AERO ENGINE FUELS OF TO-DAY AND TO-MORROW

[The following letter has been received by the Chairman in connection with his lecture on aero engine fuels. It raises several points of considerable interest in connection with the Diesel engine and fuels.—ED.]

General Motors Corporation,
224, West 57th Street,
New York,
January 17th, 1927.

DEAR COLONEL SEMPILL,

I was very glad to receive the JOURNAL OF THE ROYAL AERONAUTICAL SOCIETY containing your paper on aero engine fuels. A great deal of this paper could equally well be applied to motor car fuels, although the motor car fuel problem is somewhat different and very much more important because of the tremendous consumption.

I notice that in the discussion a good deal is claimed for the immediate probability of successful operation of aircraft engines operating on the Diesel, or some similar cycle. I certainly cannot agree with various of the statements made. It is undoubtedly true that petrol or gasoline is a more dangerous fuel than would be a heavy oil from a military point of view. On the other hand, in crashing, petrol is less apt to take fire on a hot exhaust pipe than is ordinary lubricating oil or Diesel engine oil. There are other possibilities in Diesel engines, such as the crankcase explosions and similar things, which I believe will go a long way to offset the increased safety in other directions.

The question of fuel cost, from a military point of view, can hardly be a controlling one. Commercially the cost of any fuel produced from petroleum is based partly on the heat content of the fuel in British thermal units and to a far larger extent on its availability value. In other words, on its general usefulness. Of course it is possible that in aviation a Diesel type fuel might be used, while the same fuel would not be sufficiently attractive for use in motor cars. In this case the low price of Diesel fuel might continue. At the present time the most commonly used aviation fuel is an unusually high grade motor gasoline and its price is therefore based on the cost of motor fuel.

Mr. Chorlton makes the statement that "any fuel that would burn could be used." This is certainly a most remarkable idea in view of the last fifteen years' experience in the operation of marine Diesel engines, where it has been found that the only safe oil to use is one having a considerable degree of refinement. Personally, I have seen no evidence whatever to indicate that the Diesel type engine is capable of supplying all the characteristics suggested by its proponents at one and the same time. If it is desired to obtain a high power output per lb. of weight from such an engine, it must be run at high speed and must use a very large proportion of all the oxygen available in each charge. When this is done I have never heard of a test to show fuel economies as low as can readily be obtained in the ordinary type of aviation engine. The reason is a perfectly simple one and is inherent in the difference between the two cycles.

The ordinary four-cycle engine begins to mix the air and fuel charged in the carburettor and the mixing continues accompanied by violent turbulence throughout the suction and compression strokes. The charge is then fired under maximum compression and with the maximum available expansion ratio possible with

the compression ratio used. In the Diesel cycle the injection of a charge begins only slightly before the period of maximum compression when turbulence in the cylinder is at a minimum and if the injection is continued over any considerable period of time, a good deal of the burning must be done at an expansion ratio even lower than is the case in the four-cycle engine.

It is true that some of the recent attempts at light engines with the Diesel cycle are really based on a modification of this cycle, in which the injection begins soon enough to raise the explosion pressure very considerably higher than the compression pressure. Such an engine is really a compromise between the Diesel cycle and the Otto cycle.

It is possible that this compromise cycle is the best one to work on in view of the necessity of building the ordinary Diesel engine heavy enough to take care of occasional misfiring. We know that explosion pressures in standard aviation engines regularly reach six hundred to seven hundred pounds a square inch and yet we see all Diesel engines built very much heavier in parts subject to the explosion pressure. The answer is obvious to me that it is necessary to build a Diesel cycle engine strong enough to stand an occasional attack of Otto cycle, with explosion pressures to correspond.

One of the important reasons for using high volatile fuel in aviation engines is the necessity of meeting a very wide range of temperature conditions with complete flexibility. I have never heard of any Diesel engine approaching the flexibility of the best Otto cycle engine. They can be designed or adjusted to run at various speeds, but to get one that is fairly efficient over a wide range of speed without continual hand adjustment by experts is an entirely new proposition.

It was a very great pleasure to see you in London and to meet the various gentlemen present at your extremely pleasant luncheon party. I still regret that our time was so short as to make it impossible to see many of the most interesting things available.

Sincerely yours,

(Signed) HENRY M. CRANE.

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