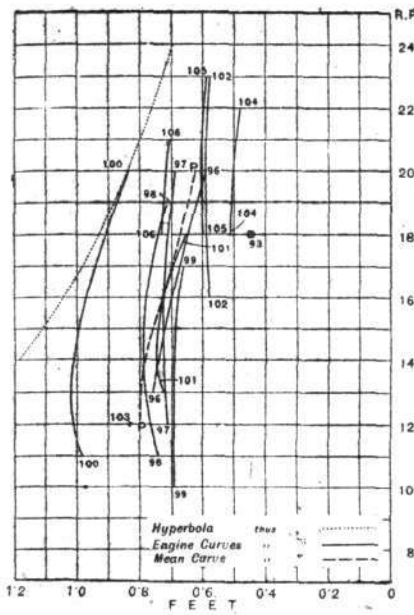
WEIGHT AND TORQUE OF AERO ENGINES.

In his presidential address before the Institution of Automobile Engineers, the incoming President, Mr. L. A. Legros, criticised at considerable length the educational system of this country. In his opening remarks, however, he summarised the progress made in the design of petrol engines, and gave some instructive tables of weights, &c., regarding



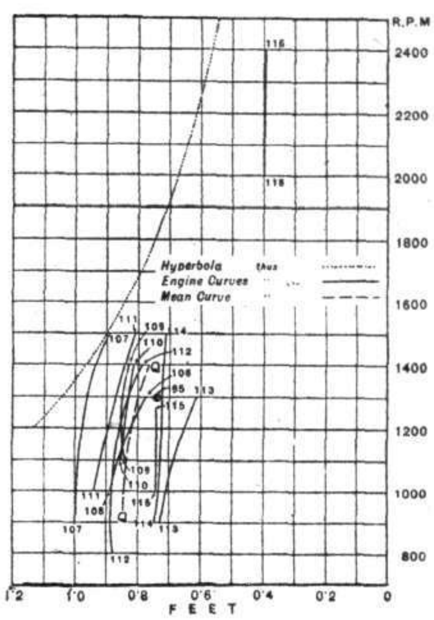


Fig. 1.—Equivalent radius; vee-type aero engines. Fig. 2.—Equivalent radius; vertical-type aero engines.

aero engines, together with some graphs, which we reproduce.

He said: "It has been suggested to me by a former President, Lanchester, that the special function of the automobile engineer, as contrasted with those of other engineers, is weight-saving, and that this Institution may well be said to represent the Weight-Saving Engineers. Though it is quite true that weight-saving was the watchword of the cycle industry, to

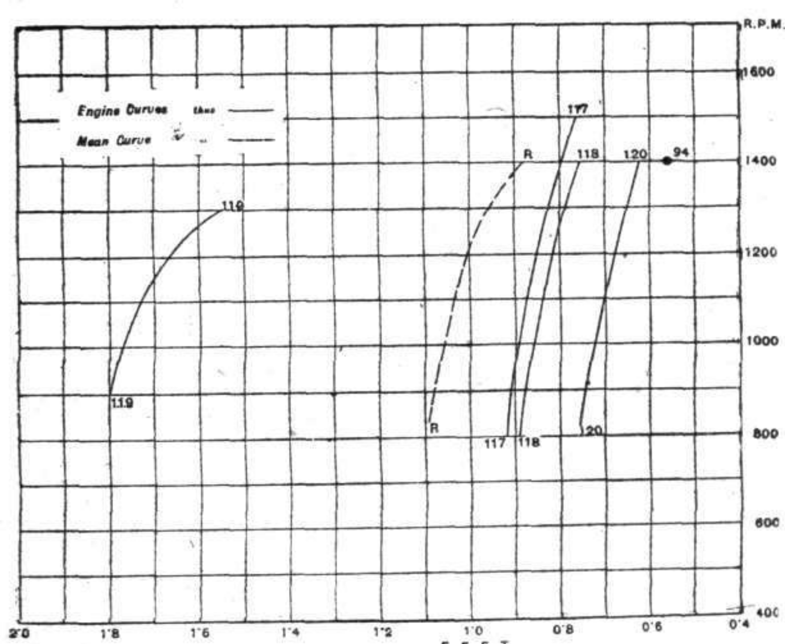


Fig. 3.—Equivalent radius; radial-type aero engines.

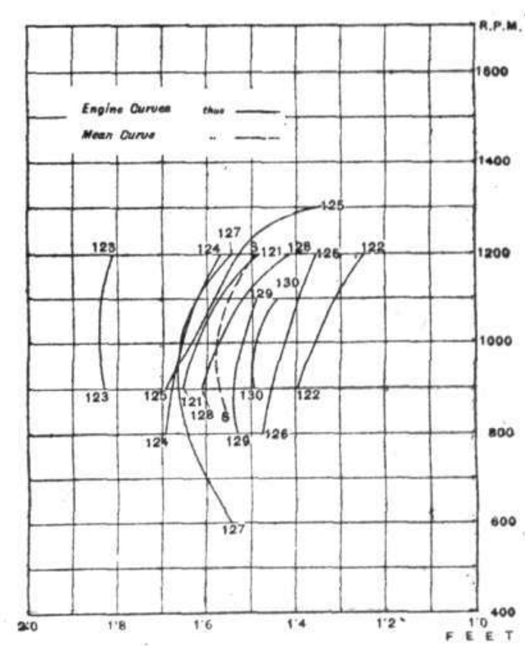


Fig. 4.—Equivalent radius; rotary-type aero engines.

which this Institution owes its birth, yet on reflection it will be remembered that weight-saving has been an important factor in all the great advances that have been made in traction, whether on land or on water.

"One fundamental conception, the study of which has contributed greatly to progress in automobile design, is torque. Most manufacturers plot the records of their engine tests as curves of brake horse-power, many also plot the torque curve, and others plot curves of fuel consumption. I have already expressed the opinion that the torque curve gives more information about the performance of an engine in a car than is apparent from the horse-power curve; moreover, it gives the data in the form in which they are actually wanted for all traction problems. In order to compare the torque curves of various engines of different dimensions, for heavy or light traction on land, for marine work and for aerial navigation, it is necessary to reduce all the torque curves to a common basis, and for this I have adopted torque per lb. of weight. Dimensionally, torque = ML^2/T^2 and weight = ML/T^2, hence torque per pound =

$$\frac{ML^2}{T^2} \Big/ \frac{ML}{T^2} = L,$$

that is a length which I will term the *effective radius* of the engine. If a gear wheel be supposed to be fitted to the crank-shaft of the engine and to engage with a vertical rack, the effective radius for the engine at any particular speed is the maximum pitch radius which this wheel can have to allow the engine to climb the rack.

"An example of a torque curve was given early in the proceedings, but no general comparison of torque curves appears to have been made up to the present. To remedy this deficiency I have made application to the best known engine and automobile manufacturers in this country, in allied countries and in America, as well as to other authorities, with the result that I have been enabled to obtain curves and data for 130 engines."

Mr. Legros then gave figures and graphs relating to various classes of engines, and we reproduce on next page those of the different types of motors for aircraft work.

"From the form in which the data have been supplied it has not been possible to fix a uniform basis throughout the comparison, but generally the weight of engines has been taken to include the magneto, the carburettor, the exhaust and inlet manifolds, the water pump and the water manifold, but dry or without water. Aero engines are either air cooled or water cooled; it is unsatisfactory to compare an air cooled engine with a water cooled engine dry—consequently, in the case of aero engines the weight of water, if any, is included, but usually there is no flywheel, consequently this latter, if any, is not included.