Conclusion and Discussion

The experimental results fail to agree with Lamé solution at high elastic grip for brass and alluminium tests. The use of maximum shear stress theory in caculating the pressure in shrink-fit members is a failure although it agrees quite reasonably well in fluid pressure test conducted by Prof. Thomson (6). There are many reasons for this phenomenon.

1. Co-efficient of Friction

In comparing test results in Series 1 with Series 5 and 6, it shows that the slope of the curves depend on the co-efficient of friction. At high values of the co-efficient of friction, the curve is steeper and deviates from the straight line by a large amount before the theoretical elastic limit is reached. On the other hand, for a low co-efficient as in Series 6, the straight line portion passes the elastic limit boundary. Thus, the co-efficient friction is the main cause of the deviation from Lamé solution within elastic range.

2. Permanent Set

At high interference fits and high temperatures, when shrinkage occurs, the elasto-plastic boundary may penetratedeeper into the hub wall without an increase in pressure or even with a drop in pressure* caused by the loss of mechanical property at high temperature and by permanent bore strain**. So far, there is no direct means to measure the exact interface pressure of shrink-fit members.

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* Robert Russel, op.cit. p. 534

** Ref. 6 p.p. 799-812

3. Thermal Stress

Shrinking of hot hub on cold shaft may cause thermal stress at bore by the rapidly cooled bore surface.

4. Axial Strain

Experiments conducted by Prof. Thomson (6) showed that there was axial strain in shrink fit hub. This might cause the elastic interference to be smaller that calculated.

In elasto-plastic portion of the curve, the efficiency of interference fits was uncertain depending on the surface condition and hardness. For two mating materials with large difference in surface hardness, the efficiency increases because of the shear of softer material surface by the ridges of harder material. For the same material, the efficiency are constant or fall down to a certain value* depending on the surface roughness and lubricating condition. The efficiency in interference fits was very small for axial load and was much effected by surface factors. The friction co-efficients were calculated and tabulated in Table 4. It shows a considerable decrease in co-efficient of friction by the using of grease as a lubricant. This factor will have great effect in service conditions. The decrease in efficiency due to the effect of combined axial load and constant torque of 88.3 in.lb. was clearly seen.

Suggestion for Further Work

Since the grip force at elasto-plastic state was not in agreement with maximum shear stress theory or even with other theory of failures. A better theory should be established to give a closer results, taking account on the co-efficient of friction effect.

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* Ref. 6 p. 812