G. HUSCHER.

ROTARY INTERNAL COMBUSTION ENGINE.

APPLICATION FILED JAN. 6, 1908.

914,281. Patented Mar. 2, 1909.

2 SHEETS—SHEET 1.

Fig. 1

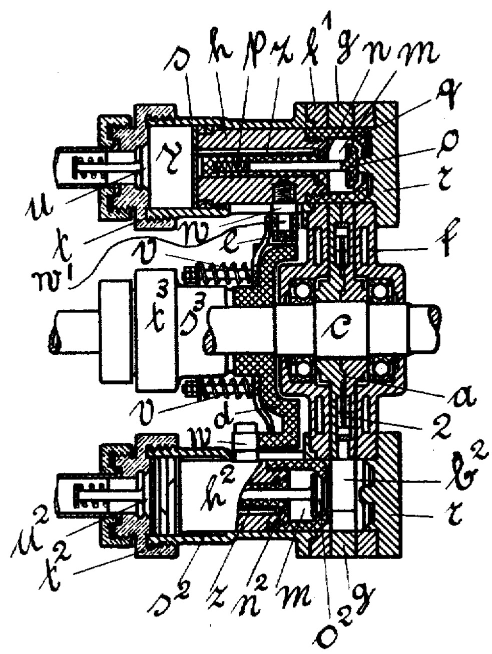
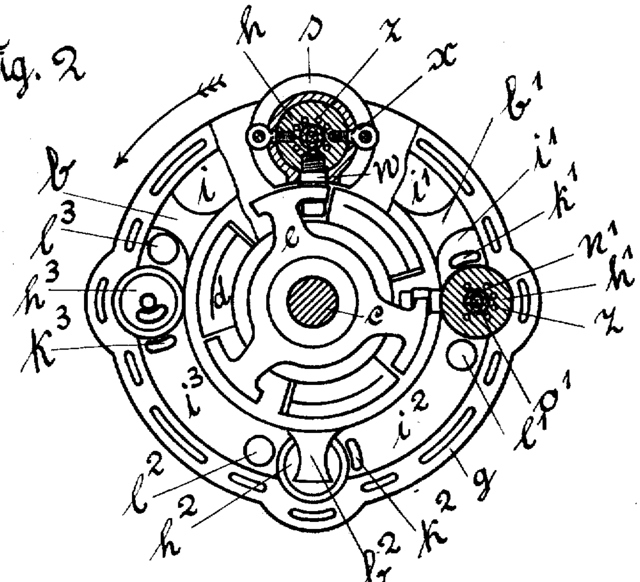


Fig. 2



Witnesses

S. Ford

A. Morrill

Inventor

Georg Huscher

by R. Madden

Attorney

G. HUSCHER.

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Fig. 3

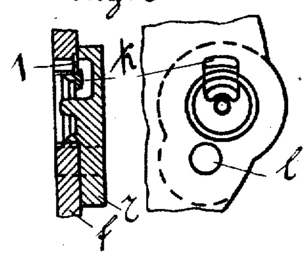


Fig. 4

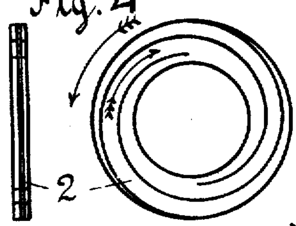


Fig 4a

Fig. 7

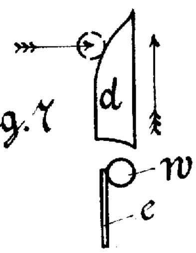


Fig. 5

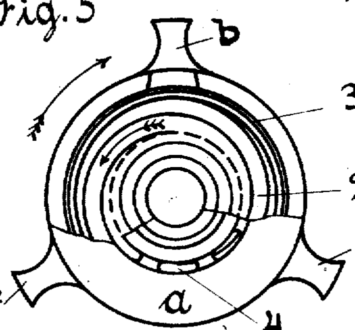


Fig. 6

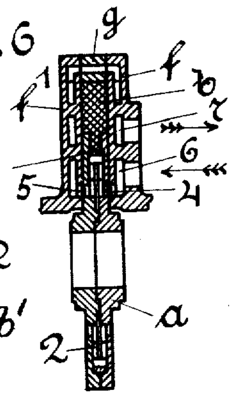


Fig. 8

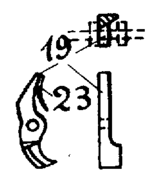


Fig. 9

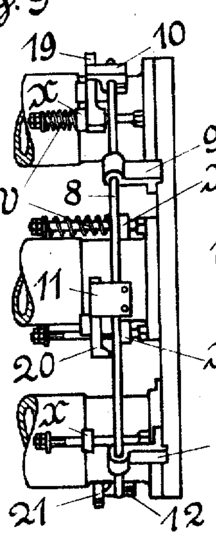
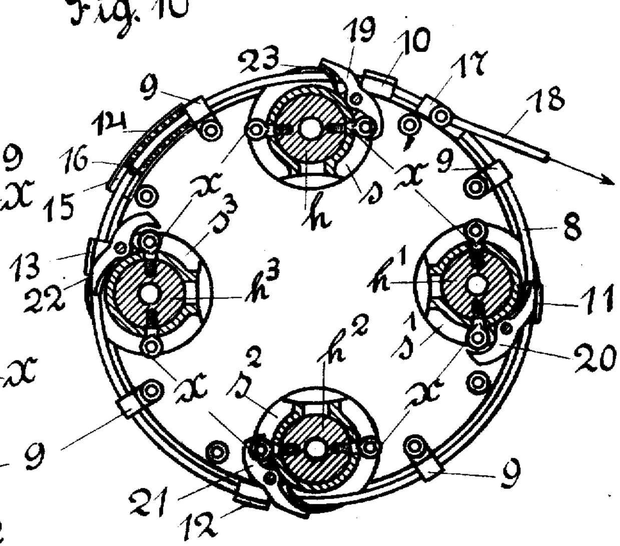


Fig. 10



Witnesses

S. Ford

A. Morrill

Inventor

Georg Huscher

by R Haddan

Attorney.

UNITED STATES PATENT OFFICE.

GEORG HUSCHER, OF BERLIN, GERMANY.

ROTARY INTERNAL-COMBUSTION ENGINE.

No. 914,281. Specification of Letters Patent. Patented March 2, 1909.

Application filed January 6, 1908. Serial No. 409,589.

To all whom it may concern:

Be it known that I, Georg Huscher, a subject of the King of Bavaria, residing at Berlin, N., Germany, have invented certain new and useful Improvements in Rotary Internal-Combustion Engines, of which the following is a specification.

This invention relates to improvements in internal combustion engines.

The improved engine is of the rotary piston type and adapted to be actuated by means of liquid or gaseous fuel.

An embodiment of the invention is shown in the annexed drawings in which—

Figure 1 is a vertical section of the improved engine. Fig. 2 is a sectional front elevation, parts being broken away. Fig. 3 is a detail view of one of the fluid inlet ducts of the working chamber. Figs. 4 and 4ª illustrate a detail of the cooling pump. Fig. 5 is an elevation of the piston disk, part being broken away to show the water channels of the cooling pump. Fig. 6 is a section of the piston disk and part of the casing inclosing same. Fig. 7 is a diagram illustrating the cam operating the inlet valves. Fig. 8 represents a detail of pawls forming part of a regulating device for the engine. Fig. 9 is a side elevation of the regulating device. Fig. 10 is a front view of the same.

The engine comprises a bi-partite rotary piston disk *a*, which also serves as a water pump for cooling purposes and has at its circumference piston members b, b^1, b^2. In view of the high temperatures generated these members are made of very resistant material and are so arranged that the maximum of space remains available and that residual impurities are driven toward the exhaust ports. The shaft *c* on which are mounted the cam disk *d* and star-shaped resilient plate *e*, is rotatable in ball bearings in the frame. The casing consists of two side parts *f* and f^1 and a central ring *g*, which inclose between them and the piston *a* an annular working chamber. The working chamber is divided into separate compartments by means of laterally arranged charging pistons h, h^1, h^2, h^3, that is to say, into explosion and expansion chambers i, i^1, i^2, i^3, which have supply ducts k, k^1, k^2, k^3 and exhaust ports l, l^1, l^2, l^3 respectively. The exhaust ports remain open. The left hand ends (Fig. 1) of the charging pistons h, h^1, h^2, h^3 are formed as ordinary pistons with inserted packing rings. The body of the piston has a prolongation in the form of a housing *q*, and a compression chamber *m* at its right hand end, with two inclined seats for valve-cones *n* and *o*. The spindle of the valve *n* is guided in the piston body *h*. This spindle is in part hollow and serves as a guide for the spindle of the valve *o*. The hollow spindle contains a spring *p* which presses the valves against their seats. The housing *q* surrounding the space *m* is open at the right hand side, and has internally a seat for the valve *o*, and externally forms a cone having its seat on a closing plate *r* inserted into the part *f* of the casing. The charging piston *h* is surrounded by a cylindrical housing or cylinder *s* fixed to the part f^1 of the casing. An automatic inlet valve *u* is located in the cover *t* of the cylinder *s*. The charging piston *h* is controlled by the cam disk *d*, the resilient plate *e* and the spring *v*. For this purpose pins *w* and *x* are fixed to the piston *h*. On the pin *w* is mounted a steel roll w^1 running on the cam disk *d*. The cam surfaces are so designed that their angles of rise decrease as the degree of compression increases (Fig. 7).

The action of the engine, described with reference to Figs. 1 and 2, is as follows: The piston disk *a* rotates in the direction indicated by the arrow in Fig. 2. When the charging piston *h* has been thrust behind the rotating piston *b* by the springs *v* and *e*, and has discharged its contents, the space *y* in the cylinder *e* is free and gas can flow through the suction valve *u* into said cylinder *s*, to fill the space *y*, whereupon the said valve *u* is closed. The charging piston *h* is thereupon moved by the cam disk *d* into the position in which the piston h^2 is shown, and the gases are forced through small ducts *z* in the piston body *h* into an annular chamber behind the valve *n*, and thrust the same from its seat, against the action of the fairly powerful spring *p*; the gases then flow into the chamber *m* closed by the valve *o*. Eddy currents of gas are produced during this action, and cause the gases to become very intimately mixed. When the charging piston *h* has been thrust into its end position the capacity of the compression chamber *m* is reduced to a minimum, and the pressures in the compression chamber *y* and the compression chamber *m* are in equilibrium, so that the valve *n* is closed and the gases are inclosed in the chamber *m*. At this moment the rotating piston b^1 arrives behind the charging piston *h*. The cam disk *d* holds the piston h in the position in which the piston h^2 is shown until the rotating piston b^1 has passed the piston h. During this time the gases compressed in the chamber m become heated by contact with the walls of the said chamber, and their pressure is thus increased. When the piston b^1 has passed the piston h the cam disk d releases the pin w and the piston h is thrust by the springs v into the working chamber i behind the rotating piston b^1, so that the space y becomes free again, and a fresh charge of gases can enter through the valve u. The charging piston h thus sucks in a fresh charge while an unused charge is still in the chamber m. At this moment the spring e reaches the pin w and thrusts the valve surfaces of the piston h against the valve seat on the plate r. The valve o is not opened, by a projection of the plate r, until the charging piston h is completely closed behind the piston b^1, whereupon the highly compressed gases flow through the duct k (separately shown in Fig. 3) and through the platinum fabric 1 therein, the gases being ignited by contact with the said fabric, and exploding in the chamber i behind the piston b^1, so that the latter is driven in the direction indicated by the arrow, until it has passed the exhaust port l^3, through which the gases flow. This action takes place twelve times during one revolution of the engine shown. The rotating pistons are actuated alternately, but always two at a time. In most cases the piston disk itself can act as a fly wheel. An indefinite number of pistons may be provided, either more or fewer than shown in the drawing, according to the degree of uniformity of rotation desired, and to the prescribed limits of dimensions and weight.

Since the temperature in the working chamber of the engine is very high while the engine is running, efficient cooling must be provided for, and having regard to the position of the bearing of the shaft c the piston disk a must also be cooled. For this purpose the disk itself is made to act as a pump, so that a separate water pump can be dispensed with.

The disk a is divided perpendicularly to its axis and has an annular bore into which a vaned disk 2 (Fig. 4) is fitted and fixed. A copper ring 3 also fits closely into this bore. One half of the disk has inflow ducts 4, and the other half has outflow ducts 5. The ring in which the ducts 4 and 5 are arranged is slightly recessed at the piston disk and in the casing, so that impurities carried by the water are washed away and do not get between the surfaces of the piston disk and casing. The disk 2 has a spiral vane on each side fitting closely against the walls of the piston disk, so that direct spiral ducts are formed.

The action of the pump is as follows. The piston disk rotates to the right. Water flows into the annular conduit 6 in the part f of the casing and thence through ducts 4 to the interior of the piston disk. By reason of the rapid rotation the water is driven outward by centrifugal force and is compelled to flow through the ducts to the left. Since the two directions indicated in the figure are opposed to each other the rotational velocity of the water must necessarily be smaller than that of the disk a. The inertia of the water increases the difference between the velocities. The lagging of the water is used on the other side of the vane disk 2, where the spiral duct has the opposite direction, to drive the water through this duct, as indicated by arrows in Fig. 4, in which the outer arrow indicates the direction or rotation of the disk and the inner arrow the direction of flow of the water. The water is thus brought back to the center of the disk, against the action of centrifugal force, and then flows through the ducts 5 to the part f^1 of the casing, which also contains spiral ducts. The water flows through these ducts and then passes through the central ring g back to the part f and to the conduit 7 leading to the discharge orifice. From the latter the water flows to a cooler, in order to be cooled before being used again.

A throttle valve is provided for regulating the supply of gas, and also a regulating device for the engine which is shown in Figs. 9 and 10. This latter device serves for regulating the number of revolutions and for safeguarding the engine. It comprises a ring 8 guided by suitable bracket-bearings 9 fixed to the casing, tappets 10, 11, 12 and 13, a spring 14 in a tube 15, a ring 16 engaged by the spring 14, and a sleeve 17 connected to a rod 18. The latter may be controlled by a governor or by hand. Pawls 19, 20, 21 and 22 are pivoted to cylinders s, s^1, s^2 and s^3, and have rearward prolongations to which springs 23 are fixed (Fig. 8). Let it be assumed that the rod 18 is pulled in the direction indicated by the arrow. The tappet 10 releases the prolongation of the pawl 19, so that the latter is thrust by the spring 23 behind the pin x fixed to the charging piston h, and thus hold back the said piston. When the rod 18 is released again the spring 14 pushes the ring 8 and tappet 10 back to their original positions; the tappet 10 pushes back the prolongation of the pawl 19 and the latter releases the pin x, so that the charging piston h can resume its function. If, instead of being released, the rod 18 is moved further in the direction indicated by the arrow, the tappet 12 releases the prolongation of the pawl 21, and the latter can engage the pin x of the charging piston h^2, so that the latter is also put out of action, as shown in Fig. 10. Further movement of the rod 18 produces the same result with regard to the charging pistons h^3 and h^1.

Movement of the rod in the opposite direction causes the pistons h^1, h^3, h^2 and h to successively resume their functions, in the order in which they are here cited. The regulator is thus adapted to put the charging pistons separately into and out of action.

Air can also be used for cooling, more particularly in the case of small motors.

What I claim as my invention and desire to secure by Letters Patent of the United States is:—

1. In an internal combustion engine the combination with a casing of a rotary disk having a plurality of radial piston members, a corresponding series of explosion chambers formed in the casing and in communication with said piston members, a series of slidable piston valves adapted to admit compressed charges to said explosion chambers, a cam adapted to move the piston valves in one direction and springs adapted to move said valves in the reverse direction, substantially as described.

2. In an internal combustion engine the combination with a casing of a rotary bipartite disk having a plurality of radial piston members, a corresponding series of explosion chambers formed in the casing and in communication with said piston members a series of double slidable pairs of piston valves each having between them a compression chamber and adapted to admit compressed charges to said explosion chambers, a cam adapted to move the piston valves in one direction and springs adapted to move said valves in the reverse direction, substantially as described.

3. In an internal combustion engine the combination with a casing of a rotary disk having a plurality of radial piston members and provided with a channel having inlet and outlet for cooling medium, a series of explosion chambers corresponding to the piston members and in communication therewith, a series of slidable piston valves adapted to admit compressed charges to said explosion chambers, a cam adapted to move the piston valves in one direction and springs adapted to move said valves in the reverse direction substantially as described.

4. In an internal combustion engine the combination with a casing, of a rotary disk having a plurality of radial piston members, a corresponding series of explosion chambers formed in the casing and in communication with said piston members, a series of slidable piston valves, adapted to admit compressed charges to said explosion chambers, a cam adapted to move the piston valves in one direction, springs adapted to move said valves in the reverse direction and means for placing said piston valves singly and collectively into and out of action substantially as described.

5. In an internal combustion engine the combination with a casing of a rotary bipartite disk having a plurality of radial piston members, and provided with a channel having inlet and outlet for cooling medium, a series of explosion chambers formed in the casing and communicating with said piston members, a series of double slidable pairs of piston valves each having between them a compression chamber and adapted to admit compressed charges to said explosion chambers, a cam adapted to operate the piston valves in one direction, springs adapted to operate said valves in the reverse direction, and means for placing said piston valves singly and collectively into and out of action according to the desired degree of power substantially as described.

In witness whereof I have signed this specification in the presence of two witnesses.

GEORG HUSCHER.

Witnesses:
WOLDEMAR HAUPT,
HENRY HASPER.