

Aug. 19, 1930.

A. MOSES

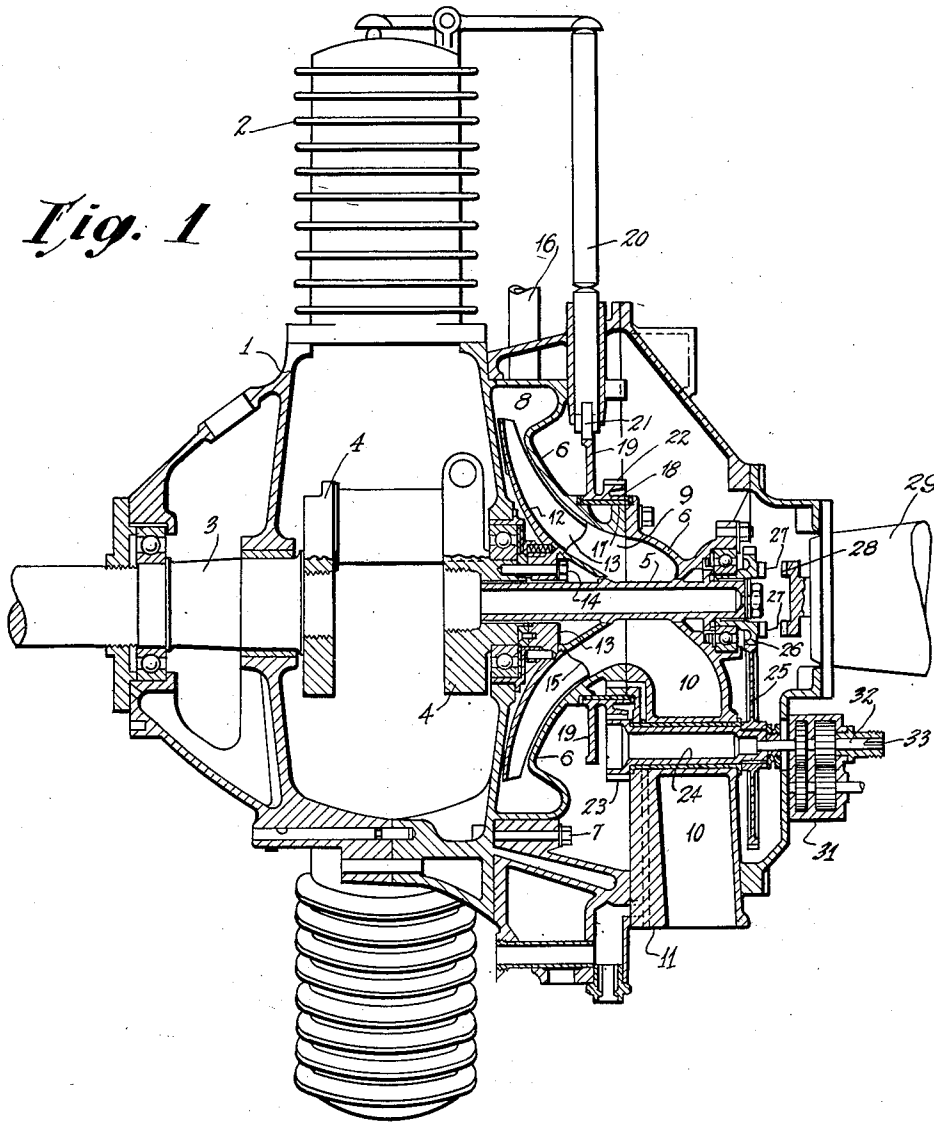
1,773,196

INTERNAL COMBUSTION ENGINE

Filed Aug. 6, 1929

2 Sheets-Sheet 1

Fig. 1



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Fig. 2

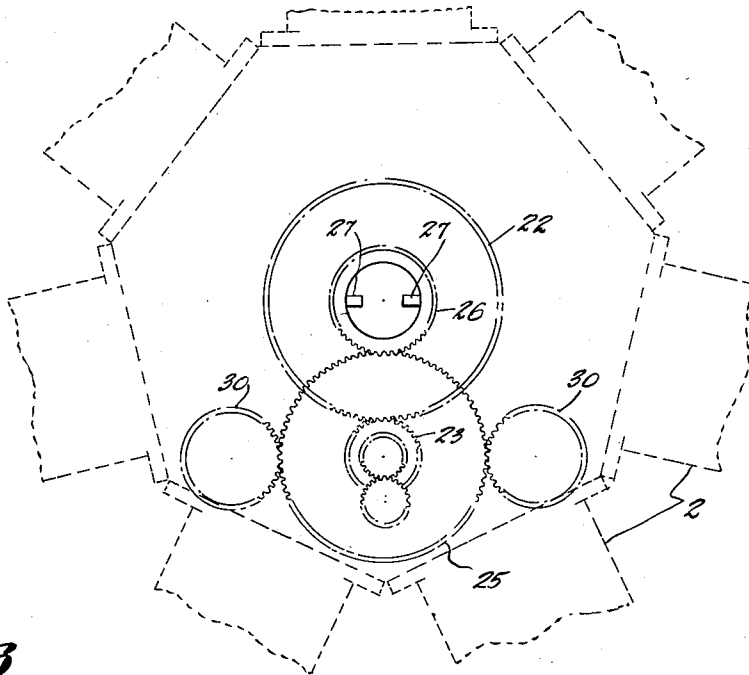
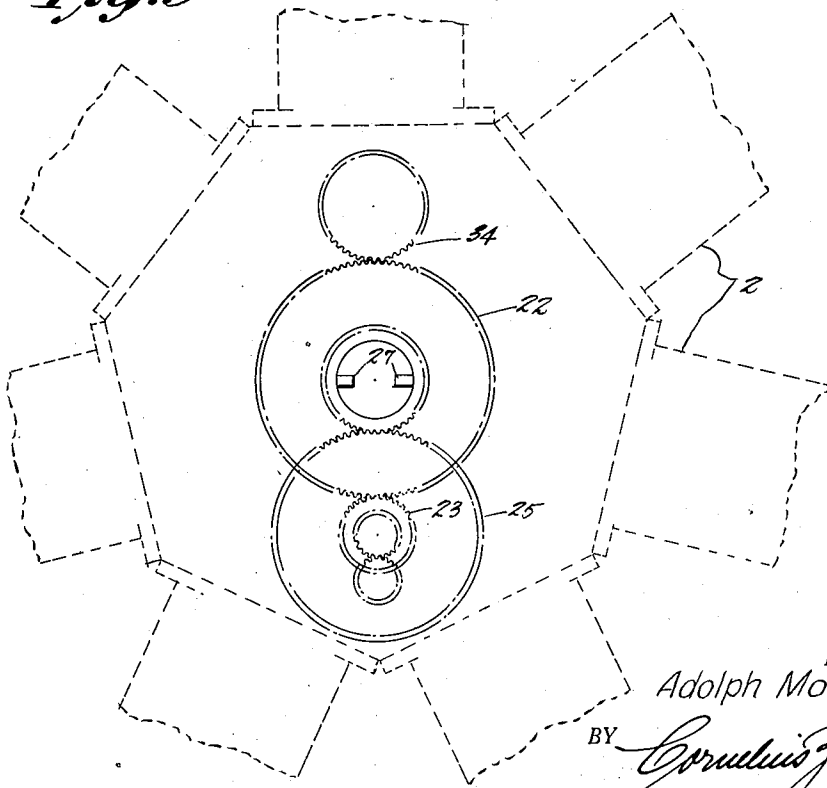


Fig. 3



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UNITED STATES PATENT OFFICE

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INTERNAL-COMBUSTION ENGINE

Application filed August 6, 1929. Serial No. 383,950.

This invention relates to engines, and more particularly to internal combustion engines of the radial type especially adapted for use in aviation. The primary object of the invention is to provide a motor of unusual compactness and lightness, and one which may be economically manufactured and will be efficient in operation. An important feature of the present invention lies in the simplification of the mechanism wherein the valve operating mechanism is so placed as to embody a minimum number of gears while the induction system is so positioned as to take advantage of the heat of the engine to assist in at least partial vaporization of the motive fuel prior to its entrance into the cylinders.

It is not uncommon in aviation engines of the type under consideration to position the valve operating mechanism between the induction system and the crank case of the engine, both of such apparatus being positioned in the rear of the crank case. This arrangement produces a somewhat longer engine in axial direction than is desirable and removes the induction system from the direct influence of the heat from the engine so that efficiency in effecting of vaporization is lost. In some cases, attempt has been made to bring the induction system closer to the crank case in order to utilize the heat of the engine for the purposes stated, and when such arrangement has been made, the valve operating mechanism has been positioned forwardly of the crank case. This is manifestly undesirable for many reasons.

With the foregoing considerations in mind, the engine of this invention is so constituted that the induction system is directly back of the crank case, while the valve operating mechanism is arranged co-axially to the crank shaft in a manner to substantially surround the intake manifold. In the preferred form of the invention, the intake manifold extends rearwardly from the crank case and tappet cam or cams are mounted directly upon the manifold in a manner to embrace the same. Associated with the tappet cam is an annular gear which is driven by a pinion mounted on the counter-shaft. This counter shaft may be conveniently sup-

ported on the manifold of the induction system and said counter-shaft carries a gear which is in mesh with another gear carried on the crank shaft.

With this arrangement, the parts are symmetrically disposed about a vertical plane passed through the axis of the crank shaft so as to give proper balance to the motor and it is further possible with such arrangement to drive the cam ring from the crank shaft with the use of but four gears. The arrangement is, further, such as to permit of convenient connection of starter mechanism, timing mechanism (either single or double timing), a tachometer drive, and other accessories by direct coupling at the rear end of the engine and through a utilization of a minimum number of gears.

The structure is unusually simple, is thoroughly efficient and is compact and well balanced.

Features of the invention other than those specified will be apparent from the hereinafter detailed description and from the appended claims, when read in conjunction with the accompanying drawings.

In the accompanying drawings, I have illustrated one practical embodiment of the invention but the construction therein shown is to be understood as illustrative only and not as defining the limits of the invention.

Figure 1 shows a radial engine in central, vertical section, and

Figures 2 and 3 show rear views of the engine with driving connections for various adjuncts.

Referring to the drawings, the engine of this invention embodies a suitable crank case 1, with associated cylinders 2 and a main crank shaft 3, the cheeks of the crank being indicated at 4. The crank shaft may be of any suitable construction and may be built of one or more pieces as may be desired, but as shown for the purpose of illustration, is of the built-up or sectional type. It extends forwardly from the forward cheek 4 through suitable bearings to a sufficient extent to support the propeller (not shown) and it also extends rearwardly from the rear cheek 4 through suitable bearings to a point well back

of the rear wall of the crank case. The details of the bearings for supporting the crank shaft may vary within wide limits without departing from this invention.

5 For the purpose of graphic description it may be noted, however, that the rear extension of the crank shaft is designated 5. It is this portion which extends rearwardly of the crank case. The intake manifold is designated 6. It is bolted directly to the back of the crank case by means of bolts indicated at 7. Directly adjacent the crank case it is in a form to provide an annular chamber 8 from which a bell shaped passage 9 leads to the main manifold passage 10. This latter passage extending downwardly to the base of the motor with the walls of such passage faced as indicated at 11 so that the carburetor may be attached directly to this faced surface to supply carbureted fuel to the manifold. The forward wall of the bell shaped passage 9 is formed by a substantially conical plate 12 provided with an axial hub 13 which is secured to the hub of the rear cheek 4 by means of screws or bolts 14 and on the plate 12 are formed fins or vanes 15. The hub 13 thus rotates with the crank shaft and carries with it the conical plate 12, and vanes 15 and these parts collectively function as a centrifugal fan to break up the combustible products and assist in efficient carburetion thereof.

The centrifugal force of the fan aside from assisting in carburetion serves to supply carbureted fuel to the annular chamber 8 and under more or less pressure so that it is efficiently fed to the induction pipes 16 of the several cylinders 2.

Embracing the manifold 6 is a bearing sleeve 17 on which a ring 18 finds a bearing. This ring 18 constitutes the cam ring and supports one or more cams 19 for actuating the tappets 20. Each of these tappets is shown as provided with a follower 21 adapted to ride on the cam 19. The drawing shows the arrangement wherein both the inlet and exhaust tappets co-act with the same ring 19 but it is within the purview of this invention to mount on the ring 18 two cams, one for the inlet and the other for the exhaust valves. The cam ring 18 is mounted to freely rotate on the sleeve 17 and for this purpose is provided with an annular gear 22. This gear is driven by a pinion 23 which meshes with the gear 22 and is mounted upon a counter-shaft 24. With the engine constructed as stated, it is entirely feasible and highly economical and efficient to form the intake manifold with a bearing for the counter-shaft 24 so that the manifold provides a support for the counter-shaft. In other words, practically all the valve operating mechanism is supported on the inlet manifold.

The out-board or rear end of the counter-shaft 24 carries a gear 25 which meshes with a gear 26 carried by and fixed with respect

to the rearward extension 5 of the crank shaft so that as the crank shaft is rotated it drives the gear 26 and this imparts rotation to the cam ring 18 through the gear 25, shaft 24, pinion 23, and gear 22.

The rear face of the gear 26 is preferably provided with dogs 27 with which dogs 28 of appropriate starting mechanism 29 are adapted to co-act to start the motor. If dual ignition is desired magnetos for this purpose may be driven directly from the gear 25 by gears 30 meshing therewith and secured to the armature shafts of the respective magnetos. If only one magneto is desired one of these gears may be omitted. The dual arrangement is shown in Figure 2. An oil pump 31, embodying pressure and scavenger sections is driven from the rear end of the counter-shaft 24 and rear end of the main shaft 32 of the oil pump is shaped as shown at 33 to receive the drive shaft of a tachometer. If battery ignition is used the distributor may be driven by a gear 34 meshing with the gear 22. It will thus be noted that the driving connections are compactly arranged in convenient position for repair and maintenance at the rear end of the motor.

It will also be apparent that the manifold provides a bearing for the rear end of the extension 5 and effectively supports the gear 26 for proper driving relation with respect to the gear 25.

I wish to call particular attention to the compact form of the engine which I have described and to the unusual accessibility of all these parts which it may be desirable to inspect from time to time. The various parts are made sectional for convenient repair and to assist in dismantling or assembly and the whole arrangement is designed to facilitate the work of the mechanic in maintenance and repair. From an operating standpoint, the manifold is positioned directly adjacent the crank case and directly back of the cylinders so as to receive heat from the engine in sufficient quantities to materially affect the induction of combustible fuel.

This heat will facilitate the proper carburetion and aid in vaporization in order that the fuel may be delivered to the cylinders in condition to give the best results in the development of maximum power at all speeds. On the other hand, the valve operating mechanism is positioned further away from the source of heat so as to facilitate lubrication and efficient gear operation without the zone of greatest temperature.

It will of course be understood that provisions are made for lubricating of moving parts but I have not considered it necessary to show or describe the complete lubricating system.

The accompanying drawings show the invention in its preferred practical form but

the invention is to be understood as fully commensurate with the appended claims.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

- 5 1. A radial motor embodying a crank case, an axially disposed crank shaft extending through the crank case and rearwardly thereof, an induction manifold directly back of the crank case and secured thereto, and a tappet cam embracing the manifold and supported to rotate thereon. 70
- 10 2. A radial motor embodying a crank case, an axially disposed crank shaft extending through the crank case and rearwardly thereof, an induction manifold directly back of the crank case and secured thereto, and a tappet cam embracing the manifold and supported to rotate thereon, a gear rigid with and co-axial with the tappet cam and rotatable therewith, a counter-shaft, mounted on and supported by the manifold for rotation on the axis parallel with the axis of the crank shaft, a pinion carried by the counter-shaft and meshing with said gear, and gearing connections between the crank shaft and counter-shaft. 80
- 15 3. A radial motor embodying a crank case, an axially disposed crank shaft extending through the crank case and rearwardly thereof, an induction manifold directly back of the crank case and secured thereto, a bearing formed on the manifold co-axial with the crank shaft, a cam ring supported on said bearing for rotation and embodying a tappet cam and a toothed gear, and gearing connections between the crank shaft and said toothed gear for driving the latter from the former. 85
- 20 4. A radial motor embodying a crank case, a crank shaft extending axially through the crank case and rearwardly thereof, an induction manifold mounted on the rear of the crank case said induction manifold extending in a rearward direction and thence downwardly in a substantially vertical direction for attachment with a suitable carburetor, a bearing formed in the depending portion of the manifold, a counter-shaft supported for rotation in said bearing, gearing connections between the crank shaft and the rear end of the counter shaft, a pinion carried by the forward end of the counter-shaft, a gear embracing the rearwardly extending portion of the manifold and mounted to rotate thereon, and a tappet cam embracing the manifold forwardly of the said gear and secured to said gear to be driven thereby. 90
- 25 5. A radial motor embodying a crank case, a crank shaft extending through said crank case and rearwardly thereof, an induction manifold positioned back of the crank case and through which the rearward extension of the crank shaft passes, a tappet cam embracing the manifold and mounted to rotate co-axially of the crank shaft, a gear also embracing the manifold rearwardly of the tappet cam and rigid with respect to said cam, and gearing connections between the said gear and the crank shaft, all of said gearing connections being rearwardly of the tappet cam. 95
- 30 6. A radial motor embodying a crank case, an axially disposed crank shaft extending through the crank case and rearwardly thereof, an induction manifold directly back of the crank case and secured thereto and through which motive fuel is fed, and a tappet cam embracing and secured to a portion of the manifold through which the fuel is fed. 100
- 35 7. A radial motor embodying a crank case, an axially disposed crank shaft extending through the crank case and rearwardly thereof, an induction manifold directly back of the crank case and secured thereto, a tappet cam embracing the manifold and supported to rotate thereon, a gear rigid with and co-axial of the tappet cam, a counter-shaft parallel with the crank shaft, a gear carried by the forward end of the counter-shaft and meshing with the gear rigid with the tappet cam, a gear secured to the rear end of the crank shaft, and a gear on the rear end of the counter-shaft meshing with said gear of the crank shaft, in combination with a starting mechanism operatively connected with the rear end of the crank shaft, an oil pump operatively connected to the rear end of the counter shaft, magneto drive gears meshing with the gear at the rear end of the counter shaft, and a connection on the oil pump for driving a tachometer. 105
- 40 8. A radial motor embodying a crank case, an axially disposed crank shaft extending through the crank case and rearwardly thereof, an induction manifold directly back of the crank case and secured thereto, a tappet cam embracing the manifold and supported to rotate thereon, a gear rigid with and co-axial of the tappet cam, a counter-shaft parallel with the crank shaft, a gear carried by the forward end of the counter-shaft and meshing with the gear rigid with the tappet cam, a gear secured to the rear end of the crank shaft, and a gear on the rear end of the counter-shaft meshing with said gear of the crank shaft, in combination with a starting mechanism operatively connected with the rear end of the crank shaft, an oil pump operatively connected to the rear end of the counter-shaft, and a gear of the ignition system meshing with and driven by one of said gears. 110
- 45 9. In testimony whereof I have signed the foregoing specification. 115

ADOLPH MOSES.