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NAVY DEPARTMENT

BUREAU OF AERONAUTICS

REPORT ON

50 HOUR ENDURANCE TEST AND SEA LEVEL PERFORMANCE CHARACTERISTICS OF THE WRIGHT MODEL P-1 ENGINE #10062 MFG. #6477.

BY

WRIGHT AERONAUTICAL CORPORATION

PATERSON, N. J.

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DATE OF TEST. FROM OCTOBER 8, 1924 TO FEB. 6, 1925

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(1) OBJECT: The object of this test was to investigate the durability of the P-1 engine and to obtain information upon which to base the further refinement of the engine.

OUTLINE OF THE DEVELOPMENT OF THE P-1 NINE CYLINDER ENGINE

AT THE BEGINNING OF THE 50 HOUR TEST.

(2) In order to give a clear idea of the work of development of the P-1 nine cylinder engine, a short description of the differences between the original engine and the final engine will be necessary.

(3) The P-1 nine cylinder engine as assembled on Feb. 4, 1924 differed from the final engine as follows:

(4) A. The outside diameter of the original engine was 47½" while the final engine is 50". To affect this change it was necessary to lengthen the master and articulated rods and the cylinder sleeves.

(5) B. The main crankcase of the original engine was made to incorporate the intake manifold system at the rear. A cone shaped section was carried out from the cylinder pads over the manifold system, which terminated in the mounting flange. The intermediate section was centered on the inside of the main crankcase and secured by studs and dowels. On the final engine the main crankcase is built in the form of an annular ring with the cylinder pads on the periphery, bridging the front and rear faces. Deep ribs join the front and rear faces at the intersection of the cylinder pads. A manifold casting as shown in sketch page 69 is bolted with studs to the rear of the main casting and the intermediate section is secured at the front, fitting over a centering ring on the main crankcase. A larger size and greater number of studs are used to secure the main crankcase and intermediate section.

(6) C. The size of crankshaft of the first engine at the main bearing was 2-25/32". The final engine has a crankshaft of 3" diameter at the forward main bearing and correspondingly larger ball bearings. The size of the rear end of the crankshaft was not changed. The larger shaft requires the use of a larger propeller hub, cam bearing and crankcase bearing housings. A new layout of gear centers was necessary together with a number of smaller changes.

(7) D. The master rod of the original P-1 was lighter in the sections at the crankshaft bearing and shorter in length.

(8) E. As mentioned under "A" the cylinder sleeves were shorter on the original engine. The valves and valve guides were also shorter than the final dimension. The valve linkage had smaller bearing surfaces.

(9) F. The original P-1 pistons were of the slipper type with a small and short wrist pin carried between two bosses supported by 2 parallel ribs placed just under the head. The final piston shown on page 66 is of the semi-slipper type.

(10) G. No magnesium castings were used on the first engine. The final engine had magnesium castings as noted in sub-assembly weights page 24.

(11) H. A number of minor differences in the two engines exist such as oil scoops on the crankshaft of the first engine, no pins in the cam bearing first engine, Splitdorf SS-9 magnetos first engine.

(12) The development of the P-1 nine cylinder engine started with single cylinder tests from which a cylinder and piston were designed which would run 50 hours at full throttle on the universal engine. The nine cylinder engine fitted with cylinders of a design similar to that developed on the single cylinder engine, was then constructed.

(13) Tests of the 9 cylinder engine started Feb. 27, 1924, brought out several defects. The engine would not run for any length of time without seizing a piston on the cylinder wall. The spark plugs would not fire consistently due to excessive oiling and the valve springs broke continually. Experiment with different piston clearances and modifications in the oiling system did not cure the trouble. The slipper type piston was finally discarded.

(14) A very short trunk type piston was then used which after a number of alterationsin engine oiling, etc., was run at full throttle developing 402 horse power. The oil and fuel consumption were high however.

(15) It was decided that an engine of this size would require a larger outside diameter to increase the bearing surface on the pistons, to decrease the angularity of the connecting rods and to permit the use of an oil scraper ring to control the oil consumption. The short cylinders and master rod were therefore stored and new cylinders with longer sleeves constructed.

(16) The engine was then rebuilt with the longer cylinder sleeves, cylinder heads with longer valve guides, longer master and articulated rods and trunk type pistons with longer skirts and oil ring grooves at the bottom. Three single NA-S7 Stromberg carburetors were used as it was believed that the maximum power and best fuel consumption characteristics could not be obtained with one double carburetor. A new type crankcase was used to which a section forming the induction system was bolted. The new crankcase was constructed to secure a steel mounting plate by a ring of studs at the rear of the crankcase. The mounting plate was designed to be supported from the airplane with a tubular mounting structure.. With the new equipment the engine ran well but was low on maximum horse power. A number of settings of magnetos and carburetors were tried which improved the performance. The valve springs were finally changed to springs of greater tension which brought the horse power up to a reasonable figure. The valve spring breakage was also checked by better heat treatment.

(17) During the above experimenting the pistons cracked in the piston pin bosses and the master rod cracked around the bolts.

(18) Magnesium was tried on the crankcase rear section, intermediate section and front section. The intermediate section broke around the centering ring to the main section. The front section broke at the cam drive gear shaft support. These parts were replaced with the original alumimum castings. A new design of semi-slipper type pistons was fitted with a ring at the skirt. The engine was then started on a 50 hour test on Oct. 8, 1924 with the equipment just described including the cranked master rod.

(19) The 50 hour test and the subsequent running is fully covered elsewhere in this report. A resume of the engine running time included in this outline will be found on page 20.