impact of the water forced on the water-wheel is utilized, and but little if any retarding action exerted on the same, as the dead-weight of water or the resisting or back action of the same on the wheel is considerably diminished.

A transverse obtuse-angled breakwater, I, is located near the wheel B, and vertically above the discharge channel *b*, so as to conduct the water dropped from the buckets to the channel *b*. The eccentric arrangement of the wheel permits the free expansion of the water carried along by the buckets beyond the breakwater I and dropped in the enlarged space of the casing opposite to the injection-nozzle, so that it is conducted in a free and unobstructed manner along the breakwater to the discharge-channel. The circumferential rim of the water-wheel, as well of the buckets, is made of cast metal, and can be readily and cheaply put together.

By my improved construction the speed of the motor can be regulated to a nicety, according to the pressure of the water supplied, and the water-wheel rotated at a uniform speed, while the power of the water is utilized in a higher degree than in the constructions heretofore in use, owing to the eccentric position of the water-wheel in the casing, the construction of its buckets, and the arrangement of the discharge-chutes and deflector-plates.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination of a cylindrical casing having a supply and a discharge channel, a supply-regulating valve, a casing surrounding said valve and provided with an annular equalizing-chamber and an injection-nozzle, a needle-valve, a governor connected to said supply-regulating valve, a water-wheel in the main casing, and mechanism for transmitting motion from the shaft of the water-wheel to the governor, substantially as set forth.

2. In a water-motor, a water-wheel having a flanged rim and inclined lips having openings, and buckets attached to said rim and extending back of said lips, substantially as set forth.

3. In a water-motor, a water-wheel having a flanged rim and inclined lips with openings, buckets attached to said rim, and side openings in the rim at both sides of said buckets, substantially as set forth.

4. In a water-motor, a water-wheel having a flanged rim and inclined lips with openings and buckets attached by side lugs to notches and recesses of the rim, substantially as set forth.

5. A bucket for water-wheels, consisting of a front portion, a middle portion extending at right angles therefrom, and a rear portion, the middle portion having a tapering center rib at its rear part, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

PETER MURRAY, JR.

Witnesses:

PAUL GOEPEL,

SIDNEY MANN.