E. E. FREYTAG & A. F. HAYN.

COMBUSTION ENGINE OR MOTOR.

APPLICATION FILED DEC. 5, 1914.

1,231,871.

Patented July 3, 1917.

2 SHEETS—SHEET 1.

FIG. 1.

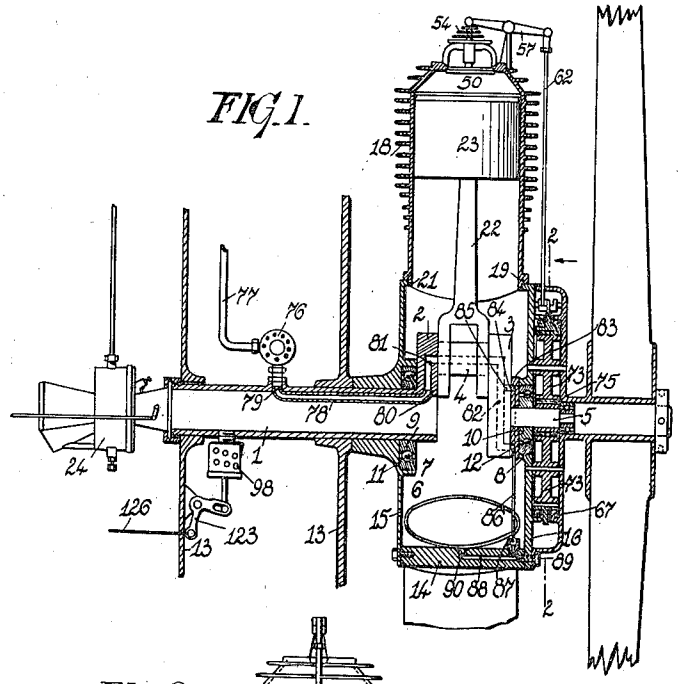
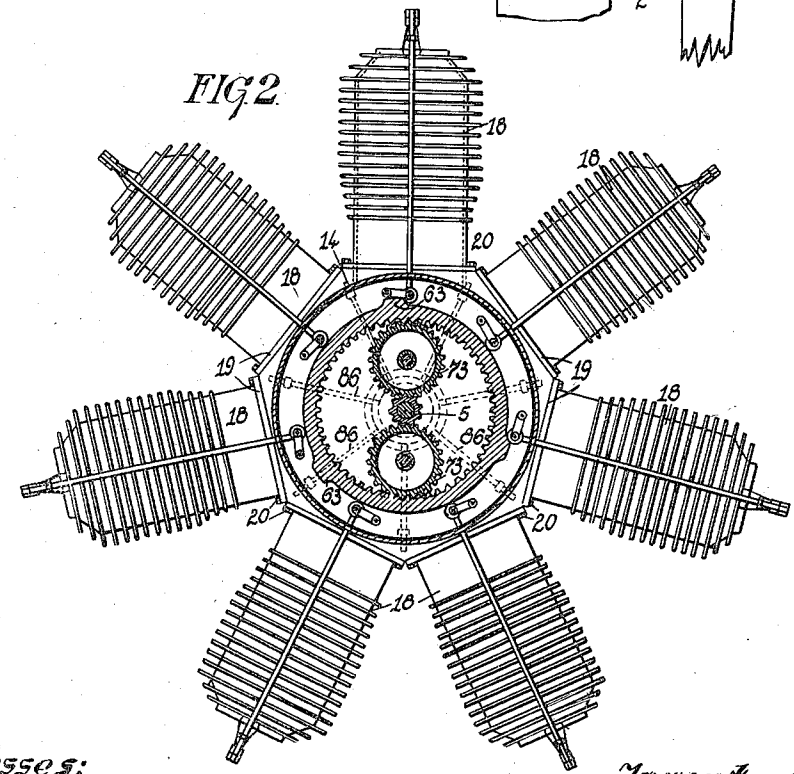


FIG. 2.



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2 SHEETS—SHEET 2.

Fig. 3

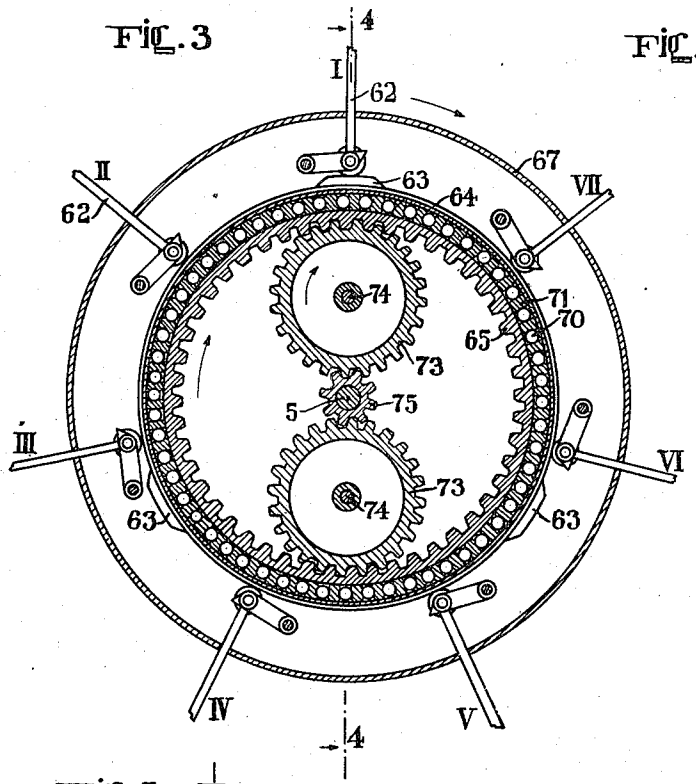


Fig. 4

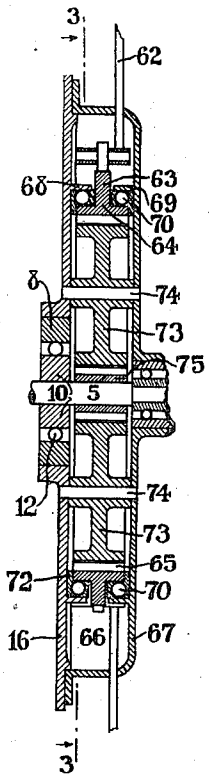


Fig. 5

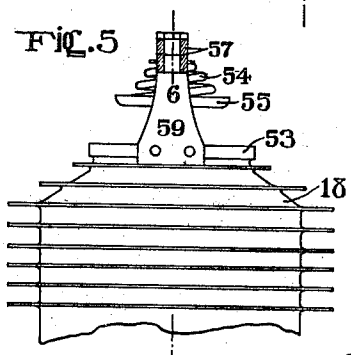


Fig. 6

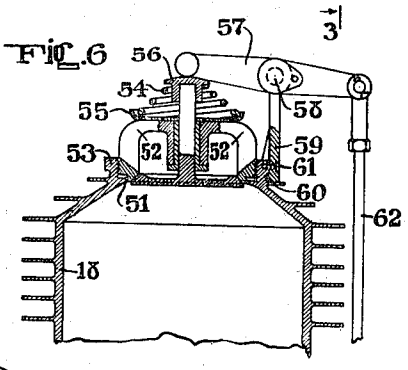
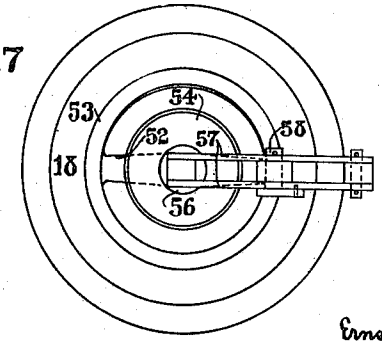


Fig. 7



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UNITED STATES PATENT OFFICE.

ERNST EMIL FREYTAG, OF ZWICKAU, AND AUGUST FRIEDRICH HAYN, OF CHEMNITZ, GERMANY.

COMBUSTION ENGINE OR MOTOR.

1,231,871. Specification of Letters Patent. Patented July 3, 1917.

Application filed December 5, 1914. Serial No. 875,699.

To all whom it may concern:

Be it known that we, ERNST EMIL FREYTAG, of 2 Schlossgrabenweg, in the city of Zwickau, Saxony, German Empire, manufacturer, and AUGUST FRIEDRICH HAYN, of 13 Altchemnitzerstrasse, in the city of Chemnitz, Saxony, German Empire, manufacturer, have invented certain new and useful Improvements in Combustion Engines or Motors; and we declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

This invention relates to engines; it has for its object an improved rotary combustion engine of that type, in which the crank casing and the cylinders fastened to it rotate around a fixed crank shaft, the explosive mixture being drawn through the hollow crank shaft into the interior of the casing and after having passed through valves arranged in the piston, enters the cylinders at each suction stroke.

The main object of our invention is to provide a combustion engine of the type described, in which, regardless of the number of cylinders present, only a single cam disk carrying the lowest possible number of cams is provided, all of these cams being located in one plane so that the engine is particularly slender in axial direction.

In the accompanying drawings we have shown our invention in the form which is now preferred by us.

Figure 1 is a vertical section through a cylinder and the crank casing of an engine according to our invention, only one half of a connecting rod being shown for sake of clearness.

Fig. 2 is a side elevation, partly in section, upon the lines 2, 2 of Fig. 1.

Fig. 3 is a similar but enlarged elevation of the cam disk casing shown in Fig. 2.

Fig. 4 is a section through the cam disk casing upon the lines 4, 4 of Fig. 3.

Figs. 5, 6 and 7 show the upper part of a cylinder,

Fig. 5 being an elevation, partly in section,

Fig. 6 a section upon lines 6, 6, of Fig. 5, and

Fig. 7 a plan view.

The engine represented in the drawings is a seven-cylinder rotary motor; however, our invention is applicable also to engines or motors of any different construction and having any number of cylinders.

Referring to the drawings, 1 is the fixed hollow crank shaft located in the frame 13 and provided at its front end with a carbureter 24 from which the explosive mixture passes into the crank casing through a boring of the crank shaft. 2 and 3 are the crank arms, 4 is the crank pin and 5 is the solid counter-pin on the other side of the crank, opposite the hollow shaft. On the crank shaft there is rotatably mounted the crank casing 6 which runs upon balls 11, 12 inserted between rings 7, 8 fixed to the casing and rings 9, 10 fixed to the crank shaft. The spaces between the crank casing and the crank shaft are tightened in any suitable manner. The casing has the shape of a regular polygon and consists of a polygonal mantle 14 and two side disks 15, 16, these parts being either connected with each other by suitable means or else made in one piece. This arrangement of a mantle having the section of a regular polygon offers the advantages of being easily worked from inside so that it can be made very thin in the middle, while the thickness near the edges is still sufficient to allow of inserting the screws for fastening the cylinders to the mantle.

Each mantle face shows an opening for a cylinder 18 to be inserted therein. In order to prevent the walls of the mantle, which are weakest in the middle, from being bent under the action of the forces resulting from the rotation of the casing and cylinders, the cylinders are provided with flanges 19, and the bolts 20 for fastening the cylinders to the mantle are inserted in the thickest parts of the mantle near the edges. The cylinders are provided with projections 21 extending into the openings of the mantle faces.

The pistons 23 are connected to the crank pins by means of connecting rods 22.

The outlet valves 50 are located in the cylinder heads 53, their seats 51 being screwed into the heads, together with the valve stem guide bushes 52. The valve springs 54 are conical spiral springs resting with their lower ends upon caps 55 located on the guide bushes 52 and protecting the springs against

the hot exhaust gases. For the sake of better protection the caps may be covered with asbestos. The upper end of each spring rests against a collar 56 fastened to the valve stem. Said collar is acted upon by the free end of a double armed valve lever 57 pivoted on pin 58 of arm 59 having substantially the form of a ring segment, a number of such arms being cut out from a ring shaped blank. A projection 60 at the bottom end of arm 59 fits into a corresponding groove in the cylinder head. Arm 59 is fixed to the head by means of a screw 61. The arrangement described above offers the advantage of securing great durability and rigidity together with a considerable reduction of the dimensions and weight of the structure, this being especially important in rotary motors on account of the action of centrifugal forces. The valve working rods 62 connected with the levers 57 are pushed outside by cams 63 and moved back by the springs 54.

Three such cams 63 are equally distributed over the circumference of a cam ring 64 bearing teeth on its inner side. The ring and the mechanism operating it are arranged inside of a chamber 66 formed between one of the side disks 16 of the crank case and the cover 67 fixed to it. Disk 16 and cover 67 are provided with ring shaped projections 68, 69 located opposite each other and serving as ball races for the balls 70 inserted between them and cam ring 64. The cams are allowed to pass between the two ring flanges 68 and 69. The balls are inclosed in casings 71 provided with radial flanges 72 fitting in between the outer edges of cam ring 64 and the side disk 16 and cover 67 respectively. These flanges consisting of metal prevent friction between the ring and the side walls.

The cam ring 64 is rotated by a planet-gear consisting of two toothed wheels 73 rotatably mounted on pins 74 fixed to the side disk 16 and cover 67 respectively, said wheels meshing with the teeth 65 of the cam ring on one side and with a toothed wheel 75 fixed on shaft pin 5 on the other side. Therefore the toothed wheels 73 besides rotating with the crank case around the crank shaft, also rotate around their pins 74 and turn the cam ring 64 relatively to the crank case. In the modification shown in the drawings, that is in a seven cylinder motor, the motor and cam ring rotating in the same direction, the relation of the radii of the gear wheels 75, 73 and 64 is 2:5:12, the cam ring making seven turns while the motor only makes six. The distribution in this case is regulated in such a way that the cylinders are operated alternately in a sense opposed to the direction of rotation, the first, third, fifth, seventh, second, fourth, sixth, first cylinder being operated, and so on. During two turns of the crank casing the cam ring 64 is turned, relatively to the casing, the distance between two cams, so that during the next four stroke cycle each cylinder is operated by the succeeding cam.

The number of cams and the velocity of the cam ring depend upon the number of cylinders; in general the number of cams is one half of the number less one of cylinders. The relation of velocity between the crank case and the cam ring rotating in the same direction should be so regulated that, while the cam ring rotates as many times as there are cylinders, the number of simultaneous rotations of the crank case is one less.

The explosive mixture is sucked into the closed crank case through the fixed crank shaft having arranged at its free end the carbureter 24. The carbureter is of the horizontal type and the explosive mixture can escape in a horizontal direction without changing its direction of flow while passing through the carbureter. This arrangement avoids the drawbacks resulting, especially in fast running motors, from the presence of curved ducts to be passed by the explosive mixture, the ice, formed in consequence of the high expansion of the mixture of air and gas, adhering to the inner walls of these curved ducts at the point where the direction of flow changes, the area of passage being reduced and the suction being unfavorably influenced.

The admixture of gasified liquid fuel to the air is effected by a spray tube of well known construction which may however be replaced by any other device for the regulation of the supplementary air.

The reference numerals incorporated in the claims are used merely for the sake of clearness and are not to be construed as limiting applicants' invention.

We claim:—

1. In a combustion motor, in combination, a fixed crank shaft, a closed crank casing 15 adapted to rotate around said fixed shaft, an uneven number of cylinders 18 radially arranged on said casing, the axes of which are located in the same plane, a cover 67 fastened to the side wall 16 of said crank casing, a cam ring 64 bearing on its inner side teeth 65 and on its outer side cams 63, all said cams being located in the same plane and being in number approximately one half of the number less one of said cylinders, the cam ring 64 being concentric with said crank casing 15, a toothed wheel 75 fixed on said crank shaft, two gear wheels 73 located opposite each other, rotatably mounted on said crank casing 15 and meshing with said toothed wheel 75 and with said teeth 65 of said cam ring 64, the relation of the radii of the wheel fixed on said crank shaft to the two gear wheels rotatably mounted on said crank casing and the cam ring 64 being substantially as 2 to 5 to 12, valve operating

rods 62 adapted to be pushed radially outward by said cams 63 and moved back by springs.

2. In a combustion motor, in combination, a fixed crank shaft, a closed crank casing 15 adapted to rotate around said fixed shaft, an uneven number of cylinders 18 radially arranged on said casing, the axes of which are located in the same plane, a cover 67 fastened to the side wall 16 of said crank casing, ring-shaped flanges 68, 69, located opposite each other on the said wall of the crank casing 15 and on said cover 67 respectively, a cam ring 64 provided with flanges on its sides, and bearing on its inner side teeth 65 and on its outer side cams 63, all said cams being located in the same plane and being in number approximately one half of the number less one of said cylinders, said cams being allowed to pass between said ring-shaped flanges of said casing and said cover, balls 70 between the inner circumference of said ring-shaped flanges 68, 69 and the outer circumference of said flanges of said cam ring 64, the cam ring 64 being concentric with the said crank casing 15, a toothed wheel 75 fixed on said crank shaft, two gear wheels 73 located opposite each other, rotatably mounted on said crank casing 15 and meshing with said toothed wheel 75 and with said teeth 65 of said cam ring 64, the relation of the radii of the wheel fixed on said crank shaft to the two gear wheels rotatably mounted on said crank casing and the cam ring 64 being substantially as 2 to 5 to 12, valve operating rods 62 adapted to be pushed radially outward by said cams 63 and moved back by springs.

3. In a combustion motor, in combination, a fixed crank shaft, a closed crank casing 15 adapted to rotate around said fixed shaft, an uneven number of cylinders 18 radially arranged on said casing, the axes of which are located in the same plane, a cover 67 fastened to the side wall 16 of said crank casing, ring-shaped flanges 68, 69 located opposite each other on the said wall of the crank casing 15 and on said cover 67 respectively, a cam ring 64 provided with flanges on its sides, and bearing on its inner side teeth 65 and on its outer side cams 63, all said cams being located in the same plane and being in number approximately one half of the number less one of said cylinders, said cams being allowed to pass between said ring-shaped flanges of said casing and said cover, balls 70 between the inner circumference of said ring-shaped flanges 68, 69 and the outer circumference of said flanges of said cam ring 64, metal ball casings 71 inclosing the balls 70 and having inwardly projecting radial flanges 72 fitting in between said ring 64 and said side wall 16 and said ring and said cover 67, the cam ring 64 being concentric with the said crank casing 15, a toothed wheel 75 fixed on said crank shaft, two gear wheels 73 located opposite each other, rotatably mounted on said crank casing 15 and meshing with said toothed wheel 75 and with said teeth 65 of said cam ring 64, the relation of the radii of the wheel fixed on said crank shaft to the two gear wheels rotatably mounted on said crank casing and the cam ring 64 being substantially as 2 to 5 to 12, valve operating rods 62 adapted to be pushed radially outward by said cams 63 and moved back by springs.

4. In a combustion motor, in combination, a fixed crank shaft, a closed crank casing 15 adapted to rotate around said fixed shaft, an uneven number of cylinders 18 radially arranged on said casing, the axes of which are located in the same plane, a cover 67 fastened to the side wall 16 of said crank casing, ring-shaped flanges 68, 69 located opposite each other on the said wall of the crank casing 15 and on said cover 67 respectively, a cam ring 64 provided with flanges on its sides, and bearing on its inner side teeth 65 and on its outer side cams 63, all said cams being located in the same plane and being in number approximately one half of the number less one of said cylinders, said cams being allowed to pass between said ring-shaped flanges of said casing and said cover, balls 70 between the inner circumference of said ring-shaped flanges 68, 69 and the outer circumference of said flanges of said cam ring 64, the cam ring 64 being concentric with the said crank casing 15, a toothed wheel 75 fixed on said crank shaft, two gear wheels 73 located opposite each other, rotatably mounted on said crank casing 15 and meshing with said toothed wheel 75 and with said teeth 65 of said cam ring 64, the relation of the radii of the wheel fixed on said crank shaft to the two gear wheels rotatably mounted on said crank casing and the cam ring 64 being substantially as 2 to 5 to 12, valve operating rods 62 adapted to be pushed radially outward by said cams 63 and moved back by springs, outlet valves 50 located in each cylinder head, a valve lever carrier 59 fixed to each cylinder head and having the shape of a ring segment, a projection 60 on each carrier fitting a corresponding groove in each cylinder head, double armed valve levers 57 pivoted on said carriers 59, said levers having one arm pivotally connected with said valve operating rods 62 and the other arm adapted to actuate said outlet valves 50, seats 51 for said outlet valves disposed in said cylinder heads, and provided with bows 52, projecting outwardly, and containing the bushes for the stems of the outlet valves.

5. In a combustion motor, in combination, a fixed crank shaft, a closed crank casing 15

adapted to rotate around said fixed shaft, an uneven number of cylinders 18 radially arranged on said casing, the axes of which are located in the same plane, a cover 67 fastened to the side wall 16 of said crank casing, ring-shaped flanges 68, 69, located opposite each other on the said wall of the crank casing 15 and on said cover 67 respectively, a cam ring 64 provided with flanges on its sides, and bearing on its inner side teeth 65 and on its outer side cams 63, said cams being all located in the same plane and being in number approximately one half of the number less one of said cylinders, said cams being allowed to pass between said ring-shaped flanges of said casing and said cover, balls 70 between the inner circumference of said ring-shaped flanges 68, 69 and the outer circumference of said flanges of said cam ring 64, the cam ring 64 being concentric with the said crank casing 15, a toothed wheel 75 fixed on said crank shaft, two gear wheels 73 located opposite each other, rotatably mounted on said crank casing 15 and meshing with said toothed wheel 75 and with said teeth 65 of said cam ring 64, the relation of the radii of the wheel fixed on said crank shaft to the two gear wheels rotatably mounted on said crank casing and the cam ring 64 being substantially as 2 to 5 to 12, valve operating rods 62 adapted to be pushed radially outward by said cams 63 and moved back by springs, outlet valves 50 located in each cylinder head, a valve lever carrier 59 fixed to each cylinder head and having the shape of a ring segment, a projection 60 on each carrier fitting a corresponding groove in each cylinder head, double armed valve levers 57 pivoted on said carriers 59, said levers having one arm pivotally connected with said valve operating rods 62 and the other arm adapted to actuate said outlet valves 50, seats 51 for said outlet valves disposed in said cylinder heads, and provided with bows 52, projecting outwardly, and containing the bushes for the stems of the outlet valves, caps 55 approximately of the size of said outlet valves on said bows 52, conical spiral springs 54 around the valve stems and resting their lower ends upon caps 55 and their upper ends against the valve stem collars 56.

6. In a combustion motor, in combination, a fixed crank shaft, a closed crank casing 15 adapted to rotate around said fixed shaft, an uneven number of cylinders 18 radially arranged on said casing, the axes of which are located in the same plane, a cover 67 fastened to the side wall 16 of said crank casing, ring-shaped flanges 68, 69 located opposite each other on the said wall of the crank casing 15 and on said cover 67 respectively, a cam ring 64 provided with flanges on its sides, and bearing on its inner side teeth 65 and on its outer side cams 63, all said cams being located in the same plane and being in number approximately one half of the number less one of said cylinders, said cams being allowed to pass between said ring-shaped flanges of said casing and said cover, balls 70 between the inner circumference of said ring-shaped flanges 68, 69 and the outer circumference of said flanges of said cam ring 64, the cam ring 64 being concentric with the said crank casing 15, a toothed wheel 75 fixed on said crank shaft, two gear wheels 73 located opposite each other, rotatably mounted on said crank casing 15 and meshing with said toothed wheel 75 and with said teeth 65 of said cam ring 64, the relation of the radii of the wheel fixed on said crank shaft to the two gear wheels rotatably mounted on said crank casing and the cam ring 64, being substantially as 2 to 5 to 12, valve operating rods 62 adapted to be pushed radially outward by said cams 63 and moved back by springs, outlet valves 50 located in each cylinder head, a valve lever carrier 59 fixed to each cylinder head and having the shape of a ring segment, a projection 60 on each carrier fitting a corresponding groove in each cylinder head, double armed valve levers 57 pivoted on said carriers 59, said levers having one arm pivotally connected with said valve operating rods 62 and the other arm adapted to actuate said outlet valves 50, seats 51 for said outlet valves disposed in said cylinder heads and provided with bows 52, projecting outwardly, and containing the bushes for the stems of the outlet valves, caps 55 approximately of the size of said outlet valves on said bows 52, conical spiral springs 54 around the valve stems and resting their lower ends upon caps 55, covered with asbestos to protect the springs against the hot exhaust-gases, and their upper ends against the valve stem collars 56.

In testimony whereof we affix our signatures in presence of two witnesses.

ERNST EMIL FREYTAG.
AUGUST FRIEDRICH HAYN.

Witnesses:
F. E. Steger,
W. H. Mücke.