

March 1, 1932.

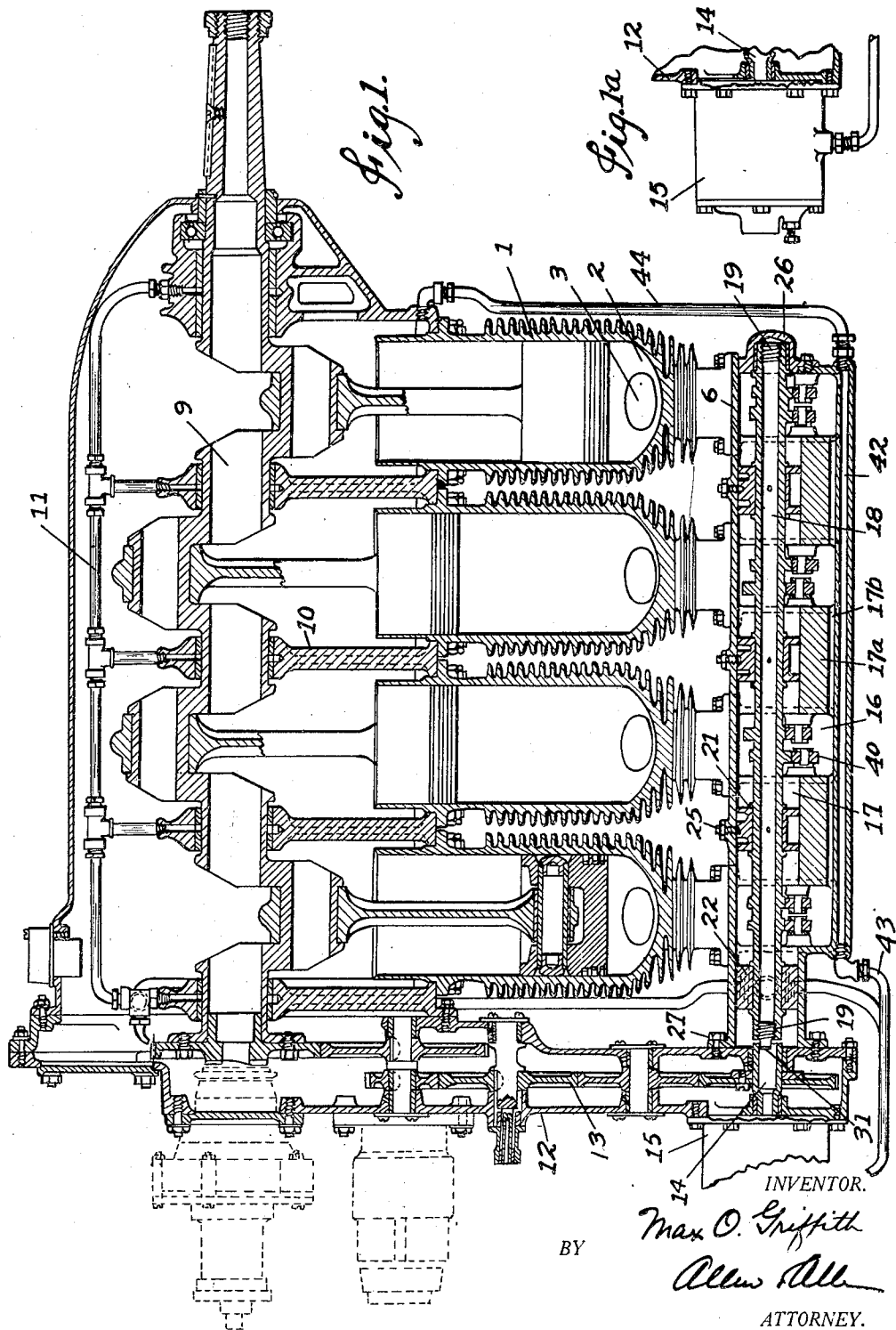
M. O. GRIFFITH

1,848,008

AIRPLANE ENGINE

Filed Sept. 28, 1929

4 Sheets-Sheet 1



March 1, 1932.

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AIRPLANE ENGINE

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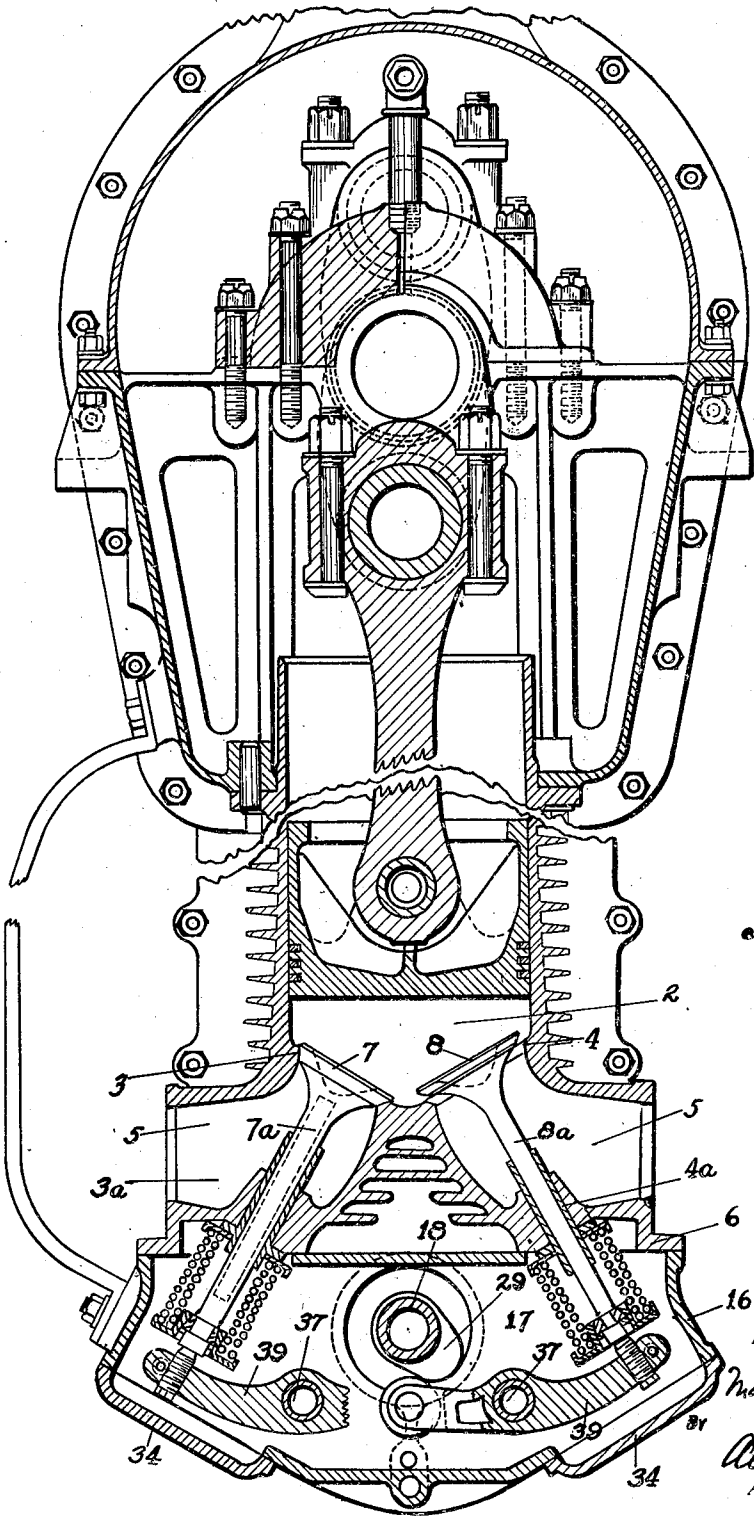


Fig. 2.

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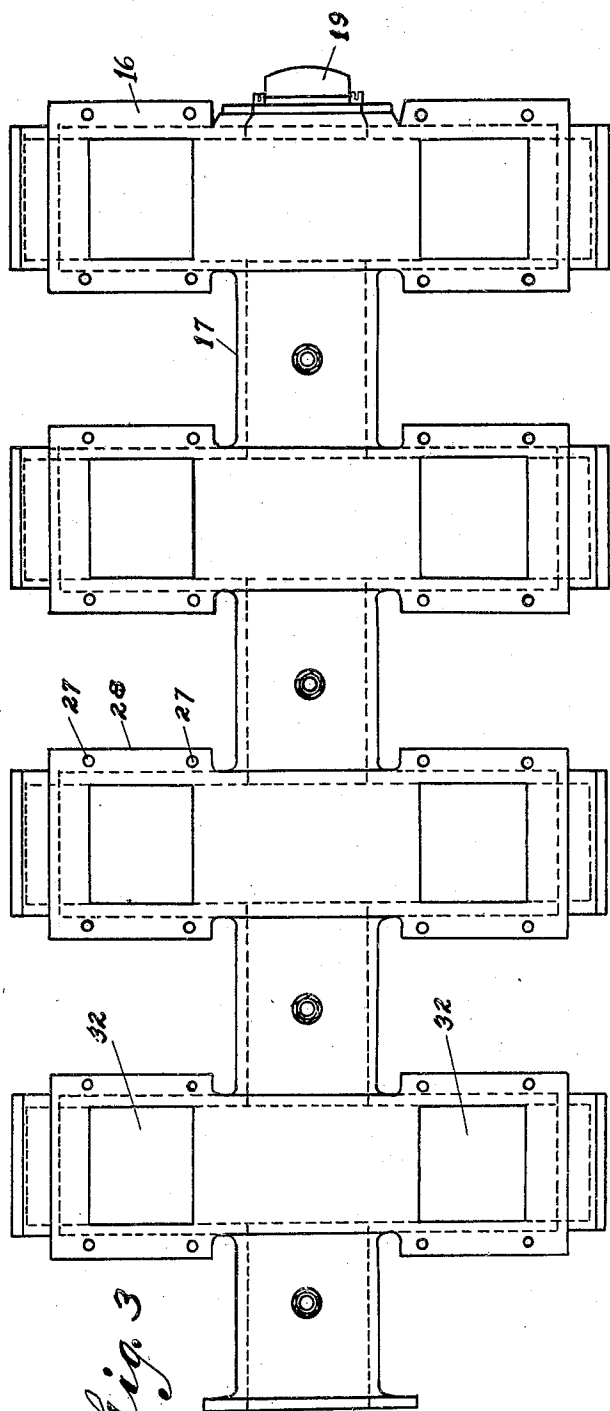


Fig. 3

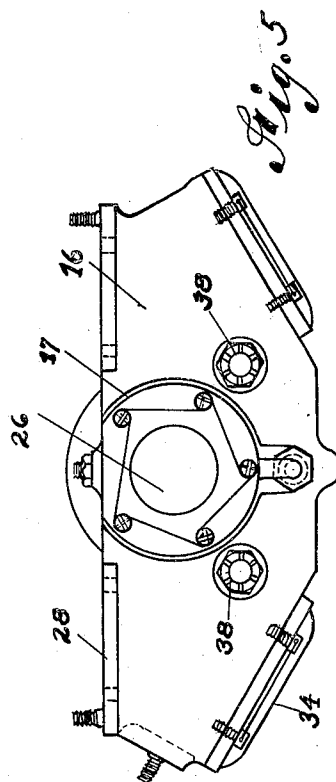


Fig. 5

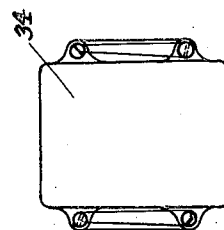


Fig. 4

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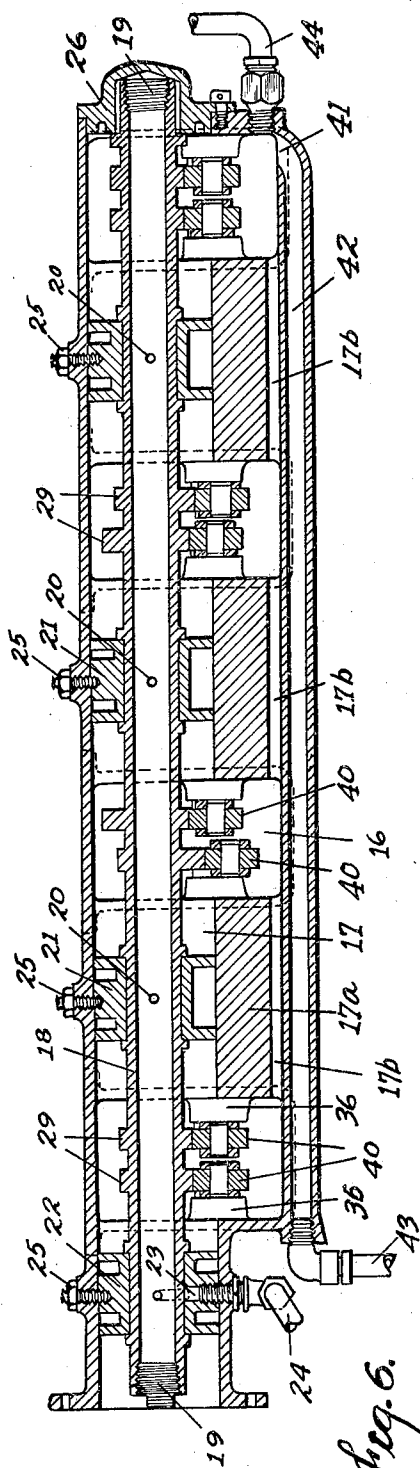


Fig. 6.

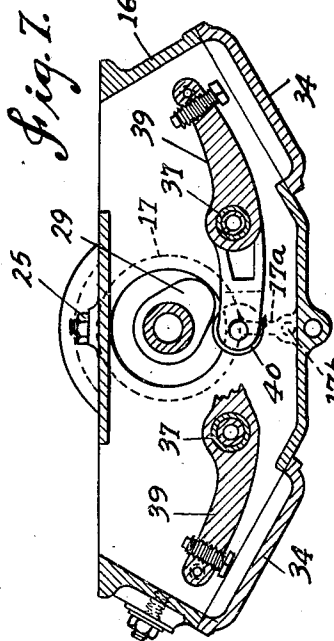


Fig. 7.

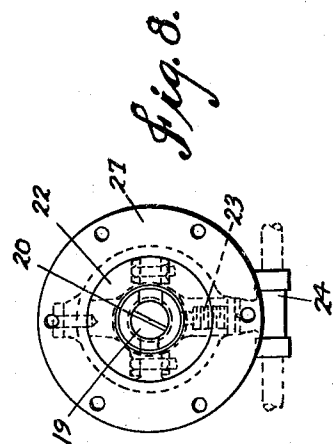


Fig. 8.

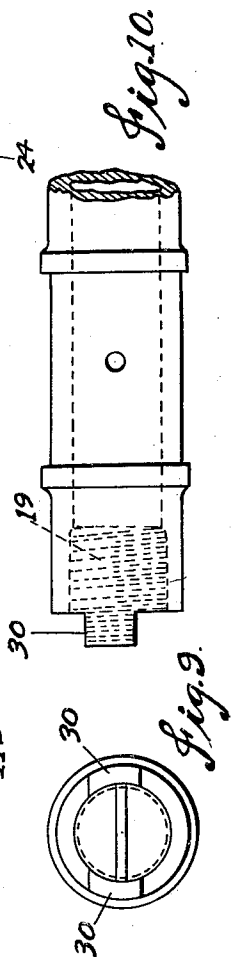


Fig. 9.

Fig. 10.

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UNITED STATES PATENT OFFICE

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AIRPLANE ENGINE

Application filed September 28, 1929. Serial No. 395,940.

My invention relates to engines particularly adapted for airplane use which are air cooled, and consequently are made of open construction so as to permit of sufficient radiation. More particularly my invention relates to in-line engines as distinguished from rotary or radial engines.

One object of my invention is to supply for an air cooled in-line engine a cam shaft and valve operating mechanism which is a unit and can be removed and installed without destroying the timing of the valves.

Another object is the provision for supplying lubrication to this cam shaft and valve operating assembly, and incidentally providing for the removal of excess oil from this portion of the engine. In connection with this assembly, I furthermore arrange for a minimum of interference with full radiation of heat from the heads of the engine cylinders. Also I provide for a spherical combustion chamber in the several cylinders and arrange the valve operating mechanism and valves so that they operate normal to the spherical chamber, as do the spark plugs.

These objects and advantages and other improvements which will be pointed out I accomplish by that certain construction and arrangement of parts of which a typical example is shown and described in the ensuing specification, and the novelty inherent in which will be duly claimed.

In the drawings:

Figure 1 is a longitudinal vertical section of the engine.

Figure 1a is a continuation of the lower right hand corner of Figure 1.

Figure 2 is a vertical cross section of the engine taken through one of the cylinders.

Figure 3 is a plan view of the cam shaft housing.

Figure 4 is a plan view of one of the valve access covers.

Figure 5 is an end elevation taken at the outer end of the cam shaft housing.

Figure 6 is a sectional detail of the cam shaft unit on a larger scale than Figure 1.

Figure 7 is a cross section through one of the rocker arm sections thereof.

Figure 8 is an end elevation of the cam

shaft housing taken from the opposite end of the same from Figure 5, and omitting the rocker arm portion so as to show just the end of said housing and contained parts.

Figure 9 is an end elevation of the cam shaft taken at its inner end.

Figure 10 is an elevation of this portion of the cam shaft.

In the illustrated embodiment of my invention the cylinders are indicated at 1, same being cast individually with the radiating fins surrounding the cylinder walls as well as the combustion chambers. As illustrated, the combustion chambers 2 are formed with a spherical surface and the ports 3 and 4 for the inlet and exhaust valve are normal to this surface. Suitable webs are cast in the heads of the cylinders as at 3a and 4a for guiding the valve stems, the said webs leaving open spaces 5 at the side for communication with the inlet and outlet manifold, and their lower parts being machined to provide a base 6 to which is mounted the housing for the cam shaft and rocker arms. The valves 7 and 8 have their stems 7a and 8a extending at a slant into the spaces to be occupied by the rocker arms. The crank shaft 9 is mounted on spaced bearings 10 which are lubricated from the pipe 11, as will be noted. The gear case 12 is mounted at the rear end of the engine in which case are located a series of spur gears generally marked 13 driven from the crank shaft and coupled up so as to drive a stub shaft 14 at the lower end of the gear case, which shaft drives the cam shaft of the engine, as will be noted.

The various accessories of the engine are driven from this gear case including the oil pump 15 which pumps oil to the various parts of the engine, and in addition, withdraws surplus oil continuously.

The housing for the valve operating mechanism is shown in plan view in Figure 3. This housing may be a single casting and has alternating wide portions 16 and narrow portions 17. The cam shaft is formed of a hollow tube 18 closed at each end by plugs 19. This shaft has ports 20 therein for distributing oil to journal blocks 21

which are held in place in the narrow portions of the housing. The block 22 at the left hand end of the housing has an oil passage 23 therein which is made to communicate with the oil delivery pipe 25. In this way the bearing 22 differs from the bearings 21 and each bearing, as will be apparent, will be held in place by a bolt 25 in the several narrow portions of the housing. The housing terminates at one end in a cap 26, and at the other end in a flange 27 which is bolted to the gear case surrounding the stub shaft 14. The wide portions of the housing are bolted to the base 6 by means of bolts passing through holes 27 in flanges 28 formed on each of the lateral projections of the wide portions of the housing. The cam shaft has formed thereon the cams 29 which lie in the wide portions of the housing. The inner end of the cam shaft is formed with projecting lugs 30 which are off center of the cam shaft and register with matching notches 31 in the stub shaft 14. The off-set relation of these lugs and notches is such that the cam shaft can be connected to the stub shaft in only one position, thereby making possible its removal and replacement without changing the timing of the cams located on the shaft. Opposite each valve stem as it lies within the housing, is an opening 32, which openings are closed by means of plates 34 adapted to be screwed in place (Figures 4 and 5).

Bosses 36 are provided in proper place in each lateral extension of the wide portions of the housing. Pins 37 are set through the bosses and secured exteriorly of the housing projections by means of nuts 38, said pins serving as supports for the several rocker arms. The rocker arms, as indicated at 39, are of usual construction, and have rollers 40 which contact with the cams on the cam shaft.

Extending downwardly from the narrow portions of the housing to the level of the inside of the wide portions of the housing are webs 17a. These webs have portions 17b therein which communicate with the wide portions of the housing. The result of this construction is that the oil which collects in the rocker arm chamber or wide portions of the housing is free to flow lengthwise of the housing to what in the drawings is the right hand thereof where there is a port 41. This port communicates with a passageway which forms a part of the housing and extends the length of the housing providing a return oil passage 42 that communicates with the oil return pipe 43. The return oil pipe 44 which extends from the aprons at the upper end of the cylinder also is coupled with the passage 42.

The construction of cam shaft housing in which there are diverging branches to accommodate valve stems which themselves diverge permits me to employ valves the ports

of which are normal to a spherical surface in the engine combustion chamber, as well as permitting the construction whereby there is free access of air all around the combustion chambers.

By removing the bolts 25 and the cap 26 the entire cam shaft and its bearings can be removed without disturbing the housing and replaced without disturbing the timing. If it is desired to gain access to any rocker arm the cover 34 can be removed which is adjacent to that rocker arm giving full access to the arm, and any rocker arm can be removed and replaced without disturbing the others and without dismounting the housing by removing the nuts 38 and driving out the mounting pin for that rocker arm.

Finally the entire housing can be unbolted from the base 6 and at 27 whereupon it can be removed from the engine, and replaced without affecting the timing of the valves in any way. It should be noted in this connection that the oil pipes will also have to be disconnected if the housing is to be removed.

It will be evident that the cam shaft and rocker arm arrangement is very convenient and that repairs can be made readily without taking the engine to pieces so far as these parts are concerned.

It is quite important in aviation practice that repairs can be made to the valve operating system without throwing the valves out of time for the reason that the timing must be accurately and carefully done, and often it is necessary to make repairs under circumstances where this is not practical. It is also of great advantage, in case of the break-down of an engine, to be able to replace a cam shaft and rocker arm equipment without dismantling the engine.

While I have described my invention as applied to cylinders in one line only, it is apparent that the device would be equally as practical in a V type arrangement in which the cylinders are in line but arranged at diverging angles.

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

1. In an airplane engine having cylinders in line, a unit assembly formed of a housing, and a cam shaft and rocker arms mounted therein, said assembly being removable and replaceable on the engine, cam shaft operating means driven by the engine, and interengaging means between the same, and the cam shaft permitting removal of the shaft endwise therefrom.

2. In an airplane engine a series of cylinders arranged in line and inverted, a housing for the cam shaft of said engine located on the under side of said cylinders, and a passageway forming part of said housing, and

providing a return conduit for oil to the oil pump of the engine.

3. A cam shaft and rocker arm housing for in line airplane engines, comprising a housing member having wide portions and narrow intermediate portions, bearings located in the narrow portions of the housing for a cam shaft, and supports in the wide portions of the housing for the rocker arms.

4. A cam shaft and rocker arm housing for in line airplane engines, comprising a housing member having wide portions and narrow intermediate portions, bearings located in the narrow portions of the housing for a cam shaft, and supports in the wide portions of the housing for the rocker arms, said supports comprising pins held in place by nuts on the outside of the wide portions of the housing.

5. A cam shaft and rocker arm housing for in line airplane engines, comprising a housing member having wide portions and narrow intermediate portions, bearings located in the narrow portions of the housing for a cam shaft, and supports in the wide portions of the housing for the rocker arms, and passages in the narrow portions of the housing communicating with the bottoms of the wide portions of the housing, thus providing a continuous oil passage through the bottom of the housing.

6. A cam shaft and rocker arm housing for in line airplane engines, comprising a housing member having wide portions and narrow intermediate portions, bearings located in the narrow portions of the housing for a cam shaft, and supports in the wide portions of the housing for the rocker arms, and passages in the narrow portions of the housing communicating with the bottoms of the wide portions of the housing, thus providing a continuous oil passage through the bottom of the housing, and a lower passage formed throughout the length of the housing and communicating with the interior of the said housing.

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