

THE LIBERTY ENGINE*

BY J. EDWARD SCHIPPER

In spite of opposition during the first months of its production, the Liberty aircraft engine lately has been accepted as representing the highest class of engineering design. A strict censorship has been maintained over its details of construction, though the main specifications have been widely known for some time. It is, therefore, with unusual interest that the drawings, published herewith for the first time, will be scanned by engineers whose interest has been aroused but whose connections have not been such as to permit them to view the prints.

The Liberty engine, used in the De Haviland and other land planes and a great number of seaplanes, is a 12-cylinder V-type, with overhead valves and overhead camshaft. It has individual drawn steel cylinders with cylinder dimensions of 5 in. by 7 in., giving a piston displacement of 1649.34 cu. in. The cylinders are bolted to the upper half of the aluminium crankcase, the two sets making an angle of 45 deg. with each other. The water jackets are of pressed steel and are welded to the cylinders and at their own seam. An engine in all respects identical with the Liberty aircraft engine, but having cast iron cylinders, is fitted on "tanks," and one of the sectional views printed herewith shows this design.

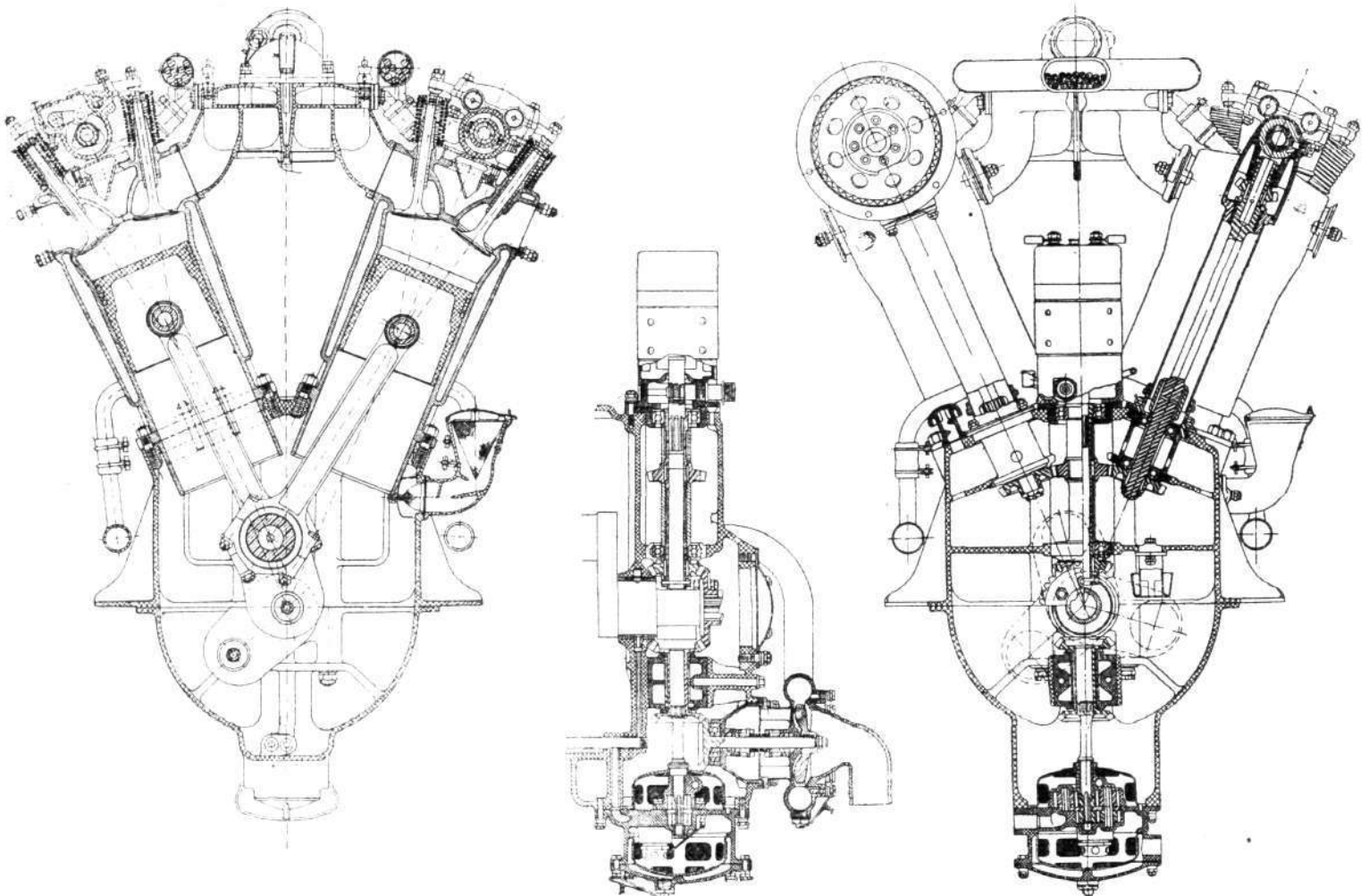
The valves are mounted in the heads of the cylinders and are inclined at an angle of 15° to the centre line of the cylinder, so that the angle made by the centre lines of the two valves is 30°. The intake manifold passes between the two rows of cylinders, and the carburetors in most of the installations are mounted in the V. The entire valve drive is housed above the cylinders and can be readily removed without tearing down the engine.

* By courtesy of Automotive Industries, N.Y.

Weight and Output

The weight of the Liberty engine is approximately 806 lbs. and the brake horse-power developed ranges anywhere between 350 and 400 in the army type with the high compression pistons (18 per cent.) and 320 to 340 in the navy type with the low compression pistons (20.5 per cent.). The centre of gravity of the engine is on the centre line of the transverse section, 10 in. above the top of the engine supports and $\frac{3}{4}$ in. toward the distributor end of the engine from the centre of the middle bearing bolts. The rated fuel consumption is .54 lb. per brake h.p.-hour, or 36 gal. per hour with wide open throttle at 1,700 r.p.m. Under service conditions, about 30 gal. per hour is a fairly representative consumption. The oil consumption is .03 lb. per h.p.-hour or $1\frac{1}{2}$ gal. per hour with wide open throttle at 1,700 r.p.m. The horizontal flying speed of the engine is 1,700 r.p.m. and the ground speed is 1,600 to 1,625 r.p.m.

The pistons are of aluminium. There are two designs of pistons used, one for the army type and one for the navy. The army type pistons have a crowned head which gives an 18 per cent. compression space. The navy type pistons have a flat head which gives a 20.5 per cent. compression space. The pistons are 5 in. in length and have three rings of the eccentric type, all at the top of the piston. These piston rings are assembled with a gap between the ends of the rings not less than .025 in. The pistons weigh 3 lb. 3 oz., and the number of ounces that the pistons weigh over 3 lb. is stamped in the depression on the side of the piston, so that in assembly it is possible to pick out pistons of similar weight. The piston casting has an unribbed section and is fairly heavy, the section being $\frac{1}{2}$ in. thick at the head and at the rings and tapering to $\frac{1}{4}$ in. at the end of the piston skirt.



THE LIBERTY 12-CYLINDER ENGINE.—The view on the left shows the engine with cast-iron cylinders, as used on tanks, while the view on the right shows it with steel cylinders and sheet metal jackets. Below is shown a section through the camshaft, oil pump and water pump drives at the forward end of the engine.