

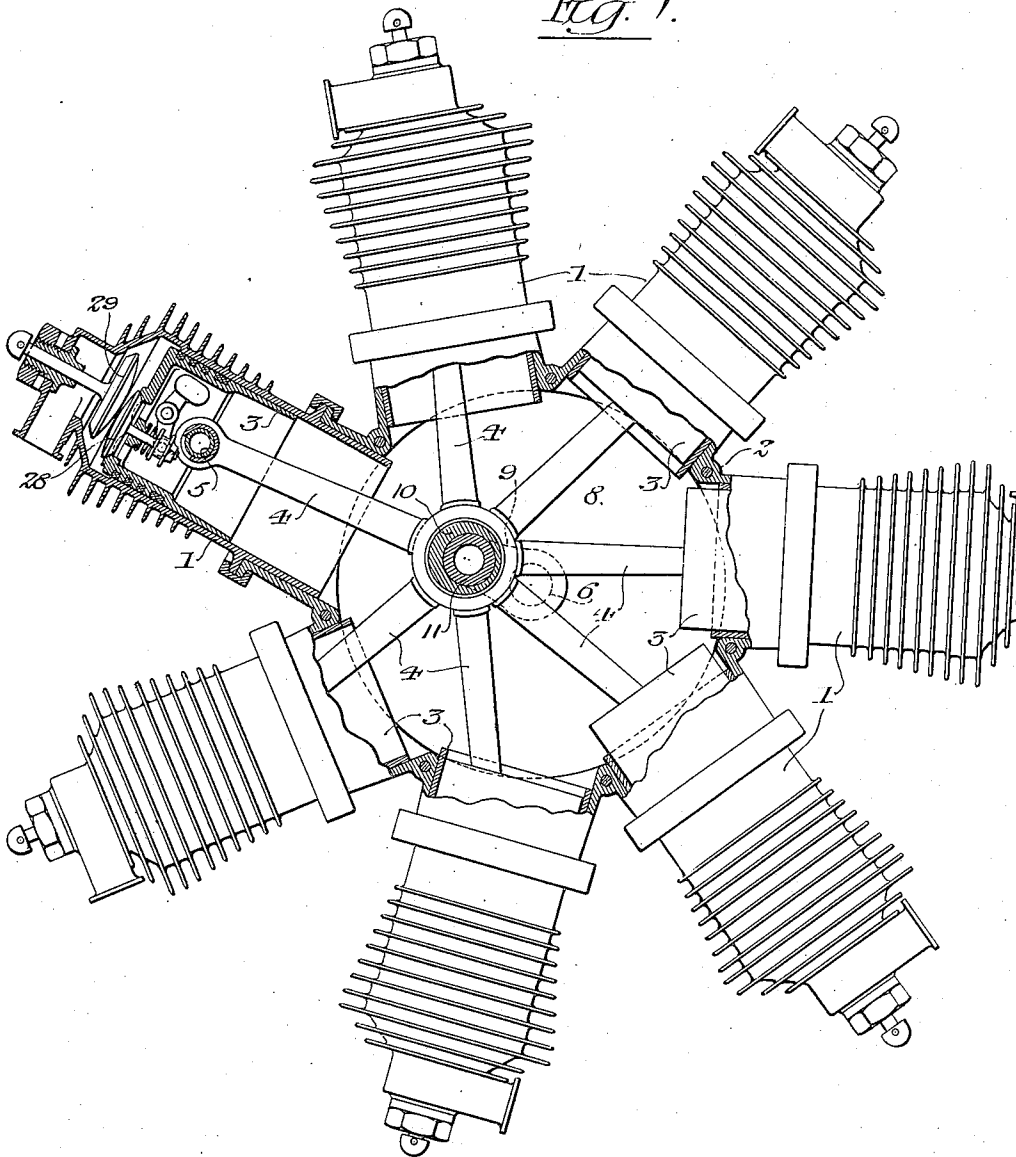
A. E. WINCKLER.
EXPLOSIVE ENGINE.
APPLICATION FILED JAN. 7, 1911.

1,174,459.

Patented Mar. 7, 1916.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

Wm. H. Whitehead
Eleanor Haginow.

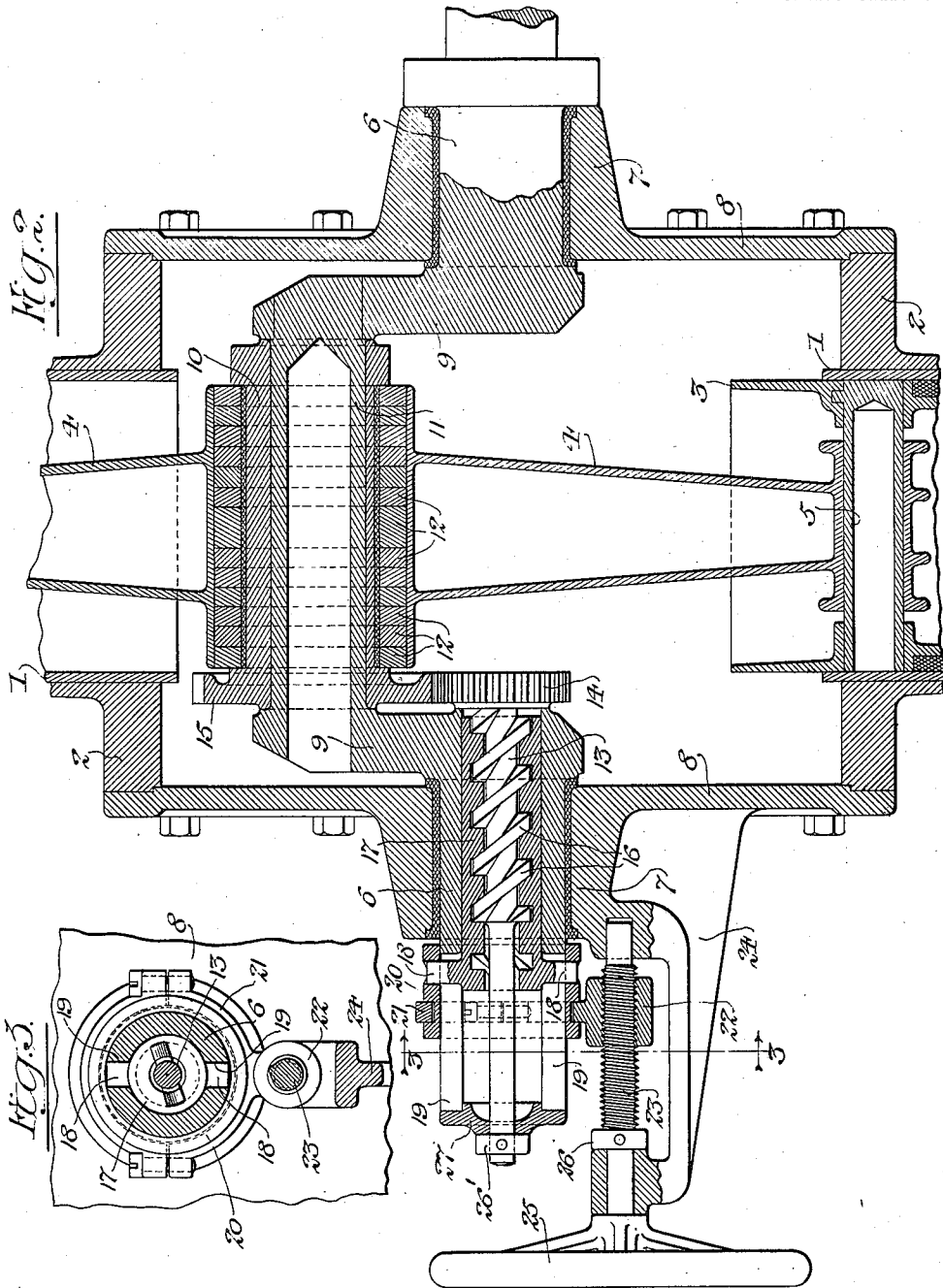
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UNITED STATES PATENT OFFICE.

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EXPLOSIVE-ENGINE.

1,174,459.

Specification of Letters Patent.

Patented Mar. 7, 1916.

Application filed January 7, 1911. Serial No. 601,425.

To all whom it may concern:

Be it known that I, AAGE E. WINCKLER, a subject of the King of Denmark, and a resident of Racine, county of Racine, and State of Wisconsin, have invented certain new and useful Improvements in Explosive-Engines, of which the following is a description.

The invention relates to internal combustion or explosive engines and more particularly to explosive engines or motors designed for aeronautic purposes.

The amount of compression of the explosive mixture effected in the motors of airships and aeroplanes is considerably decreased at high altitudes because of the decrease in the density of the air, so that there is a corresponding loss of power.

The present invention seeks to provide simple and effective means which may be readily operated while the motor is running to vary the effective length of the crank of the engine and thereby adjust the stroke of the engine pistons. By this means the compression can be uniformly maintained in spite of variations in the density of the air at different altitudes.

The invention consists in the features hereinafter set forth, illustrated in the preferred form in the accompanying drawings and more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a view in elevation of an aeronautic motor to which the present improvement is applied, with one of the cylinders and the crank casing shown in section. Fig. 2 is a detail section through the engine crank shaft and crank. Fig. 3 is a detail view with parts shown in section on the line 3—3 of Fig. 2.

While the present improvement is applicable to other types of explosive engines, it is more particularly applicable to the type of aeronaut motor illustrated and which comprises a circular series of cylinders 1 arranged in a common plane. The cylinders are mounted in substantial radial position upon a crank case 2. The pistons 3 in the cylinders are provided with connecting rods 4 coupled thereto by wrist pins 5 and all arranged to engage a common crank on the engine crank shaft 6. The crank shaft is journaled in suitable bearings 7 formed upon the ends or heads 8 of the crank casing. Within the crank casing the shaft 6

is provided with two crank arms 9 and the connecting rods 5 all engage a common eccentric bearing member which is rotatably mounted upon the crank arms.

Preferably, the common bearing member is in the form of a sleeve 10 eccentrically and rotatably mounted upon a crank pin 11 that extends between the ends of the arms 9. In the form shown, a series of rings 12 are mounted upon the eccentric sleeve 10 and the several connecting rods 5 are suitably secured to the different rings. By rotating the eccentric sleeve 10, the effective length of the crank and the stroke of the pistons 3 can be adjusted, as desired, to vary the compression space between the pistons and the heads of the cylinders and thereby vary the compression if the air is of uniform density, or maintain the compression uniform when the air density varies.

A suitable adjusting member having its axis of rotation concentric with that of the engine crank shaft extends within the crank casing and is connected or geared to the sleeve 10 to rotatably adjust the same. This adjusting member is preferably in the form of a shaft 13 extending axially through one end of the crank shaft 6 and having a spur pinion 14 on its inner end which meshes with the teeth of a spur gear 15 upon the adjacent end of the eccentric sleeve 10. Means are provided for rotating the shaft 13 relatively to the engine crank shaft 6, but which normally holds the shaft 13 in fixed relation to the crank shaft. The eccentric sleeve 10 is thus normally maintained in fixed relation to the crank pin 11, but by rotating the shaft 13 relatively to the crank shaft, the sleeve 10 may be rotatably adjusted relatively to the crank pin to thereby vary the length of the stroke of the piston. In this way, the compression may be varied or, with an aeronautic motor, the compression may be maintained uniform in spite of any variation in the density of the air at different altitudes.

With this form of engine, the crank shaft can be fixed and the engine cylinder and pistons revolved about the same or the frame and cylinders may be fixed and the crank shaft revolved. In the first instance, suitable means will be provided for rotating the adjusting shaft 13 and for holding it in position. The means for rotating the shaft 13 illustrated are more particularly

designed for cases in which the cylinders and frame are stationary. As shown, the shaft 13 is a screw shaft and is provided with double threads 16 of sharp pitch which
 5 engage the corresponding threads of a sleeve nut 17 which fits within the bore of one end of the engine crank shaft 6. The outer end of the sleeve nut 17 is provided with radially projecting studs 18 which extend laterally through longitudinal slots 19 formed
 10 in the outer end of the engine crank shaft. By this arrangement the nut is connected to the crank shaft to rotate therewith, but may be moved longitudinally or in axial direction to effect the relative rotation of the adjusting screw shaft 13.

The ends of the studs 18 engage openings in a sleeve 20 slidably mounted upon the end of the crank shaft. A split collar 21 engages an annular groove in the sleeve 20 and suitable means are provided for shifting this collar. In the form shown, the collar is provided on one side with a nut 22 which is engaged by a screw 23. This screw
 20 is journaled at its ends in a bracket 24 formed upon one of the heads 8 of the crank casing. A hand wheel 25 and a collar 26 are fixed to the outer end of the screw 23 on opposite sides of its outer bearing to
 30 hold the screw against longitudinal movement. By rotating the screw 23 by means of the hand wheel 25 the sleeve nut 17 is shifted longitudinally and the adjusting screw shaft 13 is rotated to thereby rotatably adjust the eccentric sleeve 10 through
 35 the medium of the intermeshing gears 14 and 15. The gearing greatly reduces the motion imparted to the eccentric sleeve 10 from the hand wheel 25, so that the eccentric may be readily adjusted with great nicety.
 40 If the crank shaft is stationary and the casing and cylinders arranged to revolve, the means for shifting the sleeve nut 17 should of course be mounted upon some stationary part, instead of upon the crank casing. The outer end of the adjusting screw shaft 13 extends through a cap 27 that fits on the end of the crank shaft 6 and is provided with a collar 28' which
 50 engages the outer face of the cap. The hub of the gear 14 at the inner end of the shaft abuts against the hub of the adjacent crank arm 9 and the screw shaft is thus held against longitudinal movement, but is free
 55 to be rotated by the longitudinal shift of the sleeve nut 17.

As stated, the pins 18 on the inner end of the sleeve nut 17 extend through slots 19 in the outer end of the crank shaft 6 and through openings in the sleeve 20 to thereby connect the nut to the crank shaft and to the sleeve. The nut is thereby held in fixed relation to the crank shaft 6, and inasmuch as the nut is normally held against
 65 longitudinal movement by the sleeve 20,

the adjusting screw shaft 13, which is held against longitudinal movement, is also normally maintained in fixed relation to the crank shaft, that is to say, in cases where the cylinders and frame are stationary, the
 70 adjusting shaft 13 is normally maintained in fixed relation to the crank shaft 6 and rotates therewith and the intermeshing gears 14 and 15 on the shaft 13 and eccentric sleeve 10 also rotate about the axis of the
 75 crank shaft and the eccentric sleeve 10 is thereby normally maintained in fixed relation to the crank pin and does not rotate thereon. When the shaft 13 is rotatably adjusted relatively to the crank shaft, the
 80 eccentric sleeve 10 is correspondingly adjusted relatively to the crank pin 10, but it is then maintained in its relative adjusted position. The present construction is exceedingly well adapted for varying the length
 85 of stroke and the compression of the circular series of cylinders connected to a common crank pin.

In the particular form of motor shown, the circular series of cylinders 1 are not arranged exactly in radial position. The crank shaft is slightly offset and the axes of the cylinders are tangent to a small circle struck about the axis of the crank shaft. The explosive mixture is drawn into these cylinders
 90 through the crank casing and each piston is provided with a spring-held inlet valve 28 and each opens automatically upon the suction stroke of the corresponding piston. The head of each cylinder is provided with
 95 a suitable exhaust valve 29 which is operated in any suitable manner. The arrangement of the valves is such that the adjustment of the piston within the cylinders does not affect their operation.

It is obvious that changes may be made in the details set forth without departure from the essentials of the invention as defined in the claims.

I claim as my invention:—

1. In an explosion engine, the combination with the engine cylinder, piston, crank shaft and crank, of an eccentric rotatably mounted on said crank, a connecting rod coupled to said piston and engaging said eccentric, a rotatable adjusting member concentric with said crank shaft and connected to said eccentric, and means for normally maintaining said adjusting member in fixed relation to said crank shaft, substantially as described.

2. In an explosive engine, the combination with the engine cylinder, piston, crank shaft and crank, of an eccentric rotatably mounted on said crank, a connecting rod coupled to said piston and engaging said eccentric, an adjusting shaft extending axially through said crank shaft, gearing connecting the inner end of said adjusting shaft and said eccentric, and means for rotating said adjusting shaft relatively to said crank shaft and

arranged to maintain the latter normally in fixed relation to said crank shaft, substantially as described.

3. In an explosive engine, the combination
5 with the engine cylinder, piston and crank casing, of a crank shaft journaled in said casing and having crank arms therein, an eccentric rotatably mounted between said crank arms, a connecting rod coupled to said
10 piston and engaging said eccentric, an adjusting screw shaft extending axially through one end of said crank shaft, gears connecting said screw shaft and said eccentric, a nut engaging said screw shaft and connected to
15 said crank shaft and means for shifting said nut in axial direction.

4. In an explosive engine, the combination with the engine cylinder, piston, crank shaft and crank, an eccentric rotatably mounted
20 upon said crank, a connecting rod coupled to said piston and engaging said eccentric, an adjusting screw shaft extending axially through one end of said crank shaft and held against relative longitudinal movement, said
25 screw shaft being rotatable relatively to said crank shaft, gears connecting said screw shaft and said eccentric, a nut engaging said screw shaft and connected to rotate with said crank shaft, said nut being shiftable in
30 axial direction on said crank shaft, and means for axially shifting said nut, substantially as described.

5. In an explosive engine, the combination with an engine cylinder, a piston and a
35 crank shaft having crank arms and a crank pin, of an eccentric sleeve rotatably mounted on said crank pin, a connecting rod coupled to said piston engaging said sleeve, a rotatable adjusting shaft extending axially through
40 said crank shaft, and geared to said sleeve

to rotatably adjust the same relatively to said crank pin, and means for normally maintaining said adjusting shaft in fixed relation to said crank shaft, substantially as described.

6. In an explosive engine, the combination
45 with the engine frame, of a plurality of cylinders mounted in a circular series on said frame, pistons in said cylinders, a crank shaft journaled in said frame and having a
50 common crank for said pistons, connecting rods coupled to said pistons, a common bearing member engaging said connecting rods and adjustably mounted on said crank, a rotatable adjusting member concentric with
55 said crank shaft and operatively connected to said bearing member, and means for normally maintaining said adjusting member in fixed relation to said crank shaft, substantially as described.

7. In an explosive engine, the combination with a circular series of cylinders, pistons in said cylinders and connecting rods coupled to said pistons, of a crank shaft having
60 a common crank for said pistons, said crank comprising a pair of arms and an eccentric rotatably mounted upon said arms and engaging said connecting rods, a rotatable adjusting member concentric with said crank
65 shaft and geared to said eccentric and means for rotating said adjusting member relatively to said crank shaft and arranged to normally maintain the same in fixed relation to said crank shaft, substantially as described.

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Witnesses:

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