No. 675,899. Patented June 11, 1901.

D. MORELL.

ROTARY ENGINE.

(No Model.) (Application filed Jan. 21, 1899.) 3 Sheets—Sheet 1.

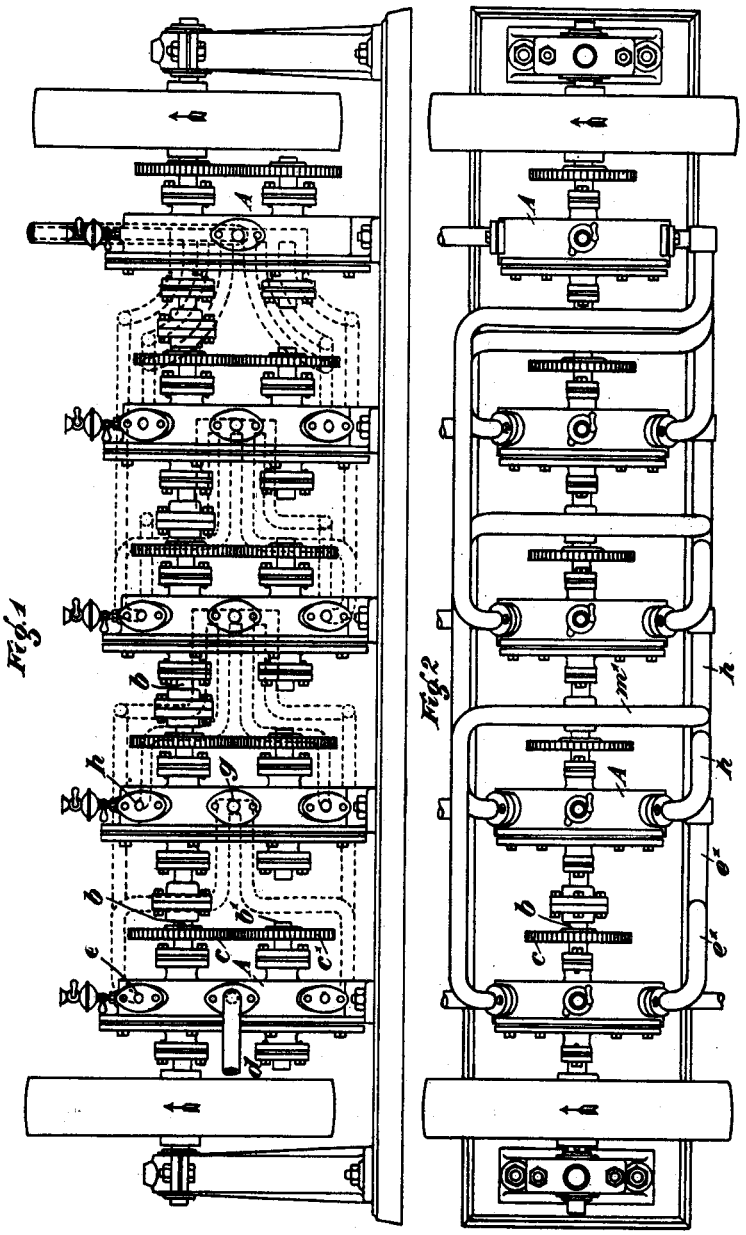


Fig. 1.

Fig. 2.

WITNESSES:
Ella L. Giles
A. Richards

INVENTOR
David Morell
BY Richards & Co
ATTORNEYS

No. 675,899. Patented June 11, 1901.

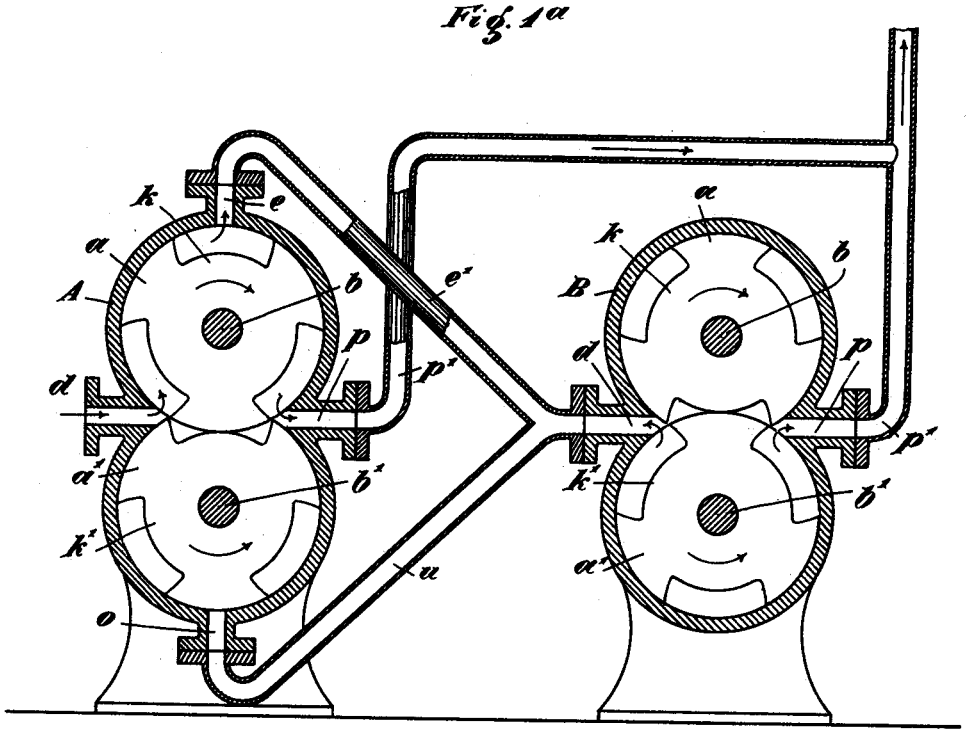
D. MORELL.

ROTARY ENGINE.

(Application filed Jan. 21, 1899.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 1ª



WITNESSES:
Ella L Gibbs

INVENTOR
David Morell
BY
Richards & R
ATTORNEYS

No. 675,899. Patented June 11, 1901.

D. MORELL.

ROTARY ENGINE.

(Application filed Jan. 21, 1899.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 3.

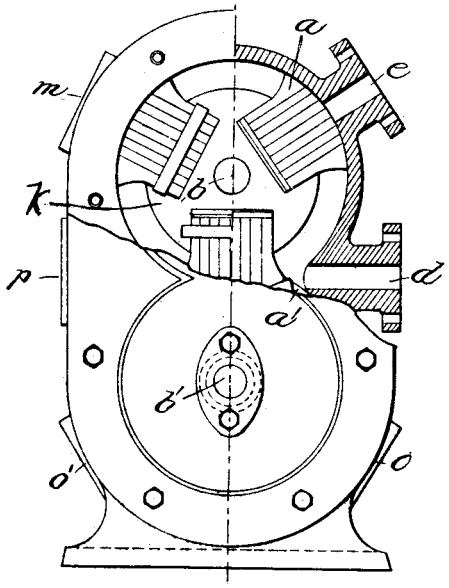


Fig. 5.

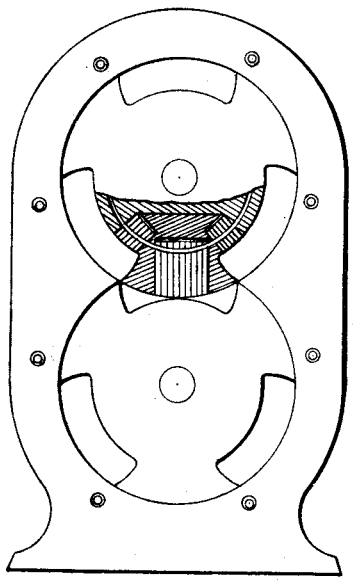


Fig. 4.

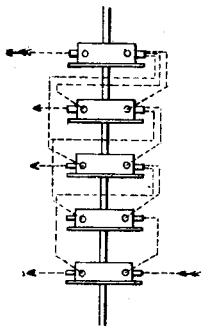
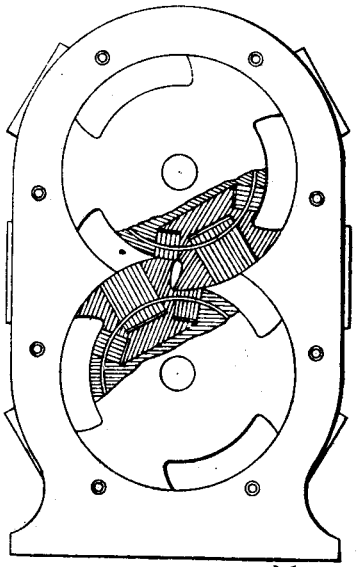


Fig. 6.



Witnesses:
Walter D. Maddox
Wm. F. Hall

Inventor:
David Morell,
By Richards & Co
Attys.

UNITED STATES PATENT OFFICE.

DAVID MORELL, OF CASSEL, GERMANY.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 675,899, dated June 11, 1901.

Application filed January 21, 1899. Serial No. 702,972. (No model.)

To all whom it may concern:

Be it known that I, DAVID MORELL, a citizen of Germany, residing at Wilhelmshöher Allee 39, Cassel, in the German Empire, have invented certain new and useful Improvements in Rotary Steam and Similar Engines, of which the following is a full, clear, and exact description.

The subject of the present invention is a rotary motor which exhibits novel technical differences from similar dynamic engines, inasmuch as a utilization of the power-generating medium raised to the utmost possible limit takes place and the efficiency of the machine is increased in a considerable manner, while the consumption of the power-giving medium is decreased.

The new machine is based upon the compound-engine principle in such a manner that the steam acts upon a first pair of pistons with full pressure and thereafter by expansion on a second pair of pistons.

The most essential effect of the machine consists in the fact that the reaction taking place in all known compound engines during the expansion of the steam in the low-pressure cylinder on the piston of the high-pressure cylinder is completely removed, so that the first pair of pistons receives the benefit of the full pressure of the steam without interference. This novel effect depending upon the construction of the machine is obtained in the manner that the steam, which has once been active in the high-pressure casing and which is inclosed in the chamber formed between two wings of a piston and the wall of the casing, said steam being conducted around in the casing toward the outlet-port, when the piston provided with three wings each turns, flows over already into the low-pressure casing, expanding in the action, before the chamber of the one high-pressure piston containing the steam reaches the outlet-port and communicates with one of the spaces between the wings of the other high-pressure cylinder of the same casing.

The accompanying drawings illustrate the invention.

Figure 1 shows the motor in front view. Fig. 1ª shows the invention in a distorted or diagrammatical manner for the purposes of more clearly explaining the invention. Fig. 2 is a plan view. Fig. 3 shows an individual casing in side view with partial section. Fig. 4 represents a diagram of the second form of execution. Figs. 5 and 6 illustrate the gearing of the wing-pistons at various working positions.

The subject-matter of the invention is illustrated most precisely from Fig. 1ª. The machine represented by this figure is constructed in the following manner: It consists of two box-casings A and B, at the interior of which two wing-pistons $a\ k$ and $a'\ k'$ are arranged. In reality the two casings A and B are side by side, so that the two upper piston-shafts b can be coupled directly with each other, as in Figs. 1 and 2. The upper and lower pistons are in forced connection by toothed wheels keyed on their shafts. In order to render possible an easier understanding of the invention, the two casings of the machine are represented behind each other in the drawings. This representation renders possible at the same time a general view over all steam-chambers and steamways of both casings. Instead of the coupling the two upper piston-shafts may be imagined in this representation to be forcedly connected by a chain and chain-wheels, while the upper and lower pistons may be connected by cog-wheels.

A is the high-pressure casing, and B the low-pressure casing, the latter having many times the width of A. Both casings have at two opposite places, where the peripheries of the casing-walls cross, an admission-port d and an outlet-port p each. The exhaust-pipes p', which combine into a common exhaust-pipe, join the exhaust or outlet ports. The high-pressure casing A possesses two other ports, e and o, besides the admission and exhaust port, on which the steam conduit-pipes e' and u connect, which combine later and enter jointly the admission-passage d of the low-pressure casing B. The machine works in the following manner: The steam enters from the boiler with full pressure through the induction-passage d into the high-pressure casing A, where it fills the chamber communicating at the time with the induction or admission port, said chamber being formed by the space between two wings of a piston and acts upon the upper piston by direct stroke while the piston is turned in the direction of the arrow.

As soon as the rim of the lower wing of the upper piston which is nearest to the admission-port has passed the admission-port the introduced steam acts upon the lower piston in the same manner, though it turns it in opposite direction to the one indicated by the arrow. As the lower piston is in forced connection with the upper one, the upper piston is turned along by the lower one, and in that operation the quantity of steam shut in on all sides in the chamber of the upper piston is conducted around ineffectively in the upper part of the casing until the chamber enters into communication with the passage or channel *e*. At that moment the steam which was shut up in the chamber of the upper piston at its (the steam's) initial tension expands and passes through the pipe *e'* and the induction-passage *d* into the lower pressure-casing while filling the piston-chamber, (in the drawings a chamber of the lower piston,) situated before the admission-port of said low-pressure casing, and making this piston rotate in the direction of the arrow. By suitable selection of the proportions in size of the low-pressure casing and its piston the steam can be allowed to expand here to a minimum terminal tension. While the steam passed over from the chamber of the upper high-pressure piston performs its labor of expansion the pistons have been turned farther and the chamber of the upper high-pressure piston has become disconnected from the passage or channel *e*, while in the meantime the communication of a steam-filled chamber of the lower high-pressure piston with the channel or passage *o* has been established. Now the steam contained in this chamber expands and passes through the pipe *u* and the admission-port *d* into the low-pressure casing, where it fills the nearest chamber of the upper low-pressure piston and yields its expansive force to the latter. After the expansive action of the steam having been inclosed in any chamber of the high-pressure pistons has taken place a volume of steam sufficient to fill them, but reduced to the minimum terminal tension, is passed around farther in the casing until the chamber enters into communication with the passage or channel *p*, when the steam will exhaust through said channel *p* and the pipe *p'*. After having performed its action the steam in the low-pressure casing is conducted around from the piston-chamber to the channel or passage *p* of the low-pressure casing and is also exhausted into the open.

The essential novel effect of the machine—*i. e.*, the avoidance of any reaction whatever of the expanding steam upon the high-pressure pistons—is a consequence of the circumstance that a special transmission passage or channel is provided for each of the two pistons, said channel being located as distant as possible from the admission and the exhaust channel, and consequently from those parts of the casing where the wings of the two high-pressure pistons gear. In this arrangement only one chamber of one high-pressure piston will always remain in communication with one of the transmission-channels during the expansion, and the expanding steam presses at all sides in this chamber uniformly upon the two fixed wings and the boss of the piston, as well as upon the part of the casing-wall closing the steam-chamber. Hence the expansive action of the steam remains without any influence upon the rotation of the pistons. This effect would cease at once if the steam which had been active in the high-pressure casing would have been passed over from the chambers of both pistons in common through the exhaust-channel *p* to the low-pressure casing. As a common exhaust-channel must absolutely be arranged at one place of the casing where it can communicate with the chambers of both high-pressure pistons, but as the two pistons attain in their revolution certain positions in which the exhaust-channel communicates simultaneously with one chamber of the one piston and with the space between wing of the same and the boss, as well as with the wing of the other piston, the steam there expanding must act simultaneously upon both pistons in the direction opposite to their direction of revolution, and thus weaken the effect of the entering boiler-steam considerably. The joint effect would be similar to that of all known compound engines in this case. In the new machine, however, the full pressure of the introduced boiler-steam acts permanently without being weakened. Owing to the mode of action of the steam a very large number of revolutions can be obtained. Therefore the machine is eminently adapted for running dynamo-engines. As the travel which one chamber of one high-pressure piston performs in the casing from the admission-port to the exhaust-port is about five times as long as the chamber itself, it becomes possible to have the steam carried along in a chamber from the admission-port exercise its expansive action in two periods by arranging instead of one passover conduit or channel each in the upper and lower part of the casing two of them at a certain distance from each other and to connect these passover-conduits with several low-pressure casings. As a matter of course other proportions of size must be applied in the low-pressure engines in this case, so that the expansion of the pressure of the steam is reduced about half in the first expansion and to a minimal terminal tension in the second expansion. Quite a number of low-pressure casings can be coupled among each other by passover-conduits, so that the expanding steam entering into a low-pressure casing can expand farther to a certain part in another low-pressure casing before it reaches the exhaust-conduit.

As shown in Figs. 1 and 2, five box-casings A are fixed next to each other on a bed-plate. The upper piston-shafts *b* are coupled, while the lower shafts *b'* are in forced communica-

tion with the coupled upper shaft individually by cog-wheels c c'. On the extremities of the shaft b salient from the two exterior casings two fly-wheels are provided. In each box-casing A, which have equal dimensions mutually, two wing-pistons a a' are lodged the same as in the machine before described. These wing-pistons are keyed on the shafts b b' and gear with their wings, owing to the toothed-wheel transmission, in such a manner as shown in Figs. 5 and 6. The first casing to the left is the high-pressure casing, while all the remaining ones are low-pressure casings. The induction of the steam takes place in the high-pressure casing through the pipe d. The steam enters here in the chamber which is before the admission-port at the time and makes the one or the other piston revolve alternately by direct impact. The volume of steam which has been active which is carried along at first inclosed in a chamber of the upper piston reaches the induction-port g, Fig. 1, of the first low-pressure casing aside of the high-pressure casing with full pressure through the conduit e, Fig. 1, and the pipe e', Fig. 2, while the steam expands and yields its force to a certain port to the piston of the first low-pressure casing, revolving said piston. It has been presumed in this premise that the steam has acted upon the upper piston of the first low-pressure casing. As soon as one chamber of the upper piston has left the induction-port g and has inclosed a quantity of steam of the already-reduced tension the chamber of the low-pressure piston enters into communication with the channel or conduit h. As soon as this has taken place the steam which has been inclosed expands further and passes through the pipe h into the induction-conduit of the third casing. The same process repeats itself with every further casing until the pressure of the steam is reduced to a minimum. However, a quantity of steam of reduced pressure has remained in the chamber of the high-pressure piston after expansion has taken place and this steam has been carried around farther in the casing. In the further advance of the high-pressure piston this chamber entered into communication with the conduit m of the high-pressure casing. From here a pipe m', Fig. 2, conducts into the pipe h, which discharges into the third low-pressure casing. Hence the steam guided through this pipe can still give its force to the piston of the third casing. In the same manner as the high-pressure casing connects with the first and second low-pressure casings the first low-pressure casing communicates in turn with the third and fourth one, and it is pointed out in this connection that the same communication as shown in Fig. 1 is provided for the chambers of the lower pistons by means of the lower pipes. It is manifest by this arrangement the power of the steam can be used in a very high degree. Only after two expansions have taken place in the upper and lower part of each casing the steam left in the chambers, which has been reduced to a quick minimal pressure, passes out through the exhaust-conduits p.

I claim as my invention—

In combination, two casings, each having inside two rotating pistons, each of said pistons having three vanes and three chambers, the outer circumference of these three vanes and three chambers lying in two circles, which cut each other in two points and which are inclosed by the wall of the casing, said wall having an induction-opening and an exhaust-opening at the cutting-points, the wall of the first casing having vis-à-vis to and in the same distance from these two openings two other openings and two pipes connected to said two other openings uniting themselves in one pipe connecting with the induction-opening of the second casing.

In witness whereof I subscribe my name in presence of two witnesses.

DAVID MORELL.

Witnesses:
CARL MAGERSUPPE,
DANIEL DUX.