extent small departures from ideal similarity were likely to affect the results. For this purpose assemblies were constructed using alternative pistons of the 'wrong' diameter, so arranged that the initial dimension of the gap was incorrect by amounts as much as 20 per cent. These supplementary measurements showed that departures of this order of magnitude caused no significant difference in the rate of change of effective area with increasing pressure, and it may therefore be concluded that great exactitude in the choice of the initial condition is not as critical as might appear at first sight. Experience in the calibration of groups of piston-cylinder assemblies of the single-piston type of Fig. 1.23 *a* also confirms that the normal manufacturing tolerances of these assemblies do not cause any material departure from the similarity conditions postulated in the above treatment.

RESULTS OF MEASUREMENTS OF VARIATION OF EFFECTIVE AREA

Fig. 1.24 *a-d* show a selection of the results which have been obtained on a number of different types of piston-cylinder assemblies. Fig. 1.24 *a-c* illustrate the results for three different ranges of pressure on assemblies of the same construction, differing only in the diameters of the pistons, these being some of the actual steel assemblies on which the basic similarity measurements were carried out. The type of assembly is a standard manufactured product and is similar to that illustrated diagrammatically in Fig. 1.23 *a*. This type of assembly is normally screwed into the top of a steel column and the load is supported on a carrier of the overhang type which in turn is supported on the top of the piston through the medium of a steel ball. The measurements all correspond to the condition with the piston rotating freely in the cylinder at a speed of the order 35-40 r.p.m. It will be noted that the changes of effective area of these assemblies were in most cases substantially linear functions of the pressure, the slope being nearly constant for the three pressure ranges which together cover the range up to about 3,000 atm. It has been found that assemblies of this general type show very consistent results as regards the rate of change of effective area, so that the examples shown may be regarded as reasonably typical.

Attention has, however, been drawn to the fact that the dependence of effective area upon pressure may be a function of the manner in which the coefficient of viscosity of the transmitting fluid depends on pressure. It has been found experimentally that variations from this cause do in fact occur, and an example is shown in Fig. 1.24 *b* in which the changes of area for a particular piston-cylinder assembly are shown over the range up to 2,000 atm., using three different transmitting fluids. As might have been expected, the dependence on the nature of the transmitting fluid is greatest over the upper part of the pressure range, this presumably

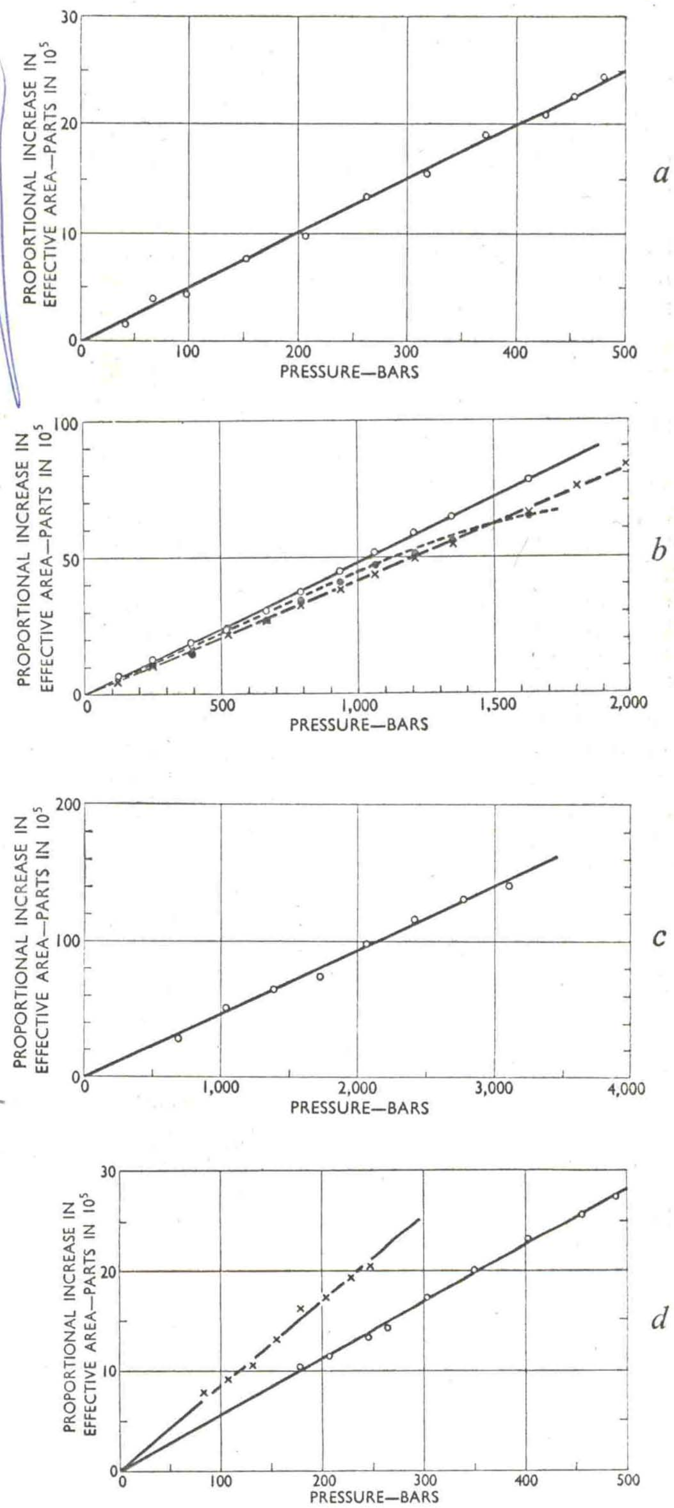

Fig. 1.24. Dependence on Pressure of Effective Area of a Steel Piston–Cylinder Assembly

a Nominal area 0·05 sq. in.
c Nominal area 0·01 sq. in.
d Differential piston cylinder.
× Nominal area 1 sq. cm.
○ Nominal area 0·5 sq. cm.

b Nominal area 0·02 sq. in.
○ Light mineral oil.
× Castor oil.
● Liquid paraffin.