CORRESPONDENCE

The Secretary, Royal Aeronautical Society,
7, Albemarle Street, Piccadilly, W.1.

SIR,—With reference to the letter from Captain J. Morris published in the November issue of the JOURNAL, may I point out that it is a fundamental of mechanics, and not a discovery, that flexibility of airscrew blades in their plane of rotation must lower the natural torsional frequency of the system. Some comments upon the magnitude of the effect may be of interest to readers of the JOURNAL.*

At the outset of the torsional vibration investigations begun during the war, the simplifying assumption was made that airscrew blades may be regarded as being rigid in their plane of rotation. There were good reasons for believing that the effects of blade flexibility in the plane of rotation must be secondary, so that further consideration of these effects could quite well be deferred until an instrument had been evolved by means of which the behaviour of aircraft engines as regards torsional resonance could be examined experimentally.

Various torsiograph tests that have been made with different airscrews or test fans fitted have confirmed that the effects of blade flexibility are small, there being little change in the natural frequency of the system beyond the small amount attributable to differences of the polar inertia moment. The influence of blade flexibility alone does not lend itself to very exact investigation because the rigidity of the hub and the firmness of grip of the airscrew affect the natural frequency to an extent which is difficult to assess and allow for. The total difference on all counts between two airscrews, one of wood and one of metal, seems to be within about 4 per cent. in extreme cases, and needs considering only when a difference of, say, 50 r.p.m. in the location of a critical speed is important. It is perhaps early to generalise, but, as far as observations go, it appears that hollow metal airscrews tend to give somewhat lower resonance speeds than wood airscrews, the difference being about 3 or 4 per cent. Thus, hollow metal airscrews appear to be less stiff in the plane of rotation than corresponding wood airscrews, but the difference may occur mainly in the airscrew centre and not in the blades.

As the same design of engine is likely to be used with a variety of types of airscrews, the practical concern is that the margin by which bad critical speeds are avoided shall not be so narrow that a change of airscrew can be of material importance. Nevertheless, in special cases, the effects of fitting different types of airscrews may not be ignored. The Tornado engine is a case in point. On this engine torsiograph observations have been made with different airscrews, including variable pitch airscrews, expressly for the purpose of noting differences in critical speeds.

Yours faithfully,

B. C. CARTER.

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