No. 633,138. Patented Sept. 19, 1899.

V. KARAVODINE.

ROTATIVE MOTOR.

(Application filed Aug. 25, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

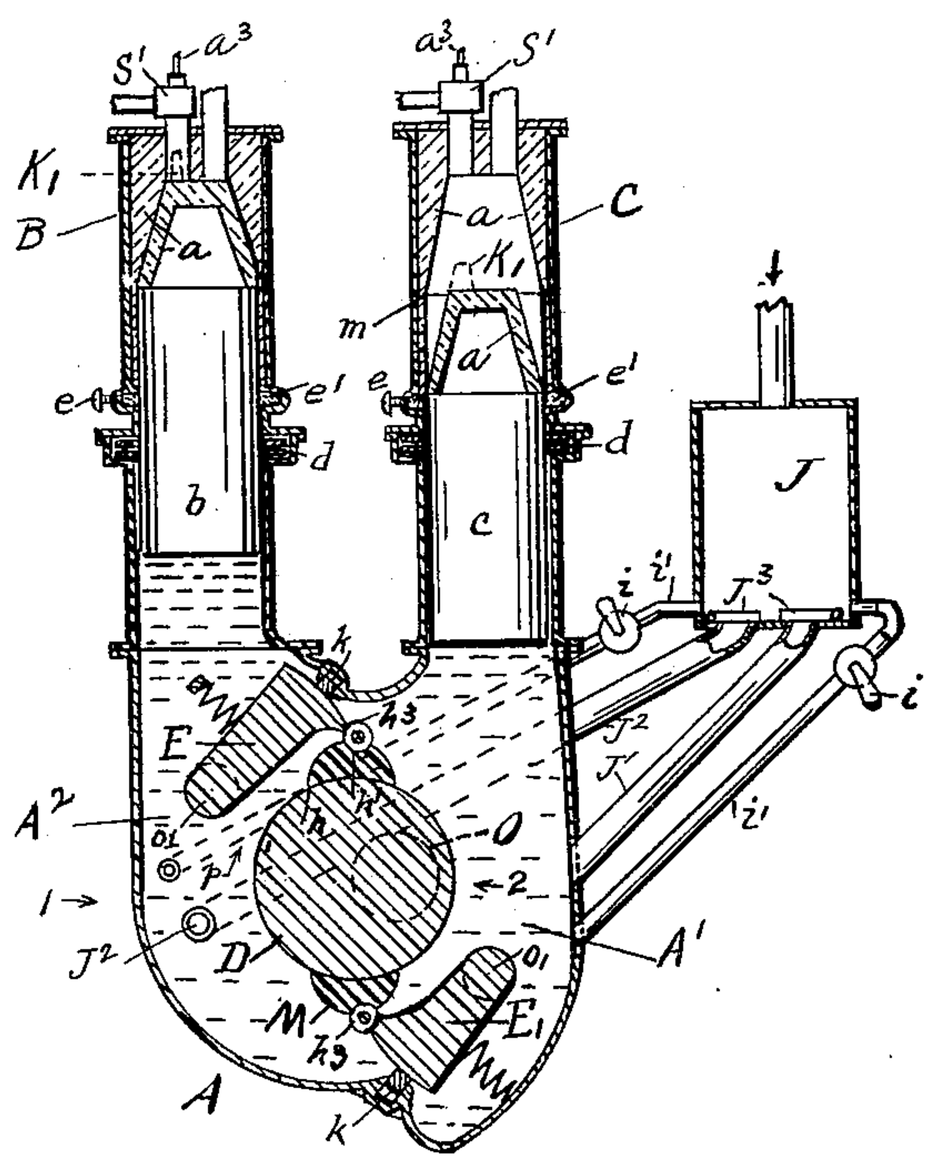

Fig. 8.

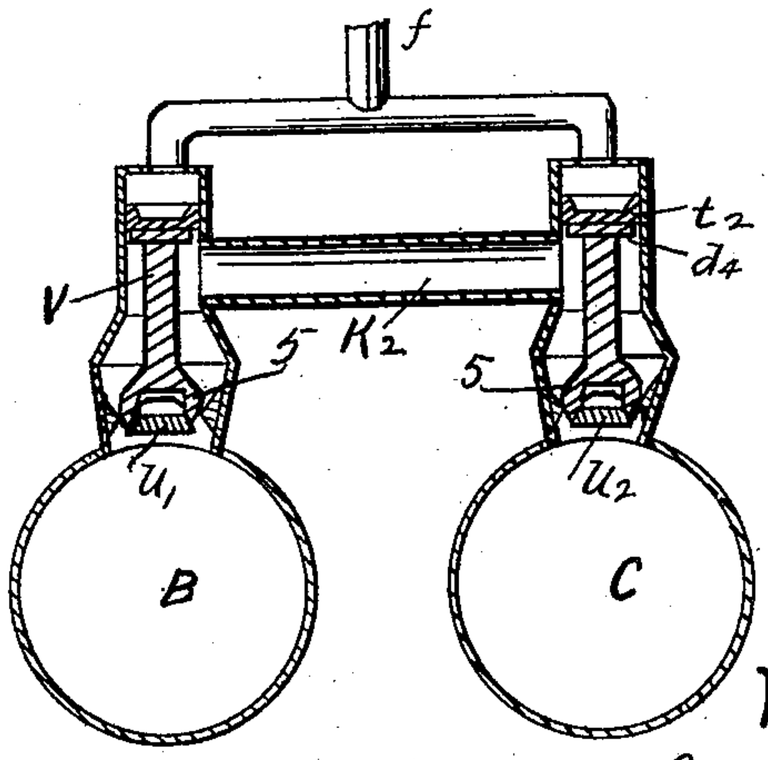

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Fig. 4.

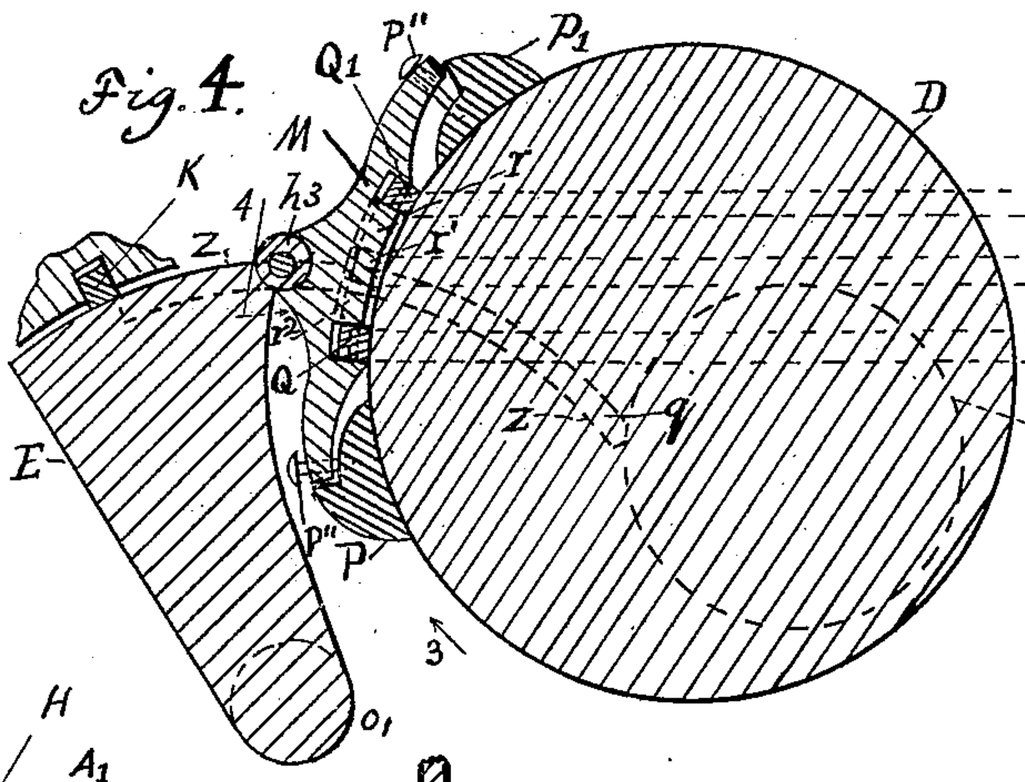


Fig. 4a.

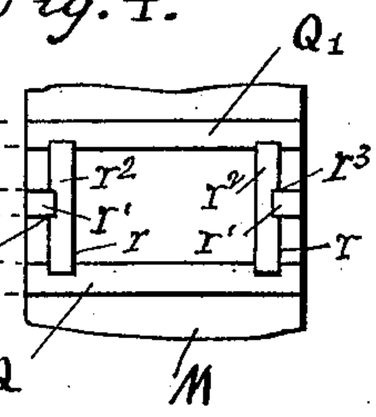
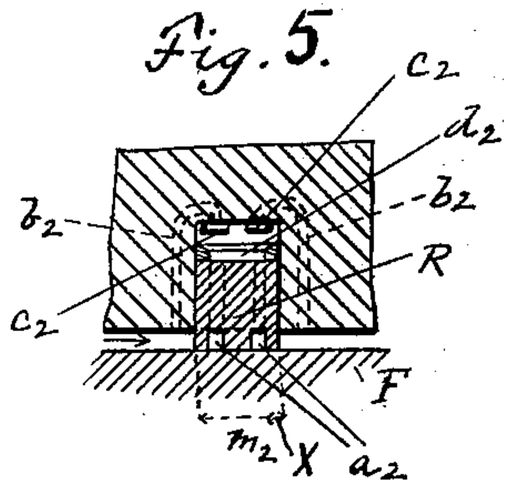


Fig. 5.



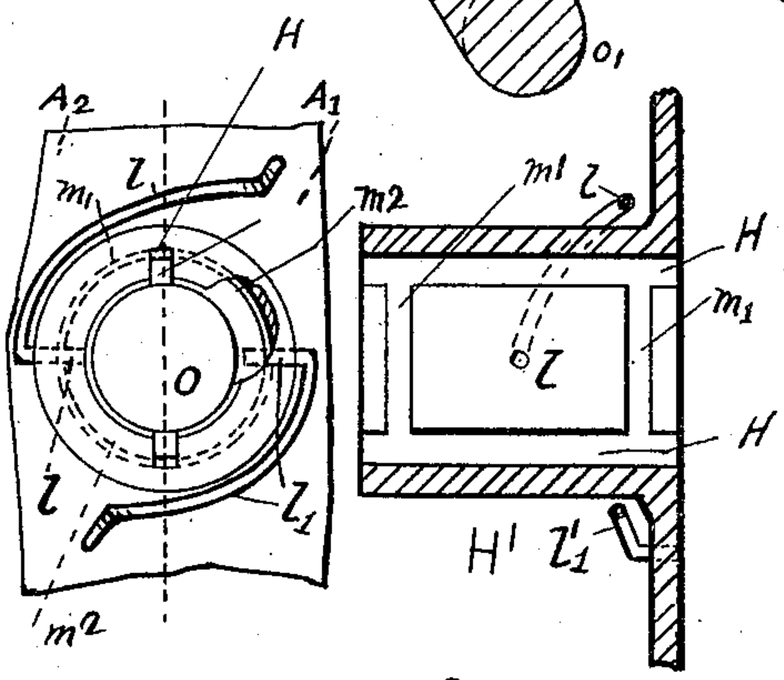


Fig. 2.

Fig. 3.

Fig. 6.

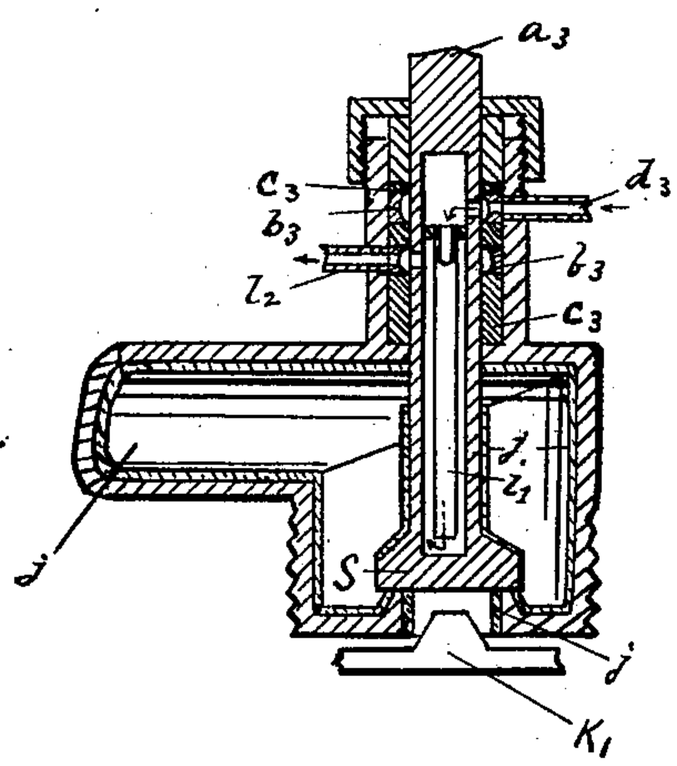
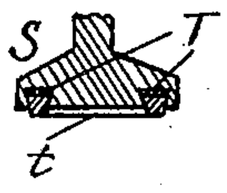


Fig. 7.



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UNITED STATES PATENT OFFICE.

VICTOR KARAVODINE, OF PARIS, FRANCE.

ROTATIVE MOTOR.

SPECIFICATION forming part of Letters Patent No. 633,138, dated September 19, 1899.

Application filed August 25, 1898. Serial No. 689,518. (No model.)

To all whom it may concern:

Be it known that I, VICTOR KARAVODINE, engineer, a subject of the Emperor of Russia, residing at Place de la République, Hotel Moderne, Paris, France, have invented a certain new and useful Rotative Motor, of which the following is a specification.

The main object of the invention is to provide an improved motor capable of operating at high temperature and pressure and with light friction.

A further object is to obtain greater efficiency in such motors than heretofore.

In the drawings, Figure 1 is a central vertical section of the motor; Fig. 2, an end view of the motor-shaft and one of its bearings. Fig. 3 is a longitudinal vertical section of said bearing. Fig. 4 is a vertical section, on a larger scale, of a modification. Fig. 4ª is a bottom plan of a detail. Fig. 5 is a sectional view showing one form of bearing-bar and means for introducing liquid-pressure behind it. Fig. 6 is a central longitudinal section of a valve and its casing. Fig. 7 is a similar section of another construction of valve. Fig. 8 is a sectional view showing a means for regulating escape of liquid from the cylinders.

The motor is composed of a chamber A, in which is an eccentric rotary piston D with a shaft O, which is the main shaft of the motor.

E E′ are bodies oppositely pivoted at *o′*, each being pressed toward piston D by a spring and forming partitions above and below the piston between the right and left sections A′ A² of said chamber. Said springs prevent the partitions moving away from the piston when not pressed by fluid-pressure.

k k are bars in suitable grooves in the wall of chamber A, which bars form a liquid-tight joint between the opposite sections of the chamber.

M M are bearing-blocks resting on the periphery of the piston and pivoted to the inner corner of the partitions. The hinge h^3, connecting parts E and M, may be of any suitable construction; but evidently the construction thereof should not be such as to admit the passage of liquid therethrough.

B C are cylinders communicating with the opposite sections of chamber A. Within the cylinders are reciprocating pistons *b c*, adapted to be moved forward and backward in the cylinders by steam or gas alternately admitted and released above said pistons *b c*.

a a are layers of poor or non-heat-conducting material in the upper ends of the cylinders B C and on the upper ends of pistons *b c* for a distance about equal to the length of stroke of the pistons, the function of which is to avoid wasteful cooling of the steam admitted to the cylinders. The material preferred for said purpose is asbestos compressed with soluble silicate and hydrate of aluminium, or I may use earthenware or slate, &c. The upper ends of the pistons *b c* are preferably reduced in diameter and tapered or trunconical for the length of the stroke and the linings of the cylinders correspondingly tapered to the points *m*. Chamber A and the lower ends of cylinders B C are filled with a liquid having a high boiling-point, such as oil.

J is a reservoir, to the top of which extends a pipe from a suitable source of pressure, as the boiler. (Not shown.) From the bottom of the reservoir pipes J′ J² lead, respectively, to chambers A′ A² on the right and on the left of the rotary piston, there being an upwardly-opening valve J³ at the bottom of the reservoir for each of the pipes J′ J², which opens upward to admit oil to the reservoir when from any cause the quantity of oil in chamber A on either side of the piston, and hence the pressure in said chamber, is too great. Between the bottom of the reservoir and each of the sides of chamber A is a pipe *i′*, containing a cock *i* by which oil may be admitted at will to either side or part A′ A² of the chamber A when needed.

d are packing-rings surrounding pistons *b c*, and *e′* are oil or lubricant grooves, and *e* are screws which when removed admit lubricating material, such as a mixture of powdered talc, graphite, and oil. The groove *e′* should be below the bottom of the coatings *a* of the tops of pistons *b c* when the latter are in their lower positions.

The shaft O rests in bearings H′, which, it will be understood, are mounted in the front and back walls (not shown) of chamber A. Each of said bearings is provided with two longitudinal grooves H, in which are packing-bars. The bearings also have interior circumferential grooves *m′*, in which are fitted semicircular rings m^2 on each side of the pack-

ing-bars, thus dividing the space around the shaft in each bearing into two non-communicating parts. The channel *l* connects the part or space on the left side of the bearing with the right section of chamber A, and channel *l'* connects the part or space on the right with the section of chamber A on the left, thereby balancing pressures on the opposite sides of the shaft.

It will be seen that during the downward movement of either piston *b c* block M is strongly pressed on that side against the rotating piston D and acts as a brake thereon. For example, when *b* descends the liquid-pressure in chamber A acts on the piston D in the direction of arrow 1, and D rotates in the direction of arrow *p*, Fig. 1, and great pressure is on block M between *h h'*, Fig. 1.

The shoes or blocks M, I prefer to make as shown in Fig. 4. The bottoms of the blocks do not exactly conform to and bear on the surface of piston D throughout their length; but said doors or blocks have narrow parts P P', conforming to and bearing on the surface of said piston D, and central parts separated slightly from said surface. P'' are headed pins held by blocks P', which pass loosely through the edges of part M and hold said part in place, but allow a slight tilting movement, for a purpose described below. In the central parts are grooves containing packing-bars Q Q', which continually bear on piston D. These grooves are connected by cross-grooves *r*, which contain segments of packing-rings r^2, thus inclosing a rectangular space for liquid. To complete the separation between the right and left sections of chamber A, short packing-pieces *r'* are inserted in grooves r^3 outside of grooves *r*.

When the pressure turns the piston in the direction of arrow 3, Fig. 4, the piston tends to move away from the upper part M, and the least increase in the depth of the inclosed space by such separation instantly diminishes the liquid-pressure in said space and allows the pressure on the partition E and part M to press the latter onto the piston until the pressure in said space equals that outside. As shown in Fig. 4, said pressure on the outside of part M slightly depresses the left edge and raises the right edge of said part. If the separation is more than that shown in Fig. 4, bar Q' moves out of its groove (under liquid-pressure, as described below in connection with Fig. 5) far enough to uncover a transverse opening through said bar, thus connecting the space between bars Q Q' with the right section of chamber A, which is not then under pressure. Consequently said space is relieved of pressure, and partition E and part M are pressed toward piston D to the normal or desired extent, but not so far as to actual contact between the central part of block M and the surface of the piston. *z* is a groove in the farther end wall of chamber A, in which is a packing-strip *q*, extending from shaft O to strip *k*, and it will be understood that there are similar grooves and strips on the front side of the chamber and piston, both above and below shaft O, thereby preventing leaking by the ends of the piston from one section of chamber A to the other. When piston *c* is descending and piston *b* is ascending, the lower partition E and block or shoe M will operate, as above described, in connection with the upper ones. (Shown in Fig. 4.)

In Fig. 5 is shown one arrangement for pressing the packing-bars, (designated generically in this figure by the letter R and the surface against which they are pressed by the letter F.) b^2 b^2 are passages from each side of such packing-bar to the groove behind the bar c^2 c^2, being inwardly-opening hinge-valves at the inner ends of said passages, one or the other of which opens to admit fluid when the pressure on the groove falls. d^2 are passages through the bar from the outer side to the longitudinal grooves a^2 in the inner or bearing side of said bar, thereby partially balancing pressure on the bar. Other means for pressing the bars forward may be used.

Fig. 6 shows a valve which may be used especially for high-temperature motors, as inlet-valves, as indicated at S', Fig. 1, for closing and opening the port admitting pressure to the cylinder B or C above its piston, being moved by any suitable mechanism. (Not shown.) Valve S and the valve-casing have coverings *j* of non-conducting material. The hollow valve-rod a^3 contains a central pipe *l'*, and an inlet-pipe d^3 admits water, which passes down through pipe *l'*, then up around it and out through l^2 to reduce the heat of the valve. b^3 is a metal ring, and c^3 are packings. K' is a projection at the upper end of each piston *b c*, which closes or nearly closes the valve-port from below at the end of the upward movement of the piston.

Fig. 7 shows an alternative form of valve for opening and closing the inlet-ports of cylinders B C. S is a clack-valve. The face thereof is grooved and a ring T of asbestos placed in the bottom of the groove. *t* is a tempered-steel ring resting against ring T. The outer wall of the groove is then bent inward and firmly secures the ring.

Instead of using reservoir J to relieve pressure in chamber A the cylinders B C may be connected together as in Fig. 8.

V are valve-rods, at the inner ends of which are arches 5, carrying valves U' U^2. Said valves U' U^2 are downward inwardly-opening valves. At the opposite end of each rod V are a head d^4 and a leather cup t^2, against which pressure introduced through pipe *f* is exerted. If pressure in cylinder B becomes greater than the pressure introduced at *f*, valve U' at the left rises and liquid passes through pipe K^2 and down through valve U^2, which opens therefor. If pressure in cylinder C becomes too great, the valve at the right is opened and liquid passes into cylinder B through valve U'.

The pistons *b c*, which are of considerable length, are or may be hollow cylinders for lightness and have tapering ends, as described, the main advantage of the latter construction being that the non-conducting layers *a* do not rub against each other during the up and down movements of the pistons, but only for an instant when the pistons reach the upper limit of their movement, and this reduces friction and wear on said layers *a*.

I claim—

1. A motor having two cylinders B and C, a chamber A divided into two compartments to each of which one of said cylinders is connected, an eccentric rotary piston D, oppositely-movable partitions E, shoes which bear upon the periphery of the eccentric piston D, reciprocating pistons *b*, *c* arranged in the cylinders, and the walls of these elements being lined with a layer of material non-conductor of heat the adjacent surfaces of which are tapering, substantially as described.

2. In a motor, a rotary eccentric piston D and shaft O in combination with two oppositely-pivoted partitions E, E′, provided with shoes joined to them and bearing upon the periphery of the eccentric piston, a liquid-chamber A in which the partitions and piston are arranged divided by them into two compartments, cylinders B, C, and reciprocating pistons *b*, *c*, substantially as described.

3. The combination with chamber A, cylinders B, C, reciprocating pistons *b*, *c*, oppositely-pivoted partitions E, E′, an eccentric rotary piston, a shaft therefor, bearings for the shaft, having circular grooves *m*′, and straight grooves, packing-bars in said grooves which divide each bearing into two compartments there being passages from opposite sides of chamber A to said compartments, substantially as described.

4. The combination of a liquid-chamber A, cylinders B, C, pistons *b*, *c* and oppositely-pivoted partitions E, E′, and eccentric rotary piston D, of shoes M M joined to said partitions E, E and bearing upon the periphery of piston D, the said shoes being provided with grooves, bars r^2, Q and Q′ in the grooves between which is a compartment, substantially as described and for the purposes set forth.

5. The combination of a liquid-chamber A, rotary piston D, partitions E, E′, cylinders B, C, pistons *b*, *c*, therein, an escape-outlet valve for liquid, and means for introducing pressure to normally hold said valve closed.

6. In a motor the combination of a liquid-chamber, a rotary eccentric piston therein, pivoted partitions having bearing blocks or devices coöperating with the piston to divide the chamber, said bearing devices consisting of parts P, P′, bearing directly on said rotary piston, an intermediate part movably held on parts P, P′, and having bottom grooves, and outwardly-pressed bars in said grooves inclosing a liquid-space, as set forth.

Signed at Paris, France, this 11th day of August, 1898.

VICTOR KARAVODINE.

Witnesses:
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ANDRÉ POUGUÉ.