ART. XVII.—*A New Method for determining the Collimation Constant of a Transit Circle;* by J. M. SCHAEBERLE.

THE collimation constant of a transit instrument is usually determined by one of the four following methods:

1. By observations of stars in reversed positions of the instrument.
2. By reversal on a collimator or very distant terrestrial object.
3. By combining observations made with the spirit level with nadir observations.
4. By Bessel's method, in which two horizontal collimators (placed on opposite sides of the instrument and having their optical axes parallel) are used.

The last two methods are usually employed in cases where, on account of the construction or size of the instrument, it is not advisable to reverse it very often; or, as in case of the Greenwich circle, where the instrument cannot be reversed at all.

As the greatest possible accuracy is sought with instruments of this class, it is especially desirable to vary the processes by means of which the instrumental constants are obtained. The various results derived, besides serving as a check on data otherwise obtained, furnish means for investigating irregular variations in the so-called constants, due to changes in the material of which the instrument is made.

The method which I am about to propose for finding the collimation constant, without reversing or disturbing the instrument, is believed to have some advantages over the ones already mentioned.

A light but rigid framework is hung from the pivots of the horizontal axis, the arms being of such a length that the telescope can be turned to the nadir. The whole arrangement being similar to a hanging level with this difference—in place of a level tube is substituted a plane mirror, securely held in such a position that when the telescope is pointed to the mirror the optical axis will be nearly normal to the reflecting surface.

With the aid of an adjusting screw one of the arms can then be lengthened or shortened until the middle transit wire and its reflected image are nearly in coincidence. The horizontal wire is then brought into coincidence with its reflected image by slightly rotating either the telescope or the hanging collimator about the horizontal axis.

Let m_1=the distance of the middle transit wire from its reflected image; positive when the image is on that side of the wire which is toward the clamp. m_2=corresponding distance after the *collimator* has been reversed. c=collimation constant —then

$$c=-\frac{m_1+m_2}{4}$$

The collimation constant is therefore positive (for clamp west) so long as the algebraic sum of the distances m_1 and m_2 is a negative quantity.

If the pivots on which the instrument rotates are not of the same diameter, the expression for c will evidently become

$$c=-\left(\frac{m_1+m_2}{4}\mp p\right)$$

p being the angle included between the axis of rotation and a rectilinear surface-element of the frustum of a cone having for bases those circular sections of the pivots which rest upon the wyes, the upper sign being used when the clamp pivot is the larger.

On account of the length of the arms of the collimator, inconvenience may be experienced in its reversal unless some changes are made in the castings through which the arms of the hanging level must pass before the instrument can be leveled. This seems to be the only objection that is likely to be raised against the practical application of the method to instruments now in activity. The film of silver, if kept properly covered when not in use, will last for years before resilvering will be necessary.

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