No. 751,732. PATENTED FEB. 9, 1904.

J. HOFMANN.

WATER MOTOR.

APPLICATION FILED JULY 6, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

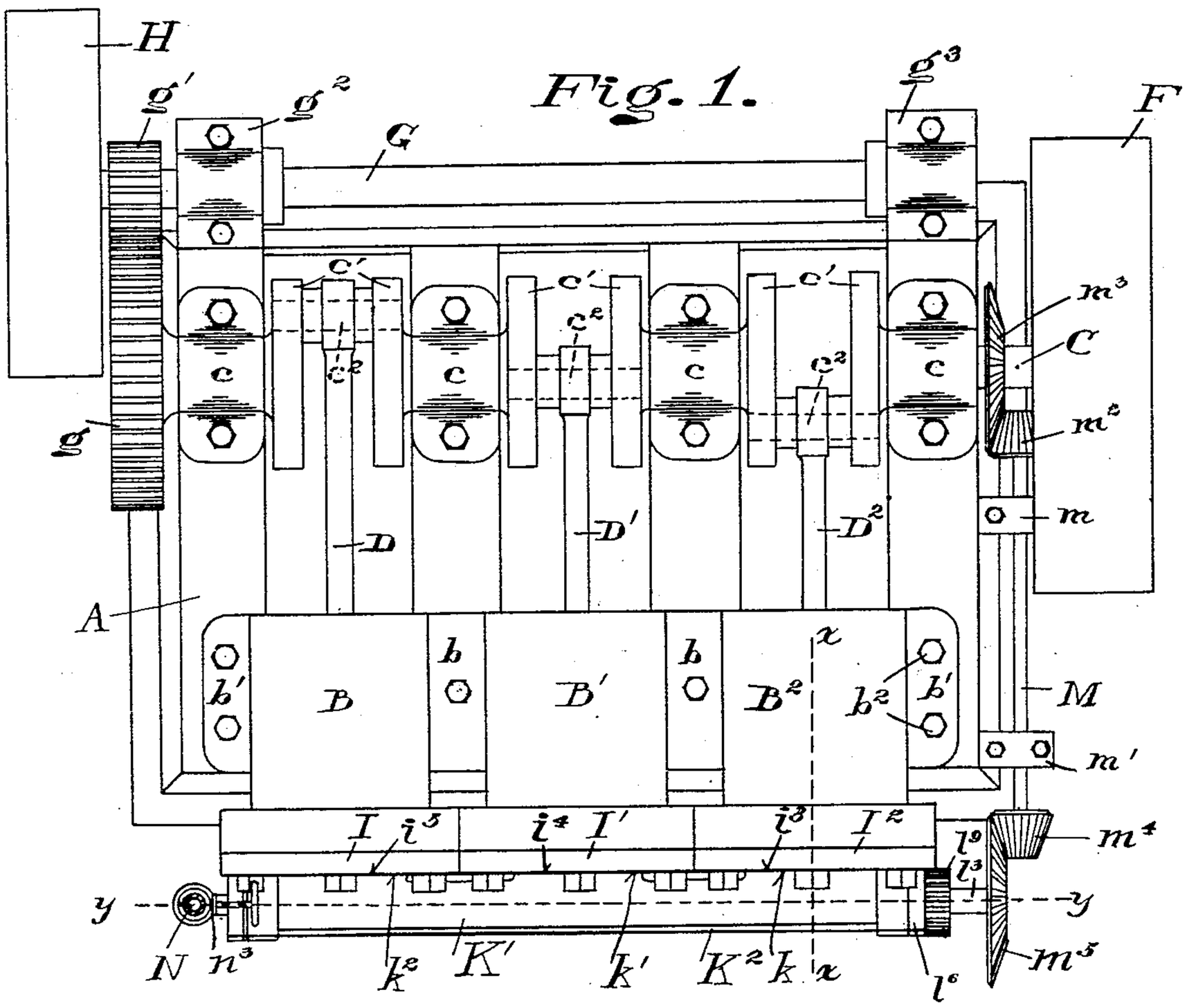
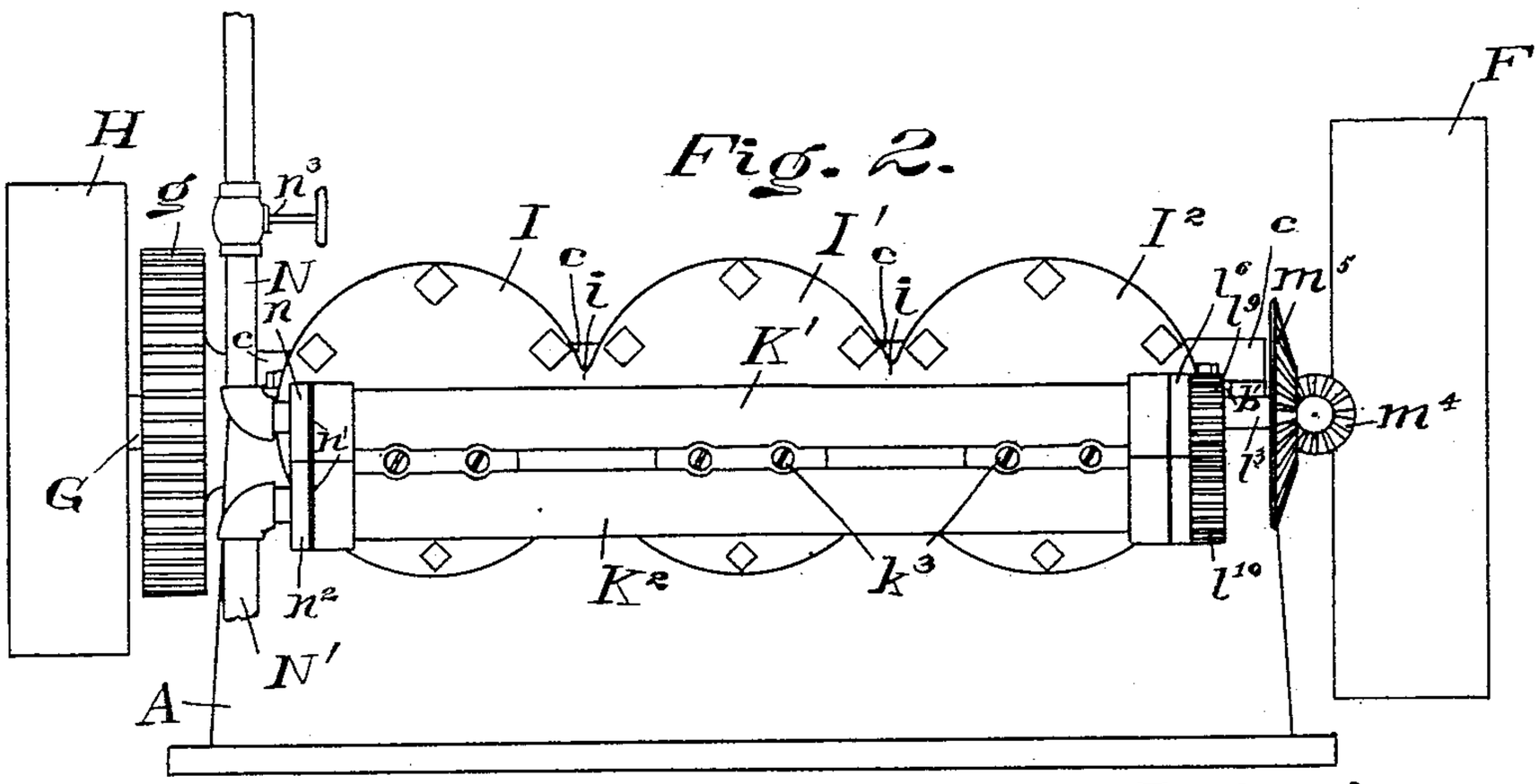


Fig. 2.



Witnesses.

Henry N. Bauer

Herbert P. Harden

Inventor.

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by A. D. Herbsleb, His Attorney.

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NO MODEL. 2 SHEETS—SHEET 2.

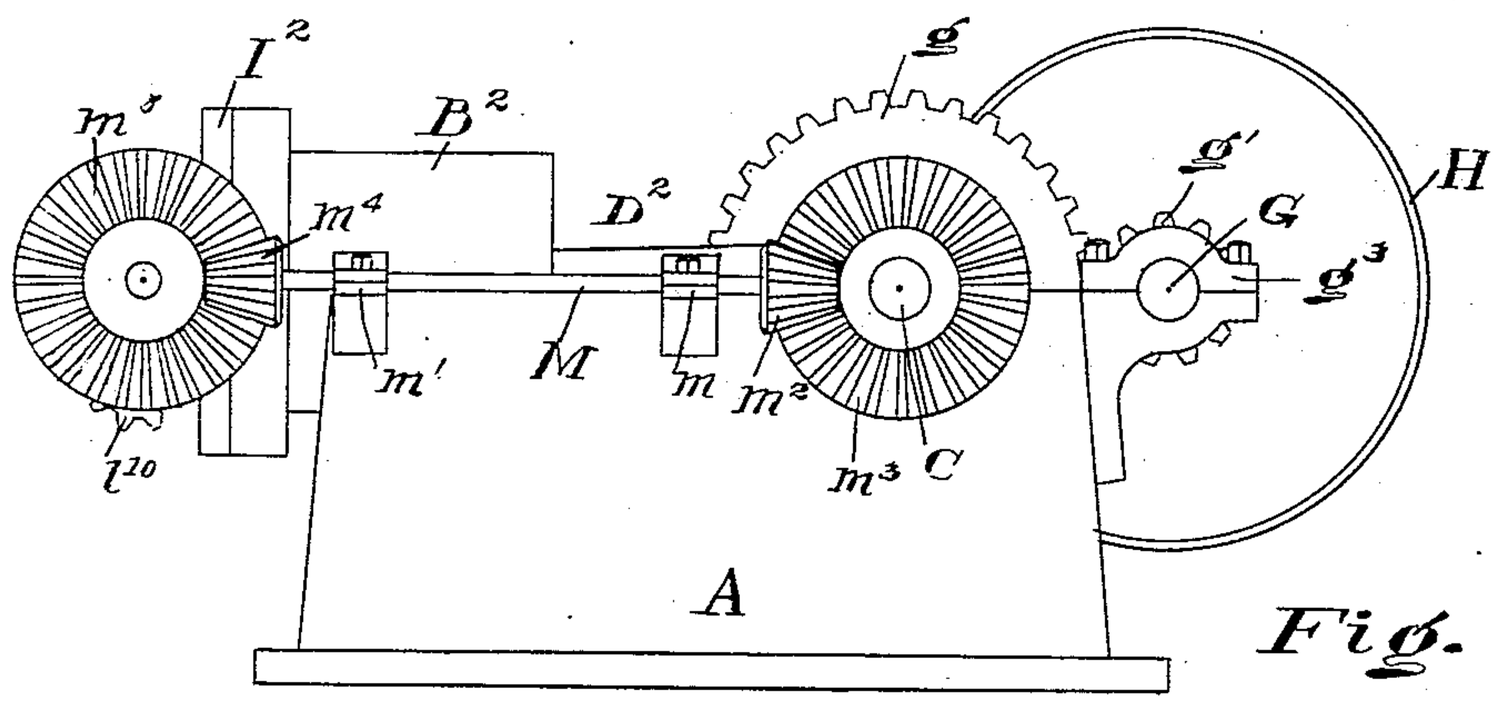

Fig. 3.

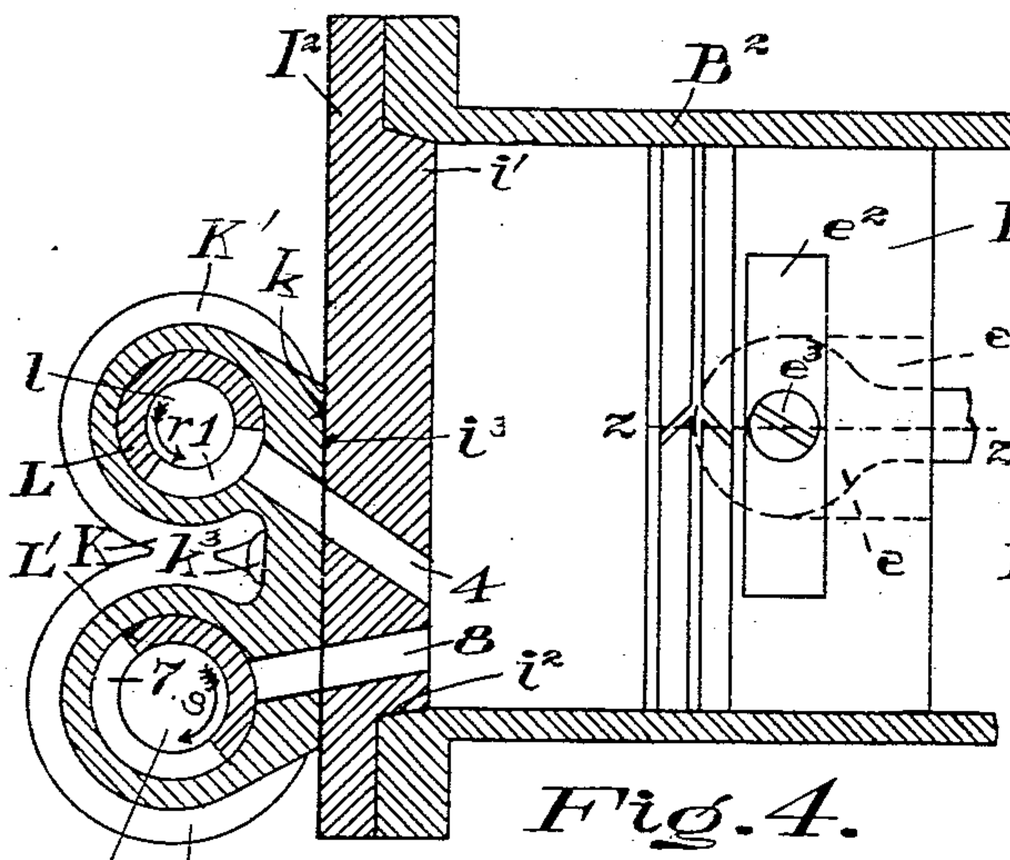

Fig. 4.

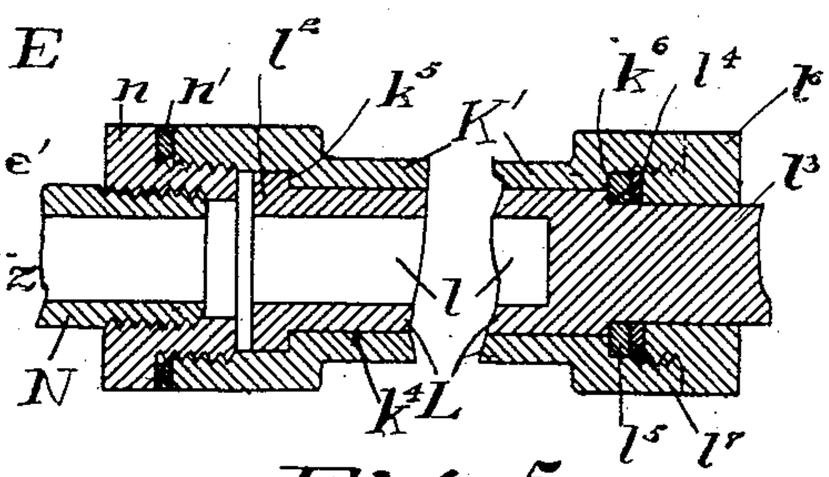

Fig. 5.

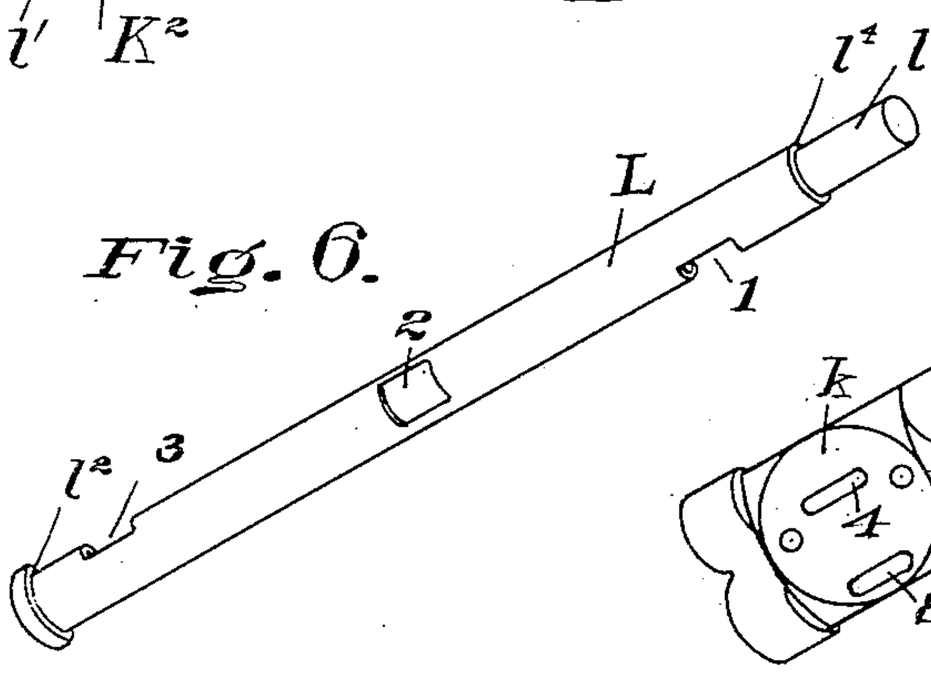

Fig. 6.

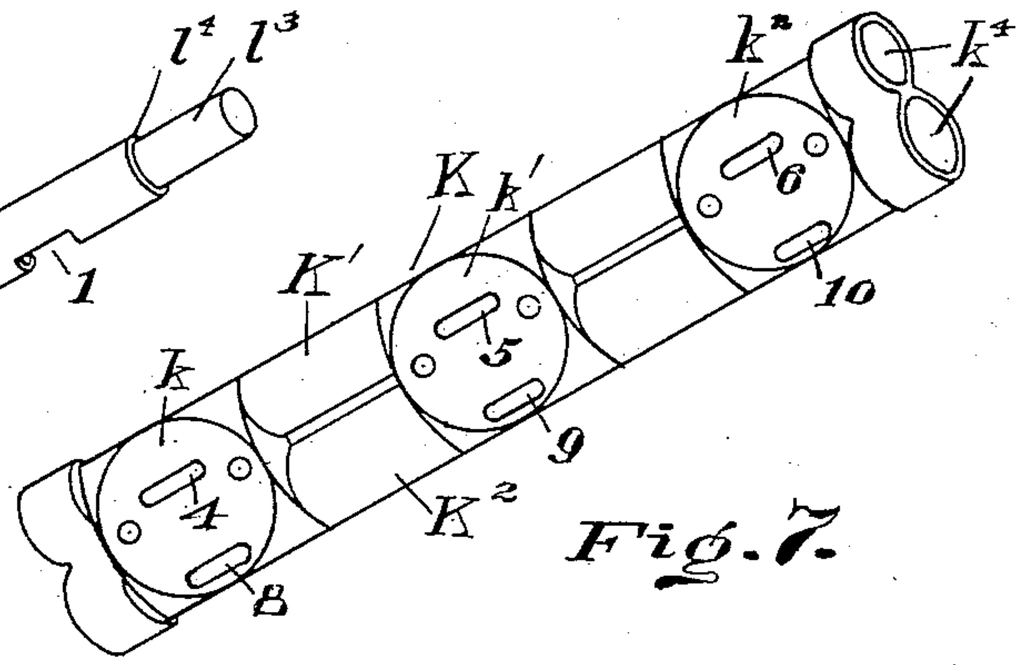

Fig. 7.

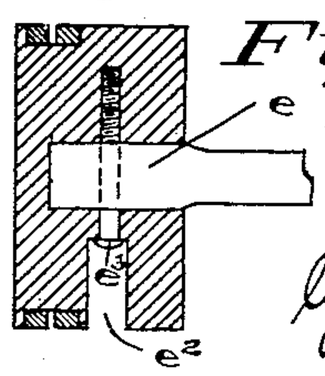

Fig. 8.

Witnesses.
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by L. F. Habsleb, his Attorney.

No. 751,732. Patented February 9, 1904.

UNITED STATES PATENT OFFICE.

JOHANN HOFMANN, OF WEST COVINGTON, KENTUCKY, ASSIGNOR OF ONE-HALF TO HARRY F. BITTLINGER, OF COVINGTON, KENTUCKY.

WATER-MOTOR.

SPECIFICATION forming part of Letters Patent No. 751,732, dated February 9, 1904.

Application filed July 6, 1903. Serial No. 164,408. (No model.)

To all whom it may concern:

Be it known that I, JOHANN HOFMANN, a citizen of the United States, residing at West Covington, in the county of Kenton and State of Kentucky, have invented certain new and useful Improvements in Water-Motors, of which the following is a specification.

It is the object of my invention to provide a new and improved water-motor of few parts of simple construction, and the invention will be readily understood from the following description and claims and from the drawings, in which latter—

Figure 1 is a plan view of my improved device. Fig. 2 is a front end elevation of the same. Fig. 3 is a side view of the same with fly-wheel omitted. Fig. 4 is a section of one of the cylinder ends, partly broken away, on the line $x\ x$ of Fig. 1, showing the inlet and outlet ports and valves. Fig. 5 is a longtitudinal section, partly broken away, of the inlet-casing and valves taken on the line $y\ y$ of Fig. 1. Fig. 6 is a view in perspective of the inlet-valve stem. Fig. 7 is a perspective view of the valve-casing, and Fig. 8 is a detail of one of the pistons in section on the line $z\ z$ of Fig. 4.

A represents a frame.

B B′ B² represent a plurality of cylinders, preferably separate from the frame and interconnected by webs b and having flanges b', through which the cylinder-casting is attached to the frame by bolts b^2.

C is a crank-shaft journaled in suitable bearings c in the frame. The crank-shaft is provided with webs c', between which the crank-pins c^2 are secured, piston-rods D D′ D² connecting the crank-pins with the pistons E, one of which latter reciprocates in each of the cylinders. The piston end of the piston-rod is widened, as shown at e, and takes into a recess e' in the rear of the piston, the walls of which recess guide the piston-rod and provide a good fit. A recess e^2 is provided in the side of the piston for the pin e^3. One end of each cylinder is shown open to the atmosphere.

F is a fly-wheel or pulley attached to one end of the crank-shaft, and G is a supplemental shaft, to which a speed varying from the speed of the crank-shaft may be imparted by pinions $g\ g'$ and from which power may be taken by a pulley H, the supplemental shaft G being journaled in bearings $g^2\ g^3$ on the frame.

I I′ I² are cylinder-heads, preferably connected by webs i and formed in one casting. A projection i'' extends from each head into the end of the bore of the cylinder, the projection and seat in the bore for the projection being made tapering for forming a close union, as shown at i^2.

K is a valve-casing, shown as a twin casing, comprising an inlet-valve casing K′ and an outlet-valve casing K² for accommodating an inlet-valve stem L and an outlet-valve stem L′. The valve-stems are respectively hollow, as shown at $l\ l'$, for respectively receiving and discharging the water or fluid introduced into the cylinders. The valve-casing K is preferably a separate casting, having seats $k\ k'\ k^2$ engaging similar seats $i^3\ i^4\ i^5$ on the cylinder-head casting, bolts k^3 securing the two together. The inlet and outlet valve casing each have an internal bore k^4, with a shoulder k^5 at one end thereof and a shoulder k^6 at the other end thereof. The inlet and outlet valve stems, respectively, have their external periphery fitted to the internal bore k^4, each valve-stem also having a flange l^2, taking against the shoulder k^5, and a reduced end l^3, forming a shoulder l^4 coincident with the shoulder k^6. A collar l^5 takes over the reduced end l^3 and against the shoulder k^6. A hollow cap l^6 is threaded into the end of the casing, with packing l^7 taking between the inner end of the cap and the collar. The reduced end of each valve-stem projects externally of the hollow cap. The inlet-valve stem has a pinion l^9 and the outlet-valve stem a pinion l^{10} attached thereto, the pinions intermeshing and being of equal size and number of teeth for similarly rotating the inlet and outlet valve stems.

M is a transmitting-shaft transmitting motion from the crank-shaft to the pinions. It is supported in bearings $m\ m'$ on the frame, one end thereof having a bevel-gear m^2, meshing with a bevel-gear m^3, secured to the crank-

shaft, the other end having a bevel-gear m^4, meshing with a bevel-gear m^5 on the inlet-valve stem, rotating the crank-shaft and valve-stem in unison.

At its intake end the inlet-valve casing has a hollow cap n screwing into the same, packing n' taking between the flange of the cap and the end of the casing, an inlet-pipe N screwing into the cap. The outlet end of the outlet-valve casing has a similar cap and packing, which cap I designate n^2, an outlet-pipe N' screwing into the cap n^2. The inlet-pipe also has a stop-cock n^3.

The inlet-valve stem is provided with a plurality of openings, as 1, 2, and 3, communicating from the periphery to the bore l of the stem, said openings being arranged in advance of one another about the circumference of the valve-stem. As shown, the openings at the periphery of the valve-stem each extend one-third the distance around that periphery, and each opening extends radially of the valve-stem at an angle of substantially one hundred and twenty degrees to each of the other openings. The object is to arrange the valve-openings about the inlet-valve stem so that one or more of the same shall always be open to the cylinders while the others are closed, the openings of the outlet-valve stem being correspondingly arranged for draining the cylinders after the power-stroke of the piston is completed. The valve-casing and cylinder-heads are provided with ports 4 5 6, with which the valve-openings 1 2 3 alternately register for feeding the cylinders, said ports being preferably in the form of elongated slits extending longitudinally of the valve-stem and slanting downwardly from the inlet-valve stem toward the bottom of the cylinder. The outlet-valve stem is similarly constructed and is provided with similar openings, of which I have shown one, (marked 7 in Fig. 4.) These openings are arranged about the periphery of the outlet-valve stem similar to the arrangement of the openings about the periphery of the inlet-valve stem, and preferably instead of extending one-third the distance around the periphery they extend at least one-half the distance around the periphery, their transverse centers being arranged in advance of each other one-third the distance around the periphery similar to the inlet-openings. The outlet-valve casing and cylinder-heads are provided with outlet-ports 8 9 10, preferably slanting downwardly from the inside of the cylinders to the valve-stem, said outlet-openings also preferably being in the form of slits extending longitudinally of the valve-stem and being preferably slightly larger than the inlet-ports. The outlet-valve stem is also preferably slightly larger and has slightly larger bore than the inlet-valve stem, as indicated in Fig. 4. The inlet-valve closes, preferably, just before the crank-pin arrives at its rear center and the outlet-opening opens as soon as the crank-pin arrives at said center.

In operation when water or fluid is introduced into the inlet-valve stem the pressure will cause seating between the flanges l^2 and shoulders k^5. It will also cause flow of the fluid through one of the ports 4 5 6 into one of the cylinders, causing movement of the piston in that cylinder and through the rotation of the crank-shaft, transmitting-shaft M, and bevel-gears cause a rotation of the inlet-valve stem, which, through the medium of the pinions l^9 l^{10}, causes rotation of the outlet-valve stem. The rotation of the valve-stems causes the alternate and successive opening and closing of the ports into the various cylinders from the inlet-valve stem and also alternate successive opening and closing of the outlet-ports from said cylinders, causing continuous transmission of power through the motor. The rotation of the inlet and outlet valve stems is so timed that the inlet and outlet valve ports of each cylinder are alternately opened and closed, the valves of the several cylinders being successively opened and closed, the size of the respective inlet and outlet ports and openings being such, however, as to permit free emptying of the cylinder. In the form shown the inlet-valve rotates in the direction of the arrow r and the outlet-valve rotates in the direction of the arrow s, Fig. 4.

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

1. In a fluid-pressure motor, the combination with a plurality of cylinders, each having an inlet and an outlet port, an inlet-valve stem and an outlet-valve stem, each having a bore for the passage of the fluid and each having openings communicating with the ports of the respective cylinders, said openings on each valve-stem being arranged around the periphery of said valve-stem in advance of one another, and means for rotating said valve-stems, substantially as described.

2. In a fluid-pressure motor, the combination with a plurality of cylinders, a crank-shaft, a piston in each cylinder, and a piston-rod connecting said pistons respectively with the crank-shaft, of a pair of valve-casings each having an internal bore, a pair of valve-stems fitting said bores, each valve-stem having openings arranged successively about the periphery of the valve-stem, means for rotating said valve-stems in unison, each valve-stem having an internal bore communicating with the openings therein, and said cylinders having ports for said openings.

3. In a water-motor, the combination with a frame, of a plurality of cylinders thereon, a piston and piston-rod for each, a crank-shaft having a crank-pin for each piston, a valve-casing extending transversely of the ends of the cylinders and having an inlet and outlet

port for each cylinder, a rotatable inlet-valve stem and rotatable outlet-valve stem, each having a hollow bore, each of said valve-stems having an opening for each cylinder, said openings arranged around the periphery of said valve-stems, said openings for each cylinder in said valve-stems respectively alternately registering with said inlet-port and said outlet-port for each said cylinder, substantially as described.

4. In a water-motor, the combination of a frame having three cylinders thereon, a piston for each, a crank-shaft having three crank-pins arranged at different points about the axis of said shaft, with piston-rods connecting said crank-pins with the pistons, a valve-casing extending transversely of the ends of the cylinders and having an inlet and an outlet port for each cylinder, an inlet-valve stem and an outlet-valve stem, each having hollowed bore, said inlet-valve stem having three openings projecting radially at angles approximately one hundred and twenty degrees from each other and communicating alternately with said inlet-ports for said cylinders and each extending substantially one-third the distance about the periphery of the valve-stem, said outlet-valve stem having three openings extending radially at angles of approximately one hundred and twenty degrees from each other and communicating alternately with said outlet-ports for said cylinders, and taking more than one-third the distance about the periphery of said outlet-valve stem, and means for turning said inlet and outlet valve stems, constructed and operating substantially as described.

5. In a water-motor, the combination of a frame having three cylinders thereon, a piston for each, a crank-shaft having three crank-pins arranged at different points about the axis of said shaft, with piston-rods connecting said crank-pins with the pistons, a valve-casing extending transversely of the ends of the cylinders and having an inlet and an outlet port for each cylinder, an inlet-valve stem and an outlet-valve stem, each having hollowed bore, said inlet-valve stem having three openings projecting radially at angles approximately one hundred and twenty degrees from each other and each extending substantially one-third the distance about the periphery of the valve-stem, said outlet-valve stem having three openings extending radially at angles of approximately one hundred and twenty degrees from each other and taking substantially one-half the distance about the periphery of said outlet-valve stem, the openings in said inlet and outlet valve stems registering alternately with said inlet and outlet ports at said respective cylinders, and a pinion on said inlet-stem and a pinion on said outlet-valve stem geared together for rotating said valve-stems in unison.

6. In a water-motor, the combination of a frame having three cylinders thereon, a piston for each, a crank-shaft having three crank-pins arranged at different points about the axis of said shaft, with piston-rods connecting said crank-pins with the pistons, a valve-casing extending transversely of the ends of the cylinders and having an inlet and an outlet port for each cylinder, an inlet-valve stem and an outlet-valve stem, each having hollowed bore, said inlet-valve stem having three openings projecting radially at angles approximately one hundred and twenty degrees from each other and each extending substantially one-third the distance about the periphery of the valve-stem, said outlet-valve stem having three openings extending radially at angles of approximately one hundred and twenty degrees from each other and taking substantially one-half the distance about the periphery of said outlet-valve stem, the openings in said inlet and outlet valve stems registering alternately with said inlet and outlet ports at said respective cylinders, means for turning said inlet and outlet valve stems in unison and means for rotating the crank-shaft and inlet-valve stem in unison.

7. In a water-motor, the combination of a frame having three cylinders thereon, a piston for each, a crank-shaft having three crank-pins arranged at different points about the axis of said shaft, with piston-rods connecting said crank-pins with the pistons, a valve-casing extending transversely of the ends of the cylinders and having an inlet and an outlet port for each cylinder, an inlet-valve stem and an outlet-valve stem, each having hollowed bore, said inlet-valve stem having three openings projecting radially at angles approximately one hundred and twenty degrees from each other and each extending substantially one-third the distance about the periphery of the valve-stem, said outlet-valve stem having three openings extending radially at angles of approximately one hundred and twenty degrees from each other and taking substantially one-half the distance about the periphery of said outlet-valve stem, the openings in said inlet and outlet valve stems registering alternately with said inlet and outlet ports at said respective cylinders, and a pinion on said inlet-valve stem and a pinion on said outlet-valve stem geared together for rotating said valve-stems in unison, a transmitting-shaft and bevel-gears between the transmitting-shaft and crank-shaft and between the transmitting-shaft and valve-stem.

In witness whereof I have signed my name hereto in the presence of two subscribing witnesses.

JOHANN HOFMANN.

Witnesses:
AUGUST F. HERBSLEB,
HARRY F. BITTLINGER.