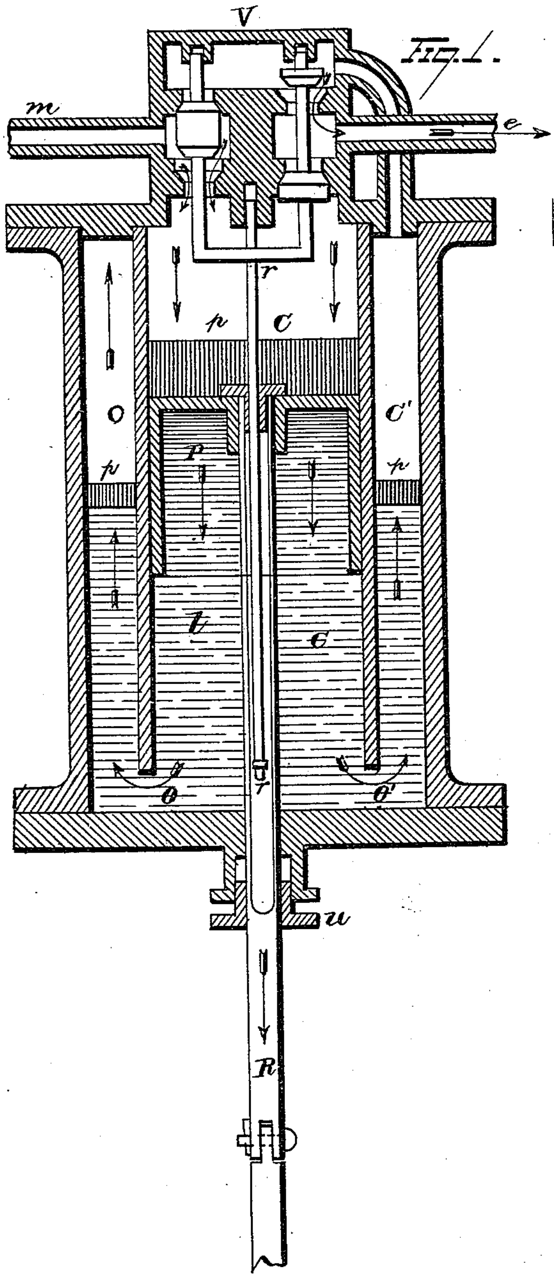
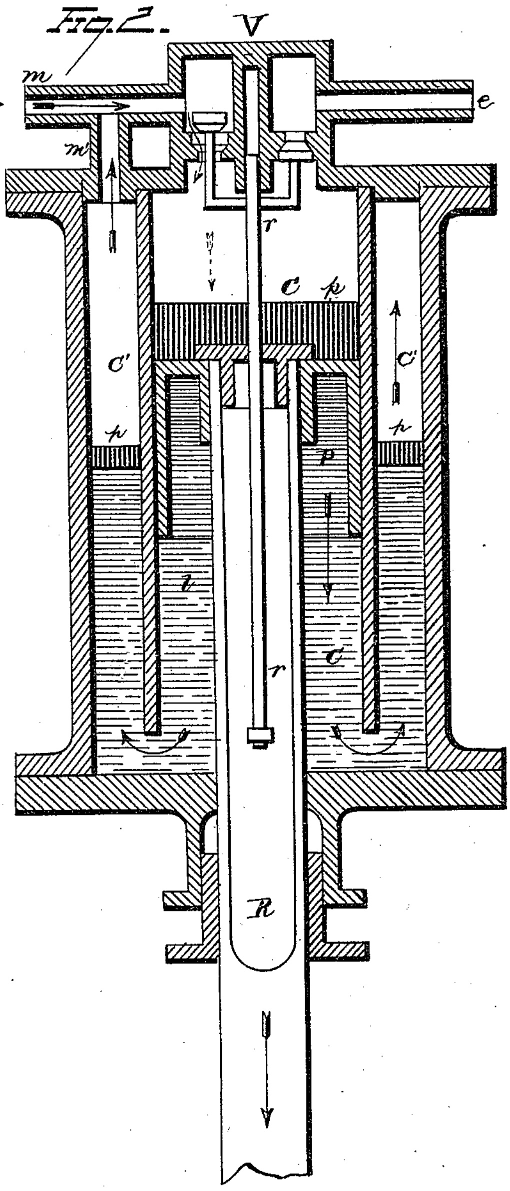
E. J. MOLERA & J. C. CEBRIAN.

Fluid Motors or Motor-Engines.

No. 212,039. **Patented Feb. 4, 1879.**





WITNESSES

E. J. Nottingham

A. W. Bright

INVENTORS

E. J. Molera and J. C. Cebrian.

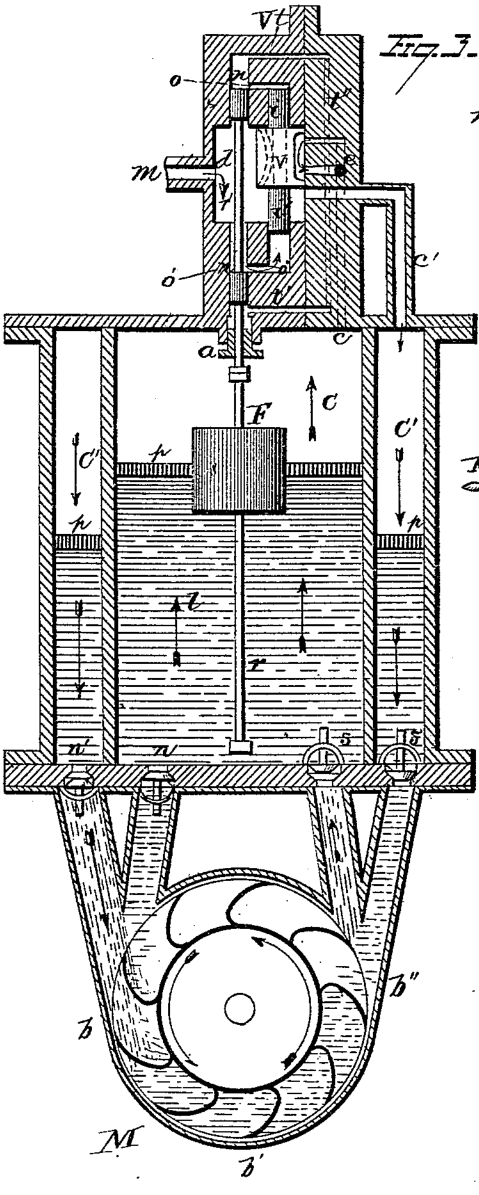
By H. A. Seymour. ATTORNEY

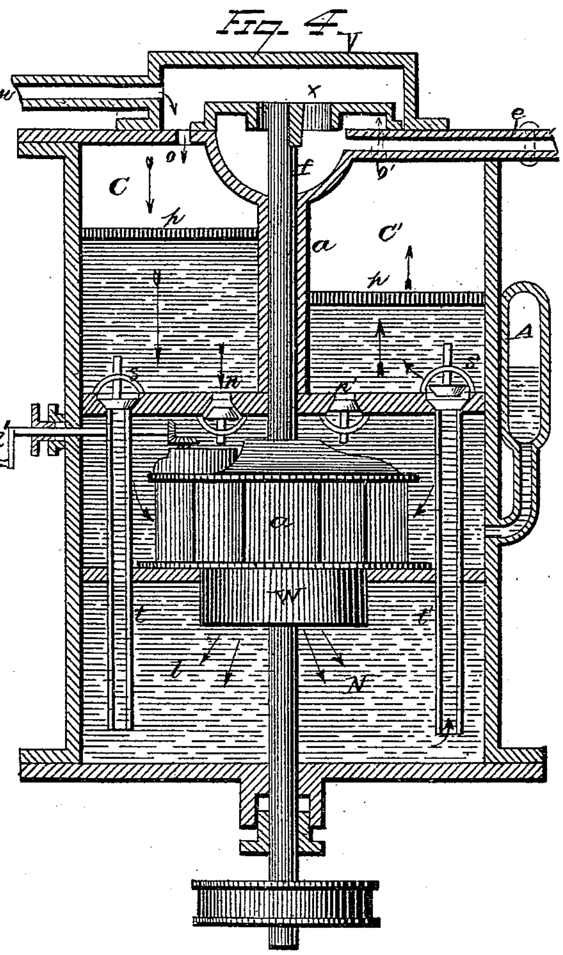
3 Sheets—Sheet 2.

E. J. MOLERA & J. C. CEBRIAN.

Fluid Motors or Motor-Engines.

No. 212,039. Patented Feb. 4, 1879.





WITNESSES

E. J. Nottingham

A. W. Bright

INVENTORS

E. J. Molera.

and J. C. Cebrian.

By H. A. Seymour. ATTORNEY

E. J. MOLERA & J. C. CEBRIAN.
Fluid Motors or Motor-Engines.

No. 212,039. Patented Feb. 4, 1879.

Fig. 5.

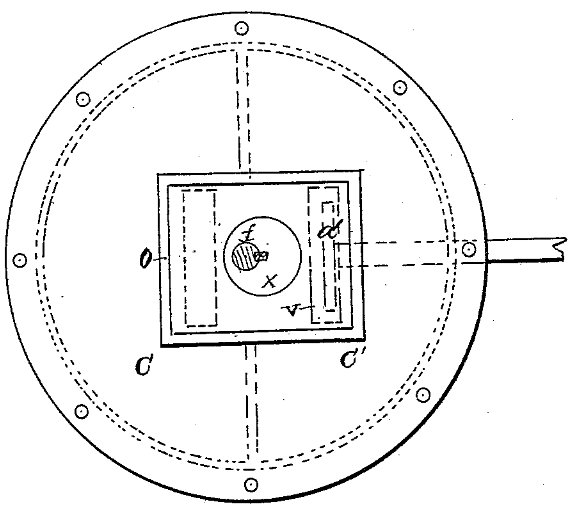
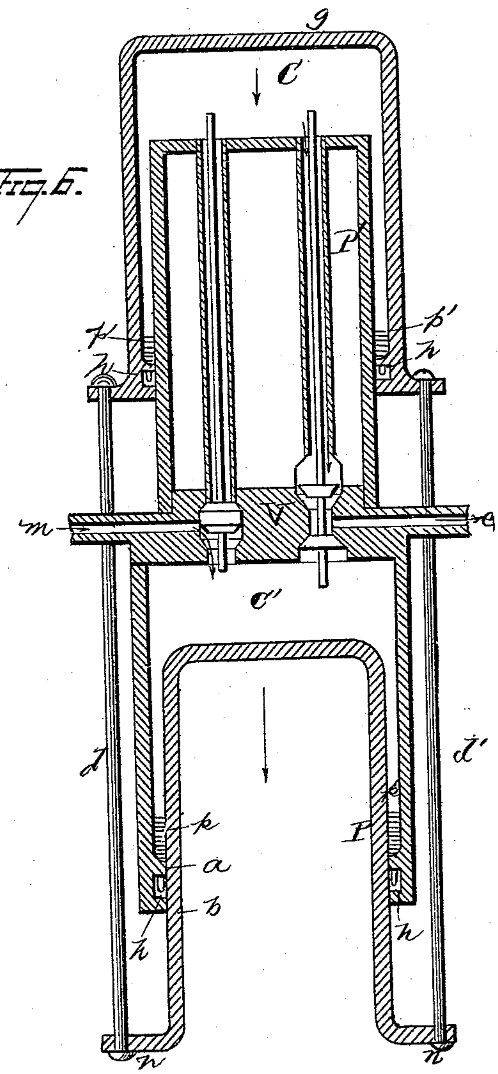


Fig. 6.



WITNESSES
E. J. Nottingham
A. W. Bright

INVENTORS
E. J. Molera and J. C. Cebrian.
By H. A. Seymour. ATTORNEY

UNITED STATES PATENT OFFICE.

EUSEBIOUS J. MOLERA AND JOHN C. CEBRIAN, OF SAN FRANCISCO, CALIFORNIA.

IMPROVEMENT IN FLUID-MOTORS OR MOTOR-ENGINES.

Specification forming part of Letters Patent No. **212,039**, dated February 4, 1879; application filed October 3, 1878.

To all whom it may concern:

Be it known that we, EUSEBIOUS J. MOLERA and JOHN C. CEBRIAN, of San Francisco, in the county of San Francisco and State of California, have jointly invented certain new and useful Improvements in Motors; and we 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 pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification.

Our invention relates to motors.

Figure 1 is an axial section of a motor or engine constructed in accordance with our improvements, the two cylinders being concentrically arranged, and the valve-chest provided with a double set of conical valves. Fig. 2 is a similar view, showing an enlarged piston-rod and a single set of valves adapted to operate for the same purposes as those of Fig. 1. Fig. 3 is a vertical section of a motor wherein vertical slide-valves are employed, and wherein the power is communicated to a driving-shaft through the medium of a liquid piston, which operates directly upon a wheel which may be connected with the driving-shaft; and Fig. 4 is a similar view, showing a horizontally-moving slide-valve and such an arrangement of parts as will cause the hydraulic motor connected with the driving-shaft to be operated by a continuous and uniform flow of liquid in one direction. Fig. 5 is a plan view of the device shown in Fig. 4, the same having its valve-chest removed. Fig. 6 is a sectional view of a further modified form of our improved motor, wherein, instead of having two plungers movable within their respective casings, we have shown one movable interior plunger connected with a movable exterior casing or cylinder.

Like letters in all the figures (wherever they occur) indicate corresponding parts, and with respect to the several figures we desire to state that they are chosen to represent a class of engines or motors embodying the principles of our invention, wherein the valve and piston arrangements shown in either figure may be transferred to devices represented in any of the other figures by simple mechanical alterations; and it has not been deemed necessary or expedient to illustrate all the modifications which can be made by such transpositions.

That our invention may be clearly comprehended, we would observe that the design of the same is to provide improved means whereby objectionable features, such as follow in detail, are removed from motor-engines.

The boring of perfectly-true cylinders is difficult and expensive, and the operation limits the size of the cylinders, and also the materials of which to make them.

The construction and maintenance of steam-packed cylinders is difficult and expensive, and they are liable to get out of order, require continual repair, and cause a waste of the motive power.

The stuffing-boxes for piston-rods, valve-stems, &c., are also open to the same objections, particularly to waste of the motive power.

The connections of the piston-rod and other parts of the machine are bulky and complicated, causing much friction and requiring very perfect fittings or constructions.

The gas, steam, or air, after finishing its work, generally has a great tensional power unexpended, which in nearly all cases is totally lost.

In many motors the degree of heat required is very high, rendering their use quite expensive, and subject to great loss of radiation. Leakages in some forms of motors render them totally impracticable for use in connection with certain fluids—as, for instance, in "ammonia" engines any leakage will result in the destruction of all brass fittings.

The purpose of our invention, as above stated, is to provide improved mechanism whereby these several disadvantages or defects may be obviated; and to this end our invention consists in certain methods of operating and in certain novel and useful combinations or arrangements of parts, all of which will be hereinafter first fully described, and then pointed out in the claims.

In connection with our improved motor we employ, of course, a suitable boiler or gas-generating chamber, which may be of any desired shape or construction. In this is generated the motive power either by the application of heat or otherwise. We prefer to employ a gas like ether, carbonic acid, ammoniacal gases, &c., which acquire great tensional powers by the application of a low degree of heat, and by employment of such gases we are enabled to utilize natural sources of heat, as solar action, hot springs, and others, thereby economizing in the production of the requisite power.

As the generation of the gas is no essential part of the present invention, it has not been deemed necessary to illustrate the boiler or any of its proper appendages; and as the kind of motive power to be employed will depend upon circumstances, it is not intended that the above enumeration of special gases shall exclude the use of any other kind, or exclude the use of any other fluid or liquid.

From the boiler the motive fluid must pass into one or more gas-chambers, C C′, wherein to expand and act upon a piston to transmit its work. V is the valve-chest, wherein the valves are located, and through which the motive fluid enters the piston-chambers, said fluid being conducted through the exhaust-pipe *e* and away to the condenser after expending its force upon the pistons. If in this piston-chamber we have an elastic diaphragm, the gas on entering will press and extend it; and if then the motive fluid be exhausted the diaphragm will, on account of its elasticity, regain its former shape and position. The fluid will therefore impart to the diaphragm a reciprocating motion, similar to that of the ordinary piston of the steam-engine. If we replace such a diaphragm by a mass of liquid having an outlet, the result will be the same, the liquid regaining its former position within its chamber after the motive fluid is exhausted. If we provide means of connecting such elastic pistons (whether solid or liquid) with other parts of machinery, we will produce a motor or engine, and by such arrangement will obviate the cost and difficulties of steam-packed pistons, inasmuch as the elastic pistons will constitute their own packing.

In Figs. 1, 2, and 3 the chambers C and C′ are located concentrically and connected by the valve-chest V, located at either end of the pair. The valves are so arranged that when the pipe *m* is in communication with chamber C it is disconnected from C′, and at the same time the exhaust-pipe *e* is in communication with C′, but disconnected from C. When the valves are shifted, reverse communications are of course made. These valves may be conical, slide, or of any approved form, so long as they operate as above indicated. In Fig. 1 they are shown as conical, in two pairs, mounted upon two parallel stems, which are united with the main rod *r*, along which a float or a plunger or open diaphragm may slide.

The rod *r* is to be provided with two stops, against which the diaphragm, float, or plunger can abut in its forward and backward motions, and thus shift the valves at the completion of the stroke.

In Figs. 1 and 2 the plunger P is provided with a cavity for the accommodation of rod *r*. The two pairs of valves might be placed on a single stem, and the same results would be obtained.

In Fig. 3 we illustrate the application of slide-valves for the same purpose. In this figure the channel *c* communicates with C, and *c*′ with C′.

At *v* is a D-shaped slide, moving in the space *d*, and having a circular pin at the top *i*, and one at bottom *i*′, both of which move in cylindrical cavities provided for them.

A cylindrical bore, *n n*, traverses the space *d* and opens into chamber C, and is also provided with communications *o o*′, leading to the cavities, within which pins *i i*′ are located. The passages *t t*′ *t*″ connect bore *n n* with the exhaust-pipe *e*.

The rod *r*′, carrying two long pistons, slides within bore *n n*, the lower piston, with stuffing-box *a*, shutting off communication of space *d* with chamber C, into which rod *r* is made to extend. Upon this extension are mounted two stops, one near the top and one near the bottom of C.

A float, F, moves upon rod *r*, following the motions of the liquid-piston in chamber C, and as this float strikes either of the stops it will pull the valve-rod up or down, as the case may be, thus shifting the valves, as will be seen by the following: When rod *r* is pulled down its upper piston closes the communication between space *d* and the upper outlet, *o*, and upper pin-hole of *i*, which latter is then open to the exhaust through *t t*″, and at the same time the lower piston opens communication between space *d* and the lower channel, *o*′, closing the lower exhaust-channel, *t*′. The motive fluid will then operate to elevate or shift the valve and hold it, and the boiler will be connected with chamber C′, and chamber C with the exhaust-passage.

When rod *r* is elevated upon ascent of the float reverse communications will be established, as is easily understood.

The valve or slide *v* is provided with a spring and screw, intended to hold it against its seat and to compensate for wear of parts. The advantage of this disposition of parts results from the fact that but little force is required to move the valve-rod *r r*′ on account of its being balanced against the pressure of the motive fluid in space *d;* but any other form of slide-valve would answer the general purposes with more or less friction.

In Fig. 4 we show another form of slide-valve. In this case the two piston-chambers C C′ are supposed to be in the form of half-cylinders, separated by the wall *a*, through which a vertical revolving shaft, *f*, is made to pass.

The valve-ports are indicated at *o o*′, and *v* represents the valve, as before. At *x* is an eccentric made fast to shaft *f*, and serving to throw the valve.

It will be plainly seen that at every complete revolution of *f* the valve will give a full stroke. Instead of making x fast to f we may insert between them toothed wheels or any other devices in order to have one stroke of the valve to any given number of revolutions of f.

In the devices represented in Figs. 1 and 3, the internal valve-motion has the advantage of dispensing with stuffing-boxes for the valve-rod which open into the atmosphere, and also of avoiding the waste of motive power, as well as simplifying the connections between the piston and the valve-rod, which are among the advantages claimed for our invention. In device represented in Fig. 4 these advantages are somewhat reduced, because the valve-motion is external, and the construction requires a perfect stuffing-box at some point of shaft f.

In cases where the valve-motion is external we may use any of the ordinary ways to produce it.

If the valve-rod projects through the valve-chest into chamber C or C′, we may employ a stuffing-box for liquids only; but if said valve-rod projects through the steam-chest at any other point, we should require a more perfect stuffing-box, as for gas, &c., which should be avoided, if possible.

Each of the described double valves may be replaced by two separate valves in one valve-chest or in two, and either may be moved internally or externally by the same or by independent mechanisms.

The chambers C and C′ may be disconnected, if desired, or may have a connection the shape and position of which will vary according to the purposes of the machine. If they be disconnected they will each have their separate elastic pistons, and these may operate independently or together. If connected they may be attached by solid pieces or made to operate together by means of an interposed liquid or otherwise, as found most desirable. If the pistons be elastic the chambers may be of any shape whatever. If we have two disconnected chambers and liquid-pistons we will have two liquid masses reciprocating; and since we may attach to each chamber a pipe at any inclination, we may direct these reciprocating motions at pleasure, and cause the liquids to communicate their power to any hydraulic mechanism. If the chambers be connected, for instance, as shown in Fig. 1, we have a single liquid mass having a motion from C to C′ and the reverse. The motive fluid enters through m into C, and presses the liquid-piston into C′, which is then connected with the exhaust or condenser. When nearly all the liquid has passed into C′ the valves are pulled down by the float, or otherwise tripped, and the motive fluid enters C′. As C is then in communication with the exhaust or condenser, a partial vacuum will be produced in C, and the liquid-piston will be forced into C by the power of the motive fluid and that of the vacuum. When this chamber is full, or nearly full, the valves will be thrown to their original position, and the motions and operations will be thus continued, so long as the motive fluid is admitted to the motor or engine.

If a plunger, P, be interposed between the motive fluid and the piston, as in Fig. 1, a rectilinear reciprocating motion will be communicated to this plunger and its attached rod, from whence it may be communicated to any mechanism. In this figure we have represented the plunger as being located inside of chamber C, by which arrangement we are enabled to operate the valves without exterior communications. Nearly all the liquid may be disposed beneath the plunger P. We might even suppress the liquid-piston on top of P; but as one of the objects of the liquid-piston is to avoid steam-packings, it is better to employ the liquid substantially as indicated.

It should be carefully observed that the device represented in Fig. 1 indicates only one disposition of material and operative parts which we may adopt. The chambers may not only be of any shape whatever, but they may be placed in any relative position, near or far apart, and they may have independent sets of valves. Their communications O O′ may be had through any pipes or vessels, or may be stopped altogether, and a plunger or other suitable hydraulic mechanism may be introduced at any point of said communications without departing from the spirit of our invention.

In further illustration of the scope of our invention we have shown at Fig. 6 two chambers, C C′, having no communication except through the valve-chest, which, in this case, is placed between the two. These chambers are again shown as cylindrical, each one having its own plunger or equivalent therefor. The plunger and its rod are in this instance supposed to be in one single piece, in consequence of which the stuffing-box u of rod R in Fig. 1 is replaced by the hydraulic-press packing h.

In order to avoid the boring of a long cylinder we give the two chambers C C′ the shape of an ordinary hydraulic-press cylinder, thus reducing the boring to the length represented by $a\ b$.

The liquids $p\ p'$ operate as the pistons, which in this case assume a ring shape, or when P is at its lowest point p may assume the shape of a circle.

In Fig. 1 we represent the chambers as stationary and the plunger movable; but if we suppose the plunger in that figure to be stationary the chambers would have to be made movable.

In Fig. 6 we indicate a union of the two instances. In the lower portion of the engine the chamber is made stationary and its plunger movable, and in the upper section the chamber is movable and plunger stationary. The two movable pieces are connected by the rods $d\ d'$, which might be suppressed.

We might still further simplify the device of Fig. 1, preserving all its advantageous characteristics, as shown in Fig. 2, wherein the double valves are replaced by single sets. In this illustration the sectional area of rod R is supposed to be equal to one-half that of chamber C, in which event the total pressure of the downward stroke will be double that of the upward stroke. The single valves establish alternate communication between C alone and m and e, the branch m' keeping C′ constantly in communication with the boiler, and there being no opening between C′ and the exhaust. Under this arrangement, if we represent by symbol X the transverse sectional area of the upper face of the plunger, and represent by symbol Y the transverse sectional area of the plunger-rod, while symbol Z is taken to represent the pressure of the motive fluid within supply-pipe m, then the pressure of the motive fluid against the upper face of the plunger can be represented as $Z \times X$, while the pressure of the motive fluid against the lower face of the plunger can be represented as $Z \times Y$; but $Y = X \div 2$; hence said lower face pressure is $Z \times X \div 2$. The difference between this upper and lower face pressure is therefore $Z \times X - Z \times X \div 2 = Z \times X \div 2$, which latter quantity represents the resultant or effective pressure imposed upon the upper face of the plunger, in subjection to which said plunger moves on its downstroke. For the upstroke there is no pressure against the upper face of the plunger, while the lower face is subjected to a pressure represented by $Z \times Y$; but $Z \times Y = Z \times X \div 2$, which latter quantity, hence, represents the force of the upstroke, plus, however, the suction-power from the exhaust. A very simple calculation will therefore give the true relation to be established between P and R to obtain an equal power for the upward and downward strokes, or to obtain two powers differing by certain desired amounts.

Figs. 3 and 4 represent devices wherein the liquid pistons are caused to flow constantly in the same direction. In Fig. 3 the two chambers C C′ are concentric cylinders, and in Fig. 4 half-cylinders, separated by the wall a.

Each chamber must have two liquid-valves, n s n' s', one opening inwardly and the other outwardly. The liquid-piston in its motion from one chamber to the other will always move from the outwardly-opening valves toward those which open inwardly. By varying the relative positions of those two valves we may obtain many different directions of the liquid-current. If the two outward valves are nearer together or in closer relative communication than with the other two, as in Fig. 3, then we obtain a constant flow in the direction b b' b''. If the communications were placed in a cross shape, we would obtain two intermittent flows crossing each other.

Fig. 3 shows the engine applied to a vertical water-wheel, from which the desired motion may be easily communicated. The two outwardly-opening valves n n' are connected by two tubes leading to the wheel-case N, as are also the inwardly-opening valves s s'.

When the motive fluid is pressing the liquid in C′ down it will open valve n', close n and s', enter case M, and through valve s will enter chamber C. In this figure we have shown a float, F, which, following the up and down motions of the liquid-piston C, will operate the valves in the valve-chest, as previously explained. When nearly all the liquid has passed into C the float will trip valve v, which allows the motive fluid to enter C′. The liquid will then close valve s, open valve n, close n', and open s', and will take the same course, b b' b'', and so the motion will continue.

The water-wheel within case M may be of any approved construction. The case will vary in shape according to the kind of wheel employed. The openings at n s n' s' may be varied, so as to cause the liquid to act at any point of the wheel, and the valve v may be moved directly by the shaft of the water-wheel, as previously intimated.

Fig. 4 shows the application of our improved motor to a horizontal water-wheel or turbine. In this case the communication between C and C′ is through the box N and through the tubes t t', which reach nearly to the bottom of said box. The valves s s' might be placed at the opposite ends of t and t', or at any point of their length. The box N is divided into two compartments, in the upper one of which are the vanes a, regulated by R′, so as to direct the liquid upon the water-wheel W in the compartment below. The upper compartment communicates with the outward valves, n n', and the lower one with the inward valves, s s'. When the motive fluid acts in C the liquid passes through n, thence through the vanes and upon wheel W, and then up through t' and s' into C′. When the motive fluid acts in C′ the liquid opens n', passes through the vanes to the wheel through t to s, and thence into C.

At A is shown an air-chamber which will act as a cushion, preventing shocks, &c. The wheel W may be of any construction whatever, and by suitably disposing the liquid valves we may cause the water to act upon the periphery or at the center of the wheel.

If in Fig. 3 we suppose two distinct communications, one from n to s' and the other from n' to s, the liquid-pistons will constitute two intermittent liquid-currents in the same direction, and each one may act upon a different mechanism if desired. The liquid pistons should be such that they have no action upon the gas or vapor used as a motive fluid, so as not to waste or even neutralize it, or any of it. Instead of using the liquid-piston directly upon any hydraulic mechanism, we may interpose a second transmitting liquid between them. In this case the liquid-piston should have no chemical action upon the motive fluid or upon the transmitting liquid. Such is the case in our figures, wherein p is the liquid piston and l the second or transmitting liquid. We may here observe that when we use a liquid communication between C and C′, whether the piston is liquid or solid, we combine in one machine the advantages of the hydraulic motors and the high-pressure motors. We use in fact a hydraulic engine deprived of the two main disadvantages hereinbefore mentioned—to wit, the head of water and quantity consumed—and we have shown how a comparatively small quantity of water or other liquid may be used over and over again upon the same mechanism, and how the head of water may be replaced by the pressure of the gas or vapor employed as the motive fluid. Either one of the chambers C or C′ and its accompanying valves may be dispensed with, in which event the motive fluid will act in the remaining chamber as before; but the resulting motion will be intermittent and not continuous. If a second transmitting liquid be employed under this modification there must be a vessel provided for its reception upon leaving the single chamber, and by establishing communication between this vessel and the single chamber similar to that before explained, as between C and C′, we can obtain results similar to those hereinbefore noted. We might even dispense with the receiving-vessel and waste the transmitting liquid, and yet employ our mechanisms if we have a source of liquid from which to feed the single piston-chamber.

By introducing proper modifications, all within the scope of the above explanations, we may employ any number of chambers, which may operate dependently or independently of each other.

As will appear from the foregoing, these engines may be applied to any kind of machines, and, therefore, to pumping-machines; but they may also be employed directly as pumping-engines. We have only to suppose each piston-chamber C C′ provided with the water-valves *n s* of Figs. 3 and 4, the inward valve, *s*, connected with the passage for the liquid to be pumped, and the outward valve, *n*, with the point where the liquid is to be delivered, and we have an illustration of a pump which may be made single or double acting and serviceable for throwing all kinds of liquids or gases, sands and muds.

These same machines may also be employed as fluid-meters. The fluid to be measured is made to follow the way pointed out for the motive fluid above—from *m* to *e*. It must therefore fill the piston chamber or chambers before it can escape; and if we know the exact capacity of said chambers, we will have the exact measurement of the fluid passed at every stroke of the elastic piston, and the number of these strokes may be conveniently registered, as in the meters now employed.

The motive fluid, after leaving the piston-chambers, is conducted to a condenser, which may be of any construction whatever, and from this condenser it must pass to the feeding-pipe of the boiler, to be used again.

We desire to add that many of the advantages herein attributed to the form of motor shown may likewise be attained by employment of an elastic or yielding chamber, the principal features of which are embodied in a separate application for patent, and need not therefore be herein enumerated.

Under the construction and arrangement shown and described our improved motor is found serviceable, simple, cheap, and to otherwise admirably answer the several purposes and objects of the invention, as previously stated.

Having fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a motor-engine actuated by gas or vapor in a state of tension, the combination, with concentric piston-chambers and a double-acting hydraulic device operated by a liquid-piston, of valve mechanism governing the supply and exhaust of the motive fluid, together with a float device movable with said piston, and adapted to operate said valve mechanism, substantially as set forth.

2. In a motor-engine actuated by gas or vapor in a state of tension, the combination, with concentric liquid-piston chambers and a plunger working within the inner one thereof, and connected with the driving parts, of a valve-stem which extends down within said inner chamber, and is adapted to operate the valve-motion in supplying and exhausting the motive fluid, said valve-stem being alternately raised and lowered by engagement of stops formed at suitable points thereon with the plunger, substantially as set forth.

3. In a motor-engine in which a hydraulic device connected with the driving parts is actuated by the expansive force of certain gases or vapors, the combination, with the liquid-piston chambers having suitable intercommunication, of a valve-chest located above the same, and a valve-stem, which latter, by engagement with the hydraulic device, operates the valve-motion within said valve-chest, substantially as set forth.

4. In a motor-engine in which a hydraulic device connected with the driving parts is actuated by the expansive force of certain gases or vapors, the combination, with the liquid-piston, of an independent liquid interposed between the latter and the hydraulic device, said piston having no chemical action relative either to said liquid or motive fluid, substantially as set forth.

5. In a motor, the combination, with a liquid-piston, of a float, diaphragm, disk, or equivalent device, movable therewith, and adapted to actuate the valves which govern the inlet and outlet of the motive fluid, substantially as and for the purposes set forth.

6. In a motor provided with liquid-pistons, (one or more,) the combination, with the piston-chamber, of a valve-chest and valves arranged therein or thereon, substantially as described, so that the valve-stems shall project through the chest only into the piston-chambers, for the purposes and objects named.

7. In a motor-engine operating with elastic pistons, the combination, with a piston-chamber provided with supply and exhaust valves and a plunger, which latter connects by plunger-rod with the driving mechanism, of a second piston-chamber having constant communication with the first chamber, and also with the pipe which supplies both said chambers with a suitable motive fluid in a state of tension, said plunger-rod being of such transverse sectional area relative to the chamber in which it works that the effective strokes of the plunger, respectively following the alternate supply and exhaust of the motive fluid, may be alike equal or variable, as desired, substantially as set forth.

8. The combination of the two chambers C C′, valve-chest V, valves *v*, liquid-piston *l*, float F, wheel-case N, valves *n′ n s s′*, and the revolving wheel, substantially as set forth.

In testimony that we claim the foregoing we have hereunto set our hands this 7th day of September, 1878.

EUSEBIOUS J. MOLERA.
JOHN C. CEBRIAN.

Witnesses:
F. O. WEGENER,
ANDRES MAURI.