Similar sets can be taken at + 90° and + 135° on original set, and the final mean will be free from errors due to eccentricity of axis. It has been my practice to take four sets at 0, 45° 01′, 90° 02′, and 135° 03′ round the circle. The vertical readings are always taken after 10 a.m. and before 3 p.m. There is sometimes a fair difference in the angles, due to refraction, but the mean of four sets taken on different days should be the best obtainable.

Level-corrections.

The level is divided from left to right from 0 to 35 divisions, so that when the instrument is face left the larger figures are at the eye end; and when face right, at the object end.

The sum of the eye and object bubble readings divided by 2 gives the position of the centre of the bubble. If this coincides with 17·5, the centre division of the scale, there will be no level-correction, but, if not, then the following rule has to be followed :—

If $\frac{E+O}{2}$ comes less than 17·5, then the correction is a plus to the actual circle reading on the circle, whether the instrument is face left or face right; if more than 17·5, then the correction will be a minus to the actual circle reading.

To get the value of one division of the level scale I took a number of readings all round the circle by the usual method of slightly altering the level of the instrument and noting the differences by micrometer and level readings. This worked out at 5·73 seconds, although the Kew certificate which came out with the instrument gave the value as 8 seconds. Adopting my figures, I made out the following table to simplify the working :—

Example IV.

$\frac{E+O}{2}$	Seconds Correction.
15·50	+*11·46*
15·75	+*10·03*
16·00	+ *8·59*
16·25	+ *7·16*
16·50	+ *5·73*
16·75	+ *4·30*
17·00	+ *2·86*
17·25	+ *1·43*
17·50	*0·00*
17·75	− *1·43*
18·00	− *2·86*
18·25	− *4·30*
18·50	− *5·73*
18·75	− *7·16*
19·00	− *8·59*
19·25	−*10·03*
19·50	−*11·46*

In Examples I and III, to get the level-corrections, work out the value $\frac{E+O}{2}$ and look up the table in Example IV, keeping an eye on the sign. This correction can be applied to the actual circle-readings before working out the vertical angle, and then the result would be the true vertical angle free of level-error. For instance, take Example II : the figures would be, to Somes,—

Face left	0°	03′	04·5″ − *1·4* =	0°	03′ 03·1″
Face right	5	19	56·0 − *5·7* =	5	19 50·3
				5	16 47·2
True vertical angle =				2	38 23·6
				2	41 26·7
				5	19 50·3

My own method is to take out the angle as in Example II and apply the correction to angle afterwards. To do this the following rule must be remembered : Change the sign of the correction opposite the lesser of the face-left or face-right readings; take the algebraical sum of the two corrections, and divide by 2. Thus in example we have $\frac{-5·7+1·4}{2} = -2·15$. This gives for the final angle 2° 38′ 25·75″ − 2·15 = 2° 38′ 23·6″, which is the same as by method shown above.

In obtaining the final vertical angle from the different sets I put down the angles with their corrections for level-error alongside and take the mean.