E. BECKER & F. DINSLAGE.

INTERNAL COMBUSTION ENGINE COMPRISING ROTATING CYLINDERS.

APPLICATION FILED JULY 1, 1912.

1,084,192. Patented Jan. 13, 1914.

2 SHEETS—SHEET 1.

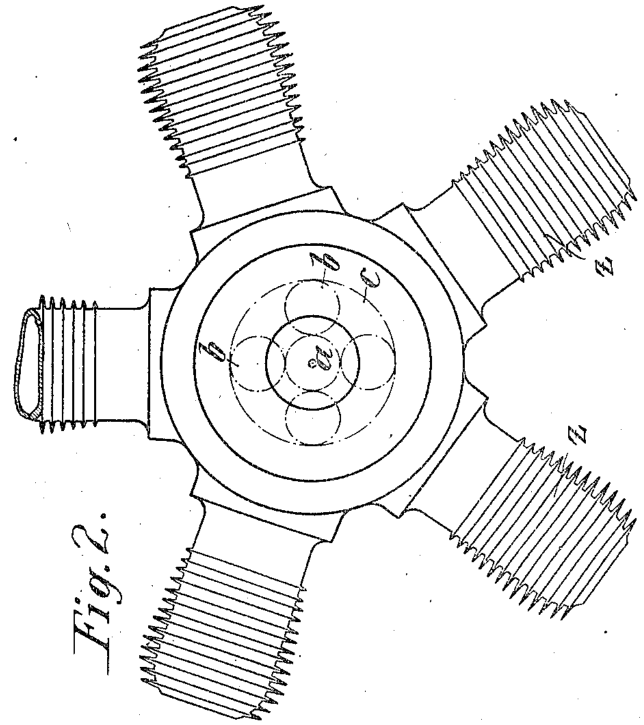


Fig. 2.

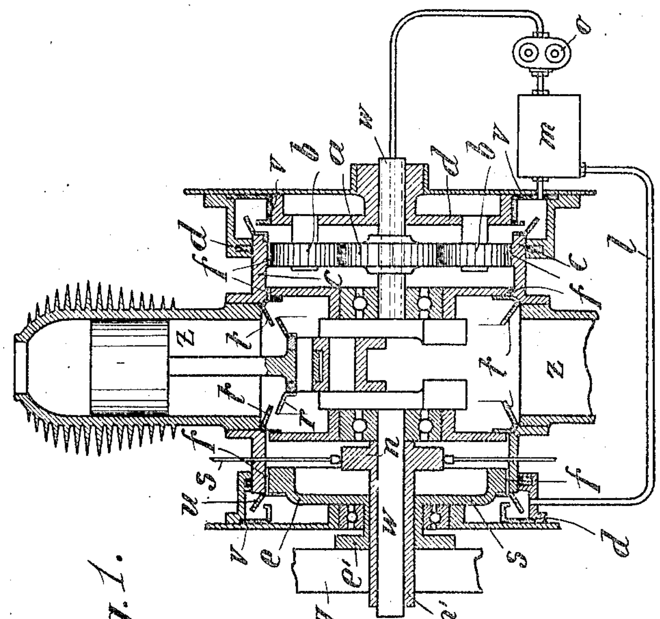


Fig. 1.

Witnesses
Clara Hohenstein
Ray F. Ernst

Inventors
Ernst Becker and
Franz Dinslage
By their attorneys
Knight Bros

E. BECKER & F. DINSLAGE.
INTERNAL COMBUSTION ENGINE COMPRISING ROTATING CYLINDERS.
APPLICATION FILED JULY 1, 1912.

1,084,192. Patented Jan. 13, 1914.

2 SHEETS—SHEET 2.

Fig. 3.

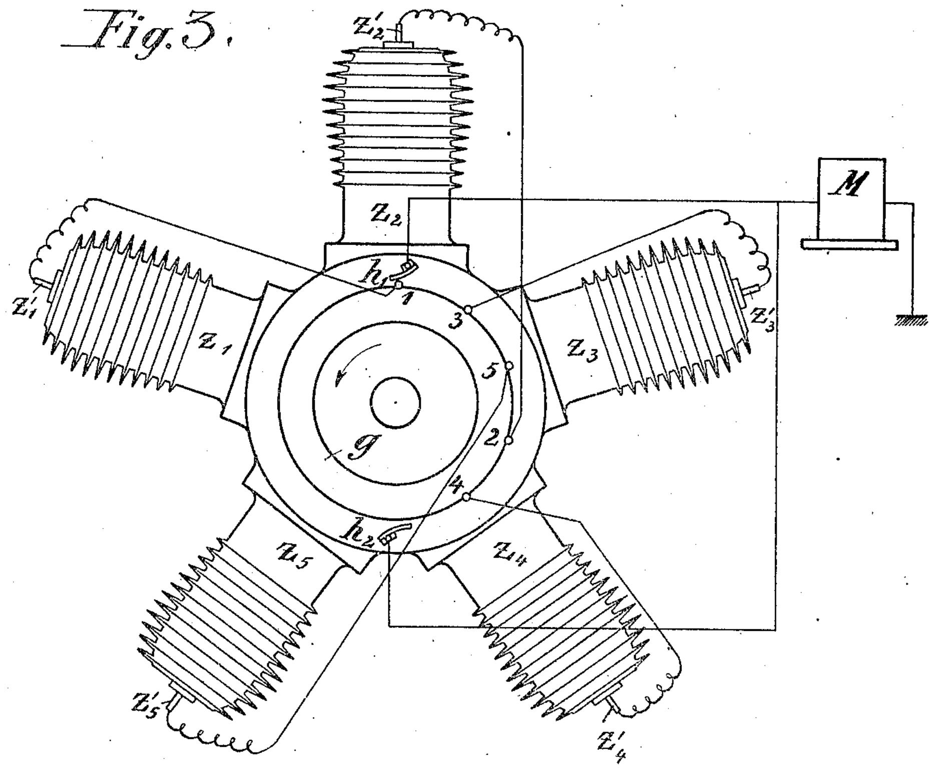
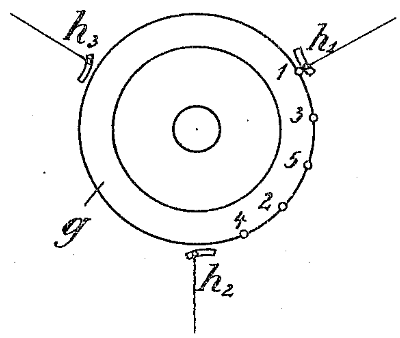


Fig. 4.



Witnesses
Clara Hohenstein
Ray J. Ernst

Inventors
Ernst Becker and
Franz Dinslage
By their attorneys
Knight Bros

UNITED STATES PATENT OFFICE.

ERNST BECKER AND FRANZ DINSLAGE, OF CHARLOTTENBURG, GERMANY, ASSIGNORS TO SIEMENS & HALSKE, A. G., OF BERLIN, GERMANY, A CORPORATION OF GERMANY.

INTERNAL-COMBUSTION ENGINE COMPRISING ROTATING CYLINDERS.

1,084,192. Specification of Letters Patent. Patented Jan. 13, 1914.
Application filed July 1, 1912. Serial No. 706,961.

To all whom it may concern:

Be it known that we, ERNST BECKER and FRANZ DINSLAGE, citizens of the Empire of Germany, and residing at Charlottenburg, near Berlin, Germany, have invented certain new and useful Improvements in Internal-Combustion Engines Comprising Rotating Cylinders, of which the following is a specification.

Our invention relates to internal combustion engines, for flying-machines, which, like the known "Gnome" motor, comprise rotating cylinders and are therefore excellently cooled by the air, and a primary object is to provide an engine of this type superior to known engines both in respect to the strains which occur and to the constructional arrangement.

Our improved engine is an internal combustion engine comprising one or more intermediate gears between the cylinders and the crank-shaft located in the center of the entire arrangement.

Engines comprising rotating cylinders and one intermediate gear between the cylinders and crank-shaft are well-known *per se*, but so far as we are aware none are known in which the connecting-rods of all the pistons are connected, notwithstanding the intermediate gear, to a single crank-shaft. Owing to this combination an entirely new type of gearing is produced, whose advantages are described hereinafter.

In the drawings exemplifying our invention, Figure 1 is a side elevation of an engine constructed in accordance with the present invention, parts being broken away and parts shown in section; Fig. 2 is a front elevation of the same, parts being omitted and parts broken away; Fig. 3 is a front elevation of the same showing the preferred arrangement of the ignition apparatus, and Fig. 4 is a diagrammatic plan of the ignition timing apparatus.

Referring now to Figs. 1 and 2, the gear *a* is keyed on the crank-shaft *w*, and through the medium of the intermediate gears *b* journaled in the stationary frame *d* drives the internal gear *c* connected to the cylinders *z*. At the other side of the engine the cover *e* is integral with or rigidly connected to the gear *c* or the cylinders *z* and has a flange *q'* to which the propeller *q* is attached. *n* designates a stationary cam formed on the bearing *n'* at this end of the crank-shaft. The valve rods *s* of the cylinders run around on this cam, whereby the valves are automatically operated. If the diameter of each gear *b* is equal to that of the gear *a* on the crank-shaft, the speed of the latter reduced in the ratio of 3 : 1 is imparted to the cylinders. For example, if the crank-shaft runs at 1,800 revolutions per minute, the speed of the cylinders and of the propeller connected therewith will be only 600 revolutions per minute. The cylinders and crank-shaft here rotate in opposite directions. As compared with known internal combustion engines whose cylinders rotate at the same speed as the crank-shaft we obtain the very great advantage that there is a great reduction in effect on the cylinders of centrifugal force and of the lateral pressure of the pistons which materially affects the life of the engine, both of which forces increase as the square of the speed and cause motors constructed for very high speeds to be dangerous and the construction of those of a speed above a certain limit impossible. Furthermore, for the particular purpose of the invention there is the great advantage that the propeller running at the same low speed as the cylinders works with a much better efficiency than a high-speed propeller. Apart from this the cylinders are utilized well owing to the pistons being able to work at the highest possible speed. For by suitably choosing the ratio of transmission between the crank-shaft and cylinders it is possible to arrange for as many ignitions as desired during one revolution of the cylinders. If the described engine has, for example, a four-stroke cycle, when the ratio of transmission is 3 : 1 there will be two explosions per revolution. In general, the number of explosions

$$Z=\frac{A+1}{2},$$

when A is again the gear ratio, and in this case equals 3.

Referring now to Figs. 3 and 4, a five-cylinder, four-stroke cycle engine is shown in which the ignitions follow one another in order in the 1st, 3rd, 5th, 2nd and 4th cylinders, so that power may be applied to the crank-shaft at equal intervals and that the torque may be kept constant. To this end, we mount on an insulated ring *g* five contact-pieces 1 to 5, spaced in the manner indicated in Fig. 3. The contact-ring *g* is connected to the cylinders and rotates with them. Two stationary contact-pieces or brushes h_1 and h_2, connected in parallel and to the same magneto M, conduct the current from the latter to one of the sliding contact-pieces 1 to 5, and thence to the corresponding spark-plug z'_1, z'_2, z'_3, z'_4 or z'_5 of the cylinders z_1 to z_5. Instead of magneto ignition battery ignition may, of course, be employed. During one half revolution of the contact-ring *g*, when each cylinder is fired once, the brush h_1 makes the connection, while during the other half revolution, when a second ignition occurs in each cylinder, the brush h_2 supplies the current.

Our invention is not limited in its application to a particular number of cylinders, nor to any particular number of ignitions per revolution of the cylinders. Fig. 4 shows the distribution of contact-pieces for three ignitions per revolution of the cylinders of a five-cylinder engine. For *x* ignitions the contact-ring will be divided into *x* parts and *x* times *h* sliding contact-pieces will be provided. The space between two fixed contact-pieces will be divided by the number of cylinders, in the example by five, and the order of ignition will be arranged as desired. The remaining $x-l$ portions will remain without contacts.

The described ignition distributer is erected exceedingly simply, because the distributing ring *g* together with the brushes or contact-pieces h_1, h_2, h_3 need not be driven by special gearing to make it operate correctly, but can be simply connected directly with the rotating cylinders or with their supporting frame. Slip-rings for conducting the current from the contact-ring *g* to the spark-plugs or from the contacts *h* to the magneto are therefore unnecessary. This is a great advantage, for otherwise the certainty of working of the motor, especially with a large number of cylinders, would be seriously endangered.

By means of the arrangement illustrated in Fig. 1 one of the greatest drawbacks arising from the use of rotating cylinders, viz, the large oil consumption, is obviated, because the centrifugal force which in other engines throws the oil into every corner of the casing, from which it cannot be recovered, is here used for positively returning the oil to the oil vessel.

The oil is lifted from the oil vessel *m* by means of an oil-pump *o* into the hollow crank-shaft *w*. This can be done by driving the oil-pump by means of a second shaft. From the crank-shaft the oil passes to the crank-pin and to the bearings of the connecting-rods. After leaving these it is flung from the oil-throwers *r* into the ring *t* rotating within the casing, passes outward right and left through holes *f* and is finally delivered by throwers *u* into channels *v* in the stationary portion of the casing. It flows thence from the lowest points through pipes *l* back to the oil vessel *m*. It is immaterial for the oil distribution whether the crank-shaft rotates as in the illustrative embodiment, or whether it is stationary.

We claim:—

1. In an internal combustion engine, the combination, with a crank-shaft, and a plurality of connected cylinders rotatable relatively thereto, of a piston movable in each cylinder, and connected to said crank-shaft, and gearing comprising an intermediate gear rotatably connecting the crank-shaft with the cylinders, the speed of rotation of the cylinders and that of the crank-shaft being always in a predetermined relation one to the other, a contact-ring attached to the cylinders and divided into a number of parts equal to the desired number of explosions in each cylinder during one revolution of the engine, one of said parts of the contact-ring carrying a number of contact-pieces equal to the number of said cylinders, a number of stationary sliding contact-pieces equal to the number of parts into which the contact-ring is divided adapted to contact with the former contact-pieces, a spark-plug mounted in each cylinder, a source of current, and conductors for electrically connecting the former contact-pieces and the sliding contact-pieces with the source of current.

2. In an internal combustion engine, the combination, with a crank-shaft, and a plurality of connected cylinders rotatable relatively thereto, of a piston movable in each cylinder and connected to said crank-shaft, and gearing comprising an intermediate gear rotatably connecting the crank-shaft with the cylinders, the speed of rotation of the cylinders and that of the crank-shaft being always in a predetermined relation one to the other, a contact-ring attached to the cylinders and divided into a number of parts equal to the desired number of explosions in each cylinder during one revolution of the engine, one of said parts of the contact-ring carrying a number of contact-pieces equal to the number of said cylinders, a number of stationary sliding contact-pieces equal to the number of parts into which the contact-ring is divided adapted to contact with the former contact-pieces, a

spark-plug mounted in each cylinder and having one pole connected to one of the former contact-pieces, a source of current having one pole connected to the sliding contact-pieces and the other pole to the other poles of the spark-plugs.

In testimony whereof we have signed our names to this specification in the presence of two witnesses.

ERNST BECKER.
FRANZ DINSLAGE.

Witnesses:
HENRY HASPER,
WOLDEMAR HAUPT.