L. H. NASH.

TURBO DISPLACEMENT ENGINE.

APPLICATION FILED MAY 9, 1905.

1,094,919.

Patented Apr. 28, 1914.

5 SHEETS—SHEET 1.

Fig. 1.

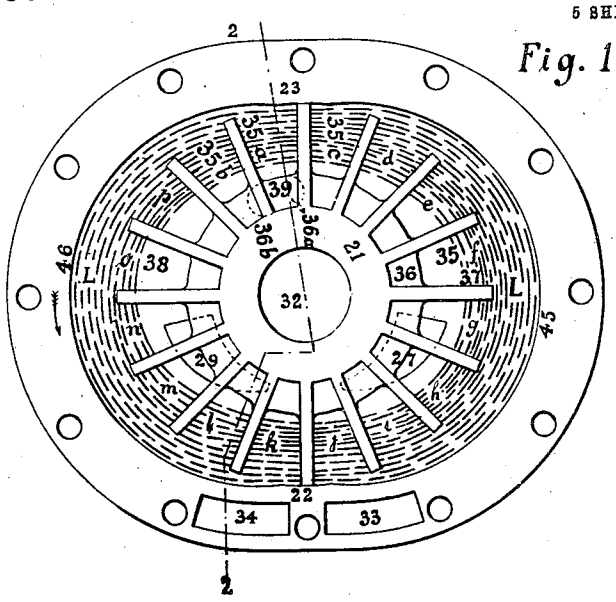
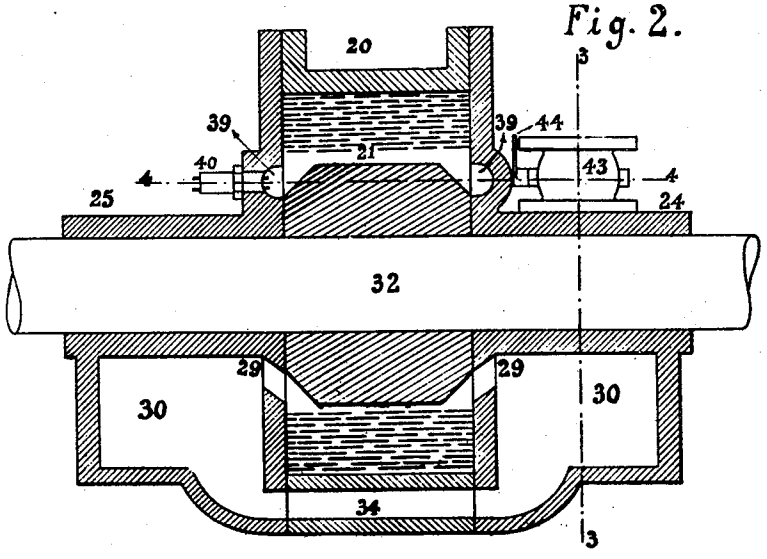


Fig. 2.



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5 SHEETS—SHEET 2.

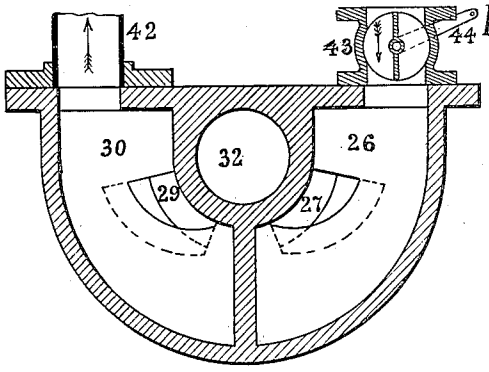
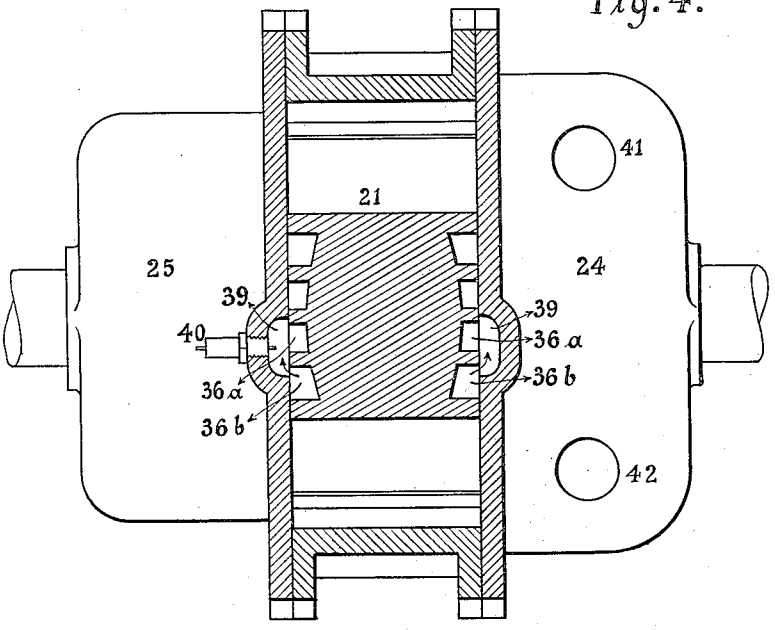


Fig. 3.

Fig. 4.



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5 SHEETS—SHEET 3.

Fig. 5.

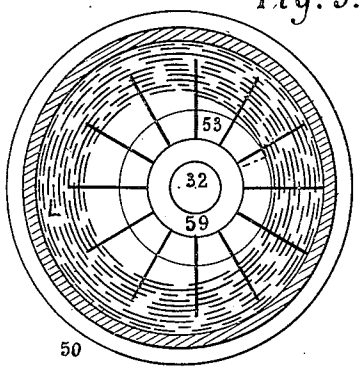


Fig. 6.

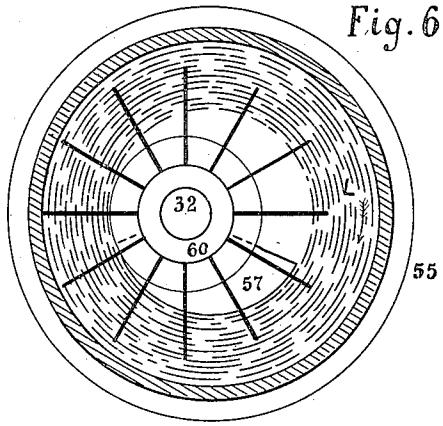


Fig. 7.

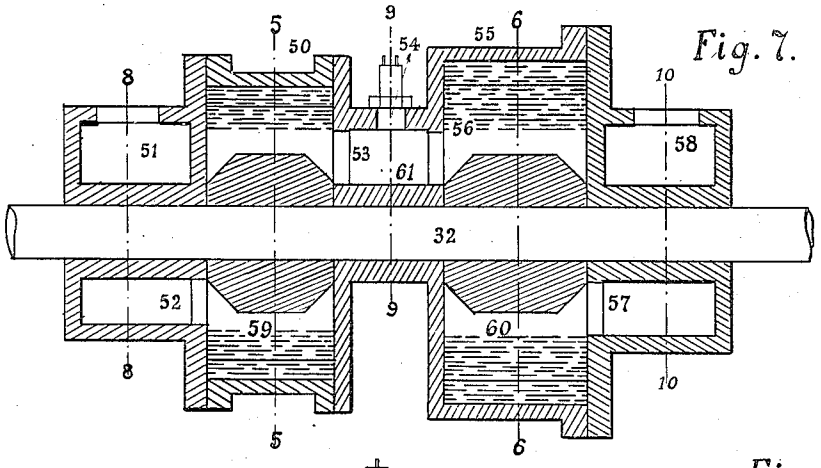


Fig. 8.

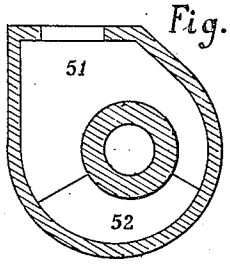


Fig. 9.

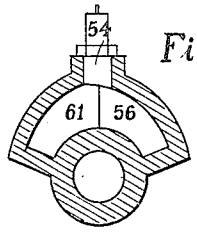
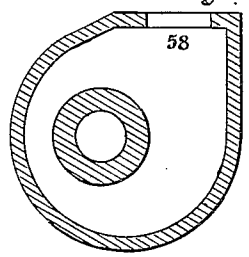


Fig. 10.



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5 SHEETS—SHEET 4.

Fig. 11.

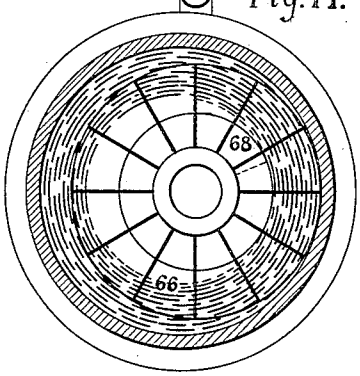


Fig. 12.

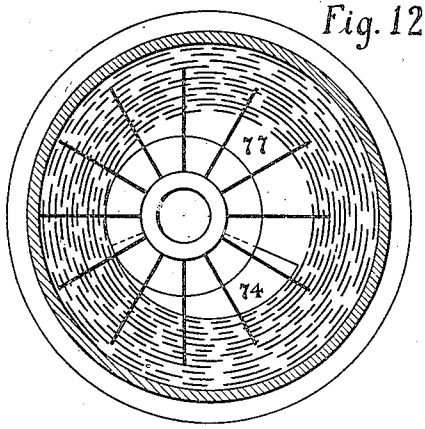


Fig. 13.

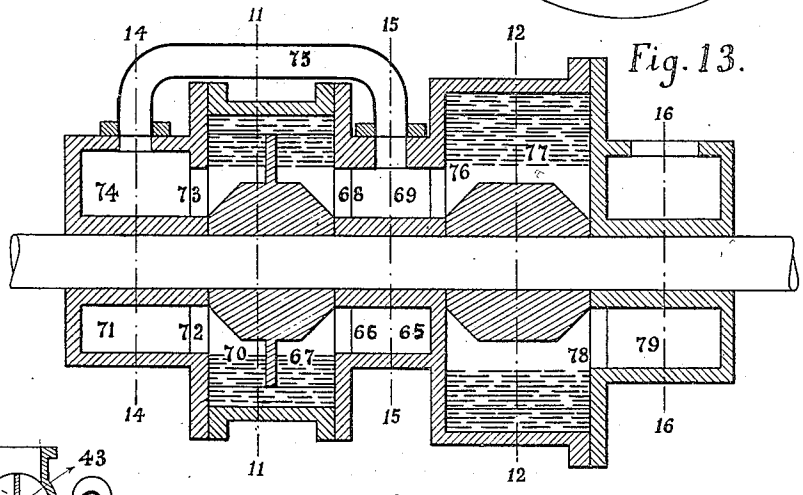


Fig. 14.

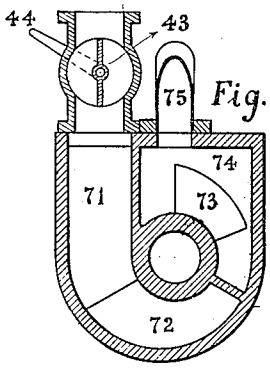


Fig. 15.

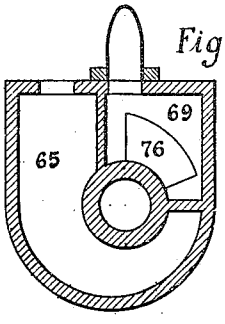
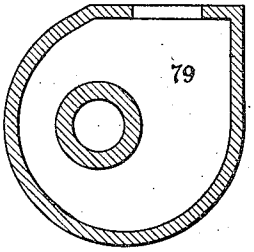


Fig. 16.



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5 SHEETS—SHEET 5.

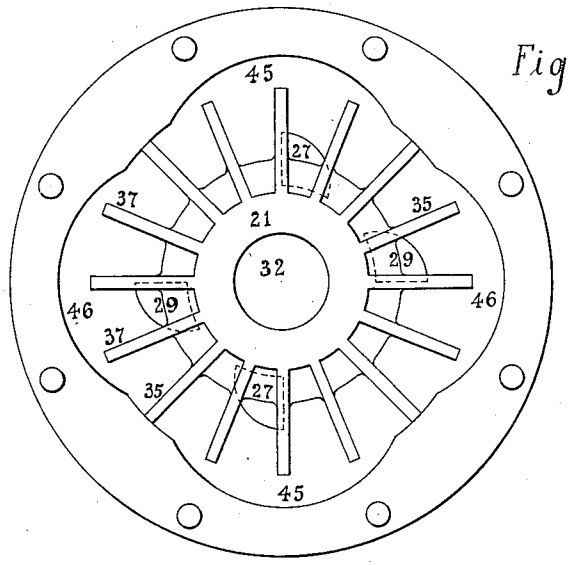


Fig. 17.

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UNITED STATES PATENT OFFICE.

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TURBO-DISPLACEMENT ENGINE.

1,094,919. Specification of Letters Patent. Patented Apr. 28, 1914.

Application filed May 9, 1905. Serial No. 259,644.

To all whom it may concern:

Be it known that I, LEWIS HALLOCK NASH, a citizen of the United States, and resident of South Norwalk, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Turbo-Displacement Engines, of which the following is a specification.

My invention is directed to improvements in motive power engines and consists in various features of construction and operation by which a combustible motive fluid is caused to give power to a motor device.

In reducing my invention to a practical form I may make use of a great variety of structures each of which will contain various features of my invention, and in the drawings I have shown many forms of devices in order to enable others skilled in the arts to practise my invention, and understand its nature. But it will be understood that I do not confine my invention to the forms shown, since other modifications may be made without departing from the spirit and scope of my improvement.

The features of novelty claimed as my invention will be particularly pointed out in the claims concluding these specifications.

Referring to the drawings;—Figure 1, shows a view of a case chamber and piston of an engine having one of the heads removed. Fig. 2, is a section on the line 2, 2, of Fig. 1. Fig. 3, is a section through the supply and discharge passages, taken on the line 3, 3, of Fig. 2. Fig. 4 is a section on the line 4, 4, of Fig. 2. Figs. 5 to 10 represent a modified form of device in which Fig. 5, is a section on the line 5, 5, of Fig. 7. Fig. 6, is a section on the line 6, 6, of Fig. 7. Fig. 7, is a longitudinal section of the engine. Fig. 8, is a cross section on the line 8, 8, of Fig. 7. Fig. 9, is a cross section on the line 9, 9, of Fig. 7. Fig. 10, is a cross section on the line 10 of Fig. 7. Fig. 11, is a cross section on the line 11, of Fig. 13. Fig. 12, is a cross section on the line 12, of Fig. 13. Fig. 13, is a longitudinal section through a modified form of my turbo-displacement engine. Fig. 14, is a section on the line 14, of Fig. 13, showing the inlet passages and supply valve. Fig. 15, is a section on the line 15, of Fig. 13, showing the intermediate passages between the compressor and motor. Fig. 16, is a section on the line 16, of Fig. 13. Fig. 17, shows another form of my liquid piston device having a larger number of lobes.

In Figs. 1 to 4, I have shown a simple form of engine having my improvements in which 20 is a cylinder of an oblong shape in which a rotary member 21 revolves. The cylinder and rotary member come in contact at two opposite sides at 22, and 23, and a crescent shaped chamber or passage is thus formed on each side of the rotary member between the case and wheel. The heads 24, and 25 complete the closure of the case chamber and support the shaft 32, on which the rotary member is mounted. The head 24 has the inlet passage 26, and the outlet passage 30 and these passages connect with similar passages in the head 25, through passages 33, and 34 in the cylinder. 29, 29 are outlet ports on opposite ends of the cylinder chamber, and in communication with the outlet passage 30, and 27, 27, are inlet ports connecting with the inlet passage 26, in a similar manner.

The rotary member, 21, has a series of blades 37, dividing its exterior into a series of chambers 35 and from each of these chambers passages 36 are formed in the ends of the rotary member and in the operation of the wheel these passages coöperate with the inlet and outlet ports 27, and 29, to control the inlet and exhaust of the working fluid of the engine. The buckets of the rotary member 21, when closed by the liquid, form inclosures for the explosive.

In order to complete the closure of the working cylinder a liquid piston is introduced into the cylinder which will assume a position on the circumference of the case when the wheel is rotating. This liquid will have an inner surface shown by the broken line 38, in Fig. 1.

It will be seen that in the rotation of the rotary member the wheel blades will enter and recede from this liquid and in doing this there will be formed enlarging and contracting chambers on each side of the rotary member between the liquid piston and the rotary member 21, which structure can be utilized for the various purposes of a pump or motor. At the same time the liquid piston also performs a function which will

be more fully described in connection with the operation of the device.

Fig. 4, shows a section through the igniter device. A recess passage 39, 39, in each head serves to convey the flame from one piston chamber to the next following it.

The igniter 40, is used to start the operation as follows: Suppose the device to be in operation and that the mixture of air and fuel is supplied to the engine through the port 27 and that this mixture is carried around by the rotary member into the position 35^a, and is then ignited by the igniter 40. The rotary member now advances into the position 35^b, and the chamber that was in the position 35^c, will now have advanced into the position 35^a. But in doing this the ports 36^a, and 36^b, will be in communication through the recess passages 39, 39, and the flame from the port 36^b, will be carried back to ignite the gases in port 36^a, and so the operation of igniting the charges will go on continuously even if the igniter 40, is not in use.

The combustible mixture is supplied to the engine through the pipe 41 through any of the well known forms of mixing devices, but since the fuel mixing device is a separate matter from my present invention which relates more especially to the engine itself, I have not shown it in the drawings.

I will now more particularly describe the action of the engine in its mode of operation. Suppose the rotary member to revolve rapidly and that the case is filled with water to the level of the edge of the ports 27, 29, as shown by the broken line 38. The water will follow the outline of the case in an annular stream and in doing this when the water enters an enlarged portion of the chamber a hollow space will be left in the center of the rotary member recesses into which the gaseous mixture can enter through the ports 27, 27. In the positions shown in Fig. 1, the spaces *g*, *h*, and *i*, are being filled with the mixture. As the rotary member moves forward in the positions *f*, *e*, *d*, and *c*, the charge is compressed until when it arrives at the position *c*, it is under considerable pressure. The amount of this pressure will depend upon the speed of the rotary member and it may be as high as desired. When the space arrives at the position 35^a, the charge is ignited and the pressure of the ignited gases will force the liquid out of the chambered spaces and cause the liquid to flow around the rotary member blades as shown by the arrow. These gases will expand as the rotary member advances through the positions 36^b, *p*, *o*, and when the chamber arrives at the position *n*, the exhaust port is opened and the charge escapes while the rotary member passes through the positions, *m*, *n* and *l*.

In order to avoid confusion in the drawings, the water is only shown in the case chambers of the motor-compressor and not in the connecting passages, because it is in the case chamber that its action as a piston takes place, and the drawings are intended to illustrate the action of the liquid piston. But when water is used a continuous supply may be injected into the compressor with the charge and this will supply the waste from evaporation and other causes. The steam generated will serve to increase the power of the engine. At the same time the liquid L, will be forced by the case walls back into these spaces and thus expel the charge from them, and the velocity of the stream of the liquid flowing around the case chamber will react upon the blades and also exert power to drive the rotary member. Thus the combined action of the displacement effect and the impulse of the flowing liquid will be combined to produce power in driving the rotary member. Because of this combined action I have called the device a turbo-displacement engine.

By the use of the terms "re-action surface" and "re-action structure" I do not desire to be limited to any particular form of element or structure to be engaged by the liquid to be driven thereby, but intend the terms to include any surface, element or structure which can be driven by the engagement of the liquid therewith.

It will be seen that the structure I have shown is able to perform all the functions of the 4-cycle heat engine in a continuous operation. That is to say, the charge is drawn in, compressed, ignited and expanded, and exhausted in a succession of chambers in the rotary member and each chamber acts as a piston chamber in a 4-cycle heat engine in which the piston is a liquid. This liquid piston is caused to enter and recede from these chambers as the rotary member and liquid rotate in the case by the form of the case walls, which approach or recede from the rotary member for this purpose. I have called the spaces so formed, lobes of the case.

It will be understood that the case chamber may be formed with any desired number of lobes and in the drawings I have shown several forms, but I do not limit my invention to any particular form of structure or any specific or particular form of casing so long as the parts operate as described. In Fig. 17, I have shown a case having 4 lobes and it will be readily understood that as many lobes can be used as may be found of advantage for the use to which the device is to be put.

The admission of the charge to the engine may be controlled by any suitable governor and I have shown in Figs. 2 and 3, one way of doing this, which consists of a throttle-valve 43, having an arm 44, for

operating the valve and this arm may be connected to any form of governing mechanism.

The quantity of the mixture entering the engine may be regulated by opening or closing the valve 43, as will be readily understood.

In Fig. 1, it will be seen that the lobe 45, acts as a compression pump while the lobe 46 acts as a motor and that the compressed charge is carried around by the rotary member from the compressor to the motor. In Fig. 17, I have shown a 4-lobed structure in which two of the lobes 45, 45, act as compressors and two lobes, 46, 46, act as motors. That is to say, the device has two sets of motor-compressors. and this form has the further advantage that the pressures upon the rotary member are balanced and the power of the device is increased.

The operation of the motor-compressor sets are the same as before, that it to say they act in parallel. The two inlet ports are connected to the same passage and the two outlet ports are connected to the same outlet passage, and the effect of the device is doubled. The motor-compressor sets may be arranged in series so as to have the two compressors compounded and the two motors compounded, and in this application I do not limit myself to any exact way of combining these sets but the specific device wherein the parts are combined in series will form the subject matter of a separate application for a patent.

In the figures heretofore described the motor-compressor sets have been formed by a series of lobes in a single cylinder, but I may use a separate cylinder for each lobe. In Figs. 5 to 10, I have shown such a structure in which 50, is a single lobed compressor of my liquid piston device having the inlet passage 51, and inlet port 52. The rotary member 59, is mounted on the shaft 32, so as to revolve in an eccentric relation to the case chamber. 53 is the outlet port of the compressor and it discharges into the passage 61, which leads to the inlet port 56, of the motor. The charge is ignited in the passage 61, by the igniter 54. The motor has a rotary member 60, which is mounted on the shaft 32; and 57, is the exhaust port which leads to the passage 58.

The operation of the device is as follows: The combustible mixture is admitted to the compressor through the passage 51, and port 52, and is compressed, after which it passes out of the port 53, into the chamber 61, and is ignited by the igniter 54. It then passes into the motor chamber and is expanded therein and escapes through the outlet port 57, to the passage 58.

In the modification shown in Figs. 11 to 16, the compressor is divided into two chambers so that the air and fuel may be compressed separately. The fuel may have a portion of air mixed with it but I prefer to have less air than is required for complete combustion. The fuel constituent of the charge enters through the valve 43 and passage 71, to the chamber 70, and after compression it passes out of the port 73, and pipe 75, to the combustion chamber 69; while at the same time the air is received through the pipe 65, and port 66, into the compressor 67, and after compressing the air is discharged through the port 68, to the chamber 69, where it mixes with the fuel and combustion takes place. The hot gases then pass through the port 76 into the motor chamber 77 wherein they do their work and escape from the port 78, into the passage 79.

I have thus described a few of the modifications of my improved liquid piston motor in order that others skilled in the arts may be able to practise my invention but the description of these few modifications is not intended to exclude other modifications not shown, because many other forms can be made without departing from the spirit and scope of my improvement.

The particular features of novelty which constitute my invention will be particularly pointed out in the claims concluding these specifications.

From one point of view my device may be considered as an internal combustion steam engine, since the water is introduced into the combustion chamber, and the combustion of the charge will generate steam which adds to the power of the engine. The water for maintaining the liquid piston can be introduced into the supply passage with the charge and some of this water will be used in forming steam and will develop power. Therefore the heat that is lost on the water jacket of the older forms of internal combustion engines will be saved in my liquid piston engine by the utilization of the steam as before described. I have thus far spoken of the use of water as the liquid piston, but I may employ a heavier liquid as mercury for this purpose. When mercury is so used the cooling water would still be used and a stream of water would be supplied to supply steam and as a cooling medium. However the cooling water might be used in an external jacket as is the usual manner in the older forms of heat engines.

I claim:—

1. In a power engine, the combination of a case, a rotary member in the case provided with a plurality of re-acting surfaces and intervening recesses, said recesses being connected by a passage, a liquid within the case adapted to enter and recede from said recesses as the member turns, means for introducing a combustible charge into said recesses, and means for igniting the charge whereby liquid is forced out of one recess through said

passage against a re-acting surface to another recess.

2. In a power engine, the combination of a case, a rotor within said case having recesses in its circumference and re-action blades intermediate of said recesses, the outer ends of said recesses being connected by a passage, the case having ports in the center for controlling the inlet and discharge of a combustible charge to the recesses of the rotor, and an igniter for igniting said charge to force the liquid through said passage and direct it upon the reaction blades of the rotor.

3. In a power engine, the combination of a case having two lobes and intervening bearing surfaces, a rotor in the case adapted to form joints with said bearing surfaces and having a plurality of re-acting surfaces and intervening recesses which do not extend to the adjacent surfaces of said lobes, a liquid in the case passing in and out of said recesses as the rotor turns, means controlling the inlet and discharge of a combustible charge to said recesses, and means for igniting the charge.

4. In an engine, the combination of a rotor having recesses adapted to contain a liquid piston, a case inclosing the rotor and providing a passage for conveying the liquid piston from one rotor recess to another as the rotor turns, means for controlling the inlet and discharge of a combustible gas into and out of said recesses, and an igniting device for igniting the charge.

5. The combination of a case having extended portions and intervening bearing points with a rotor in the case and making contact at said points upon the case walls leaving intermediate passages around the case walls, said rotor having blades and intervening recesses, said recesses being connected by said passages, a liquid piston revolving with the rotor, means for introducing a combustible charge into said recesses between the liquid and the walls of said rotor, and means for igniting the charge for driving the liquid out of said spaces through said passages upon the blades of the rotor to exert power and refill said recesses.

6. In an engine the combination of a case formed with a plurality of lobes and intervening contact points, a rotor provided with radial blades and intervening recesses revolving in said case, said blades forming joints with the case at said contact points, a liquid piston revolving in said case, entering and receding from said rotor spaces, and means for introducing and exhausting a combustible charge into said rotor recesses, to expel the liquid and force it into other rotor recesses and against the blades of said rotor.

7. In a four-cycle engine the combination of a rotor having recesses adapted to contain a liquid piston with a case inclosing said rotor and forming joint at a plurality of points with the said rotor and having intervening lobes forming passages for a liquid, a liquid rotating in said casing entering and receding from said rotor passages as controlled by the recesses of the case, means for introducing a combustible charge into a rotor recess by the outflow of the liquid piston, means for compressing the charge by the return of the liquid piston, means for igniting the charge and forcing said liquid from the said recess ahead of said rotor against its structure and into another recess, and exhaust means.

8. The combination of a rotor having a plurality of recesses, means for introducing a liquid and a combustible charge into said recesses, means for igniting the charge to drive the liquid from one recess to an adjacent recess, and a case inclosing the rotor and directing the flow of the liquid upon the rotor and into said adjacent recess.

9. The combination in a power engine of a rotary member having radial arms forming a multiplicity of intervening recesses, a liquid piston therefor, means for introducing a combustible charge for actuating the liquid piston, means for igniting said charge, means whereby each succeeding combustible charge is ignited by the previously ignited charge, and a case inclosing the rotary member and directing the liquid piston upon the rotor and into adjacent recesses.

10. The combination of a motor device consisting of a case having two enlargements or lobes, one acting as a motor chamber and the other as a compressor chamber, a rotary member in the casing and having a series of inclosures, a liquid in the casing forming one wall of each of said inclosures and adapted to enter and recede therefrom, means for introducing a combustible charge into said inclosures, said case being formed to cause the liquid to enter the inclosures to compress the charge, means for igniting the charge and thereby forcing said liquid through a lobe of the case against the rotary member to impart driving force thereto and to refill said inclosure, and a port for exhausting the gases.

11. The combination of a motor device consisting of a case having multiple enlargements or lobes, one acting as a motor chamber and the other as a compressor chamber, a rotary member in the case and having a series of inclosures, a liquid in the case forming one wall of each of said inclosures and adapted to enter and recede therefrom, means for introducing a combustible charge into said inclosures, said casing being formed to cause a liquid to enter the inclosures to compress the charge, means for igniting the

charge and forcing said liquid through a lobe of the case against the rotary member to impart driving force and to reënter said inclosure to expel the exploded gases, and a port for exhausting the gases.

12. A motor consisting of a case, a rotary member in the case and having a plurality of inclosures, said case containing a liquid body, combined with means for introducing a combustible mixture into said inclosures and igniting it therein for driving said liquid from one revolving inclosure to another.

13. In a motor, the combination of a revolving member having a plurality of inclosures and reaction surfaces, a casing inclosing said member, a liquid entering and receding from said inclosures as the member rotates, and means for introducing and exploding a combustible charge in an inclosure to expel the liquid therefrom and force it in the direction of rotation of the revolving member against a reaction surface and into another inclosure.

14. In a power engine, in combination, a rotary member having a plurality of inclosures, a case inclosing the same, means for introducing a combustible charge into said inclosures, a liquid in the case revoluble with said inclosures and adapted to enter the same to compress the charge therein, a plurality of revoluble reaction surfaces, means for igniting the compressed charge to cause it to expel the liquid from the said inclosures into engagement with said reaction surfaces to drive the same.

Signed at Brooklyn in the county of Kings and State of New York this 31st day of March A. D. 1905.

LEWIS HALLOCK NASH.

Witnesses:
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E. W. HAVILAND.