ECONOMY TEST OF THE DH-4

(FLYING SECTION REPORT)

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Following the development of a satisfactory flow-meter installation for airplanes, an application was made to determine the economical operating conditions of the DH-4. Attempt was made to check the results of previous economy tests, to ascertain the effect of the altitude adjustment, and to confirm a theory of economical operation previously developed.

METHOD OF TEST.

The same airplane and flow-meter installation, as described in the above report, was used. This installation consisted of a Schroeder flow-meter, surge tank (to dampen out oscillations produced by the hunting of the carburetor float), and the necessary control and vent valves located in the rear cockpit. The flow-meter used is, in effect, a small vertical weir with a small piston or indicator resting on top of the column of liquid. The height to which this piston is raised is proportional to the amount of liquid flowing. The installation was calibrated by disconnecting the fuel line and actually weighing the amount of fuel flowing per unit time.

Tests were made at three different altitudes to determine the fuel consumption speed function. At a given altitude the airplane was flown level by a sensitive altimeter and at constant air speed, with no altitude adjustment; the corresponding reading of the flow meter was made after steady conditions were established. After the reading without altitude adjustment was made, the adjustment was opened until the motor began to spit badly and then closed again until it just barely functioned smoothly. The flow-meter reading was then taken as before. This manipulation was repeated for several other speeds at the same altitude and for the same range of speeds, at other altitudes.

RESULTS.

The readings of the flow-meter, after tests, were converted to flow in pounds per minute by the use of the calibration curve submitted in a previous report. The results of these conversions are shown in figures 1, 2, and 3, in which are plotted the fuel consumption versus air speed for the various altitudes.

It will be observed that the indicator readings follow closely the theoretical expectations and have rather remarkable continuity considering the unsatisfactoriness of previous tests. It is believed that the installation can be used satisfactorily for all economy tests, at least under six thousand feet.

It was impossible to get satisfactory flow-meter readings above 6,000 feet on account of the fact that the rapid vaporization of the gasoline due to the decreased atmospheric pressure was greater than could be accommodated by the manipulation of the air relief cock previously described, and was large in proportion to the total gas flowing.

It is interesting to note that the fuel consumption in pounds per minute, or gallons per hour, has a definite minimum around 72 miles per hour true speed, and nearly constant for each altitude. The value of this minimum consumption is nearly one-third of the full throttle consumption. Further, this value increases with the altitude approximately 0.05 pound for each thousand feet.

The operation of the altitude adjustment at the minimum consumption point results in a very considerable fuel saving. This fuel saving increases with altitude, but on account of the fact that the total consumption is increasing also, the percentage saving is approximately constant and about 9 per cent.

CONCLUSION.

The Schroeder flow-meter is an accurate and convenient instrument for airplane economy tests at low altitudes. There is a critical altitude beyond which the results are no longer accurate on account of the fact that the weight of gas vaporized is an appreciable percentage of the total flow. This critical altitude is somewhere between 3,000 and 6,000 feet. The determination of this altitude will be obtained in a combined flow meter and time test probably on a bombing airplane.

A distinct fuel saving by the use of the altitude adjustment can be effected, and advantage should be taken of this in long cross-country trips.

The nature of the fuel consumption curves confirms the theory developed to specify the conditions of economical operation.