not entirely correct, at least for the assemblies of type a), and it will be the cylinder, the lateral dimensions of which are not small compared with the length of the working section of the bore, where the principal limitation will arise. If the cylinders were appreciably longer compared with their wall thickness, and the region of attachment were located further away from the working portion, the dependence on the nature of the fluid might well be reduced. Although the changes so far observed are not very large, they are sufficient to require that any standard calibration of a piston-cylinder assembly intended for work of high accuracy must be associated with the particular fluid used. This is an aspect of the pressure balance on which more data would be useful.

b) *Results of measurements involving three materials with discussion of errors*

The three-material procedure has been carried out for two pressure ranges — 500 and 1200 bars — employing assemblies of type a) — Fig. 2 — of nominal areas 0.05 and 0.02 in² respectively, using castor oil as the pressure transmitting fluid. The results of these measurements are summarised in Tab. 2 in which are shown the values of the distortion coefficients for the steel assemblies determined both by the direct and indirect methods. Over the pressure range in question the dependence of disrortion on pressure was closely linear, with no appreriable hysteresis effects. The actual coefficients given are best fits by least squares to some four to six sets of data. It is worthy of note that it has been verified by direct balancing that the distortion coefficients of the two steel assemblies concerned are actually equal to within 1%. The total dispersion of the results is in the region ± 4%, but it will be seen that there is evidence that the direct comparisons involving bronze (λ'_S) are subject to more scatter than the remainder. This result is not surprising since, from the point of view of the influence of possible uncertainties in the elastic constants, this comparison is in every way at a disadvantage relative to the other two. Since the factor k has here its smallest value (= 1.44), and the comparison is with an assembly having a *larger* distortion, the operative factor in equation (3.6), viz $(k-1)$, is particularly sensitive to an error in k. The fact that the Poisson's ratios are somewhat different is also not an advantage, although the correction factor already discussed should take account of this. Making use of equations (3.6) to (3.8) and introducing the actual numerical values of k_{BS} ..., it is easily shown that an error of x% in the relevant ratio of elastic moduli (k) leads to percentage errors in the three values, λ'_S, λ''_S and λ'''_S of the distortion factor, of about 3.3x, 1.4x and 0.9x respectively. In this respect therefore, the direct comparison using S and T and the indirect comparison, would be expected to show an appreciable advantage over the direct comparison using S and B. Considering now the errors associated with the correction terms θ_S ... of equations (3.6) to (3.8), introduced to allow for differences of Poisson's ratio, some advantage may lie with the direct comparison using S and T in which the two Poisson's ratios are nearly equal, the correction term in this case amounting to only about 2% of the total distortion factor.

The data of Tab. 2 are therefore seen to be consistent with the assumptions that the main errors involved are associated with the values adopted for the elastic moduli, and that the ratios of these are known to the order of ± 1 or 2%, the corresponding distortion coefficients being contained within a dispersion of about ± 4%. If, however, the two most favourable comparisons (λ''_S and λ'''_S) are selected, and the mean taken, the final result is unlikely to be in error by more than about 2%. In the practical application of the results this procedure has been adopted.

Table 2. *Results of three-material experiments*

Nominal effective area	Pressure range (bars)	Distortion coefficient of steel assembly for castor oil (bar^{-1}): Direct comparison with bronze (λ'_S)	Direct comparison with tungsten (λ''_S)	Indirect comparison (λ'''_S)
0.05 in² (0.322 cm² approx.)	500	$4.2_1 \times 10^{-7}$	$4.0_0 \times 10^{-7}$	$4.0_9 \times 10^{-7}$
0.02 in² (0.129 cm² approx.)	1200	$3.9_6 \times 10^{-7}$	$4.1_0 \times 10^{7}$	$4.0_5 \times 10^{-7}$
Mean results for above cases		$4.0_8 \times 10^{-7}$	$4.0_5 \times 10^{-7}$	$4.0_7 \times 10^{-7}$

c) *Extension to pressures of 6000 bars*

The extension of the similarity method from 3000 to the region of 6000 bars has been carried out entirely with assemblies of type b), of nominal area 0.005 in², those of type a) being normally restricted to use below 3000 bars. The experimental value of the distortion coefficient is $3.0_2 \times 10^{-7}$/bar, and is thus appreciably smaller than the figure for assemblies of type a) averaging at about $4.0_6 \times 10^{-7}$/bar.

The form of the type b) assemblies approximates more closely to the "ideal" piston-cylinder combination. In considering the formal theory in Section 2 it was noted that a very simple approximation to the distortion factor could be derived on the assumption that the radial displacements of the piston and cylinder surfaces at any position due to the fluid pressure in the interspace are proportional to the pressure at that position, and the limitations of this assumption were discussed. Inserting the appropriate numerical values in equation (2.6) the distortion coefficient so deduced, assuming a ratio of external to internal cylinder diameter of 10:1, is about 2.9×10^{-7}/bar. The close approach of this figure to the experimental value for the type b) assemblies certainly suggests that the assumptions involved in the "naive" theory are not greatly in error in this case. There are, however, some features of the actual cylinder, notably the