(*b*) *Local* changes in the shear modulus would be significant in the neighbourhood of a loaded rigid frame, but less so near a flexible frame. Thus for values of $A/B<10$ (*i.e.* a comparatively rigid frame), the shear terms in the energy equation are paramount, and the shear flow is proportional to $G \sin \alpha$ (as is evident from Section 14, (*b*), p. 158). If G varies round the frame, the shear distribution will be modified, and will in fact no longer be sinusoidal. The effect will diminish with increasing flexibility as the bending terms become progressively more important.

(*c*) The value of G to be used at a particular angular station would be a mean value obtained by integrating the stress-strain curve between zero and an assumed maximum stress. This mean value would lie between G and G_s (secant modulus), in general being nearer to G than to G_s. In estimating the maximum shear stress, a method of successive approximations could be used, as suggested by Mr. Saravanos, but in most cases a first estimate should suffice.

(*d*) Analytical terms based on post buckling behaviour of the skin could be included in the energy equation, but the deriving of such terms is outside the scope of the present investigation.

2. *Compression buckling of the skin.*

(*a*) In general, compression buckling, whether from local or remote loading, would occur over a narrow angular range of the skin. For transport and bomber aircraft, where the fuselage is designed mainly by bending in a vertical plane, regions of high compressive stress will in general be regions of low shear loading.

(*b*) The chief effect of compression buckling will thus be to increase the strain energy of skin and stringers in end load. It will be significant, therefore, only in those cases where the end load in skin and stringers is significant, *i.e.* when $A/B>100$ and $A \gg 10^4$. The normal engineering procedure of taking " 15 *t* of skin on each side of the rivet " working with the stringer in compression seems therefore to look after this effect adequately, and even to over-allow for it.

(*d*) Where a more refined calculation is required, it will be necessary to calculate a mean value of the modulus on the lines of paragraph 1(*c*).

3. *Conclusion.*

Shear buckling might modify the skin shear distribution at a rigid frame, and to a less extent at a flexible frame. In general the effect should be small, except with severe buckling near a rigid frame.

Compression buckling will generally occur in regions of low shear loading. Its effect on the skin shear distribution will be small, and is probably already over-allowed for by using standard engineering estimates of " effective skin areas " in regions of compressive stress.

4. *Experimental results.*

The writer knows of no experimental results which show the effect of buckling on the skin shear distribution at a loaded frame. It would be interesting to compare any such results that become available with the predictions set out above.

K. J. Dallison.

Temperature Control

18*th March* 1953.

Sir,—Dr. Still's paper " Temperature Control of Jet-Engined Aircraft " in the February 1953 Journal has included a chart (Fig. 19) which needs care in application. Its derivation is not given but it would appear to be that published by the American Society of Heating and Ventilating Engineers. If this is so the comfort zones marked were decided from subjective tests on American people and as such are not strictly applicable to non-Americans as the body is habituated to local climatic conditions. In support of this the A.S.H.V.E. found that the standards for people from different districts varied but for simplification the chart shown was published. In this writer's opinion the acceptable tolerance on the values shown could be large, at least on dry bulb temperature. The " Effective Temperature " should be suited to the route flown if economic factors and the equipment allow in commercial aircraft. In military aircraft of short flight duration the tolerance could be very large.

" Effective Temperature " is a subjective standard which is not a simple function of humidity, dry bulb temperature, etc., as it is complicated by factors such as the presence of radiant heating. The word " Temperature " is misleading as it implies objective measurement and by its use one tends to overlook the most important human factor. If one used, say, " Comfort Standard " this danger might be overcome, especially if we introduced an arbitrary scale of measurement with 68° Effective Temperature becoming 100.

J. A. C. Williams, *Associate Fellow.*

In reply to Mr. Williams:—

The object of Fig. 19, dealing with the subject of Effective Temperature Control, was to indicate the effects of humidity, air velocity and clothing on the comfort standard of the average human being.

There are many such charts available today and they all have an arbitrary standard and hence will be different for different people.

It is obvious that the Effective Temperature required for different airline routes will vary.

I would agree with Mr. Williams that the term " Effective Temperature " is misleading but it has become so accepted that it is somewhat difficult to delete such a phrase from our minds and use the more exact description of " Comfort Standard."

E. W. Still, *Fellow.*