INSTRUMENTS.

A NEW "LODIS" LEVELLING STAVE

by

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Messrs. Carl ZEISS, Jena, have brought out, for use with the Lodis and Kipplodis, a new levelling stave which was exhibited for the first time before a large party of topographical operators, in connection with the opening of the optical telemetry courses, from 2th to 22nd February 1939.

The incentive for the construction of this stave, or rather for the modification of the previously employed graduations, came from practical experience, and are as follows (1):

In the summer of 1937, I caused the optical-polar survey of the Wölferbütt district, which was in hand under the agricultural land redistribution act, to be completed with the Kipplodis. After termination of the daily field work, the officials who had been operating with Kipplodis (2), complained that they could see "only lines". This drawback was due to the fact that, at greater distances, it is not an easy affair to pick out a round-figure graduation-line on the left-hand half-image, as an index for the reading of the graduation of the right-hand half-image, and to hold it fixed during the reading, especially in a vacillating atmosphere.

With cold weather and steady images, the distance reading for an ever so slightly trained observer is an easy matter. However, here also a certain amount of training is nevertheless required, in order to pick out from the multifarious graduation lines of almost the same appearance, those appropriate for the difference reading, and to estimate the centimetres of the distance (fig. 1). A slight gap on the image separating edge, which

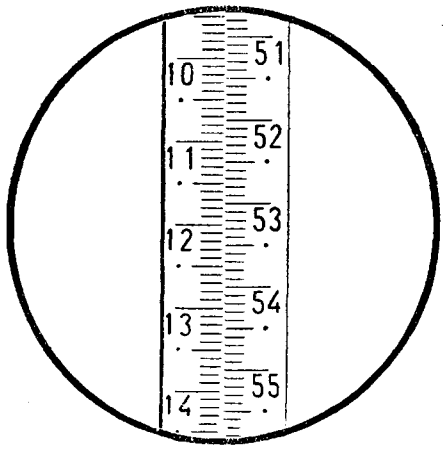

FIG. 1.

Telescopic image with the old stave. Reading: 53.26 — 12.00 = 41.26 m.

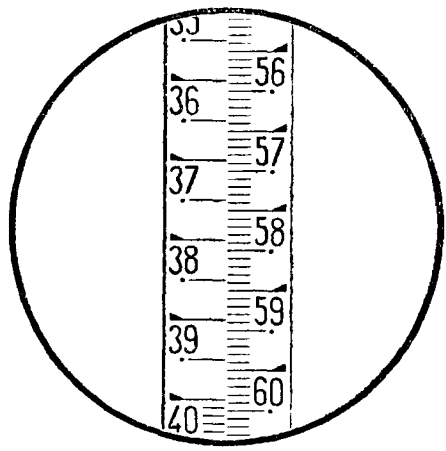

FIG. 2.

Telescopic image with the new stave. Left-hand section, from lower stave half; right-hand section from upper stave half. Reading: 58.37 — 38.00 = 20.37 m.

(1) *Instrument and measuring method with the Lodis and Kipplodis are here assumed to be known. They were described in detail in the* Zeitschrift für Vermessungswesen, 1930, p. 469 & seq., and 591 & seq.

(2) *See Hydrographic Review Vol. XVI, N° 1, May* 1939, page 164, fig. 6.

may be caused instrumentally, or again the fact of not holding the stave exactly vertical, due maybe to its oscillation under the prevailing wind, also enhances the difficulty in reading, especially when, in the interest of speeding up the measurement, with long measuring lines, it is sought to take the offsets as long as possible (50-60 m.). It was a matter of great concern to me to make the stave reading more convenient and thereby more reliable. Messrs. Carl ZEISS gladly yielded to my suggestion. The result was as follows :

The first thing that occurred to one was to prolong the ten-unit lines sideways to such an extent that, by a corresponding lateral fine setting on the left-hand half-image, there would no longer appear the multitude of the graduation-lines, but, in an appreciably clearer sequence, only the ten-unit lines serving as index. This would, however, not have been feasible without considerable widening of the stave. Only the possibility of a shortening of the decimal-lines of the 1/2 centimetre-graduation and the simultaneous emphasizing of the decimetre index-lines remained. During the trials carried out by Messrs. Carl ZEISS, it proved necessary, however, not to shorten the decimal-lines of the stave over its whole length (4 m.), but merely in *the lower two metres* (0 — 40 *of the graduation*).

This seemingly peculiar result presents the following advantages:

1. The double image is composed, especially with long sights, mostly of parts belonging both to the upper and lower stave halves (Fig. 2). In such cases, with the new stave graduation, the image separating edge does not need to coincide exactly with the middle of the stave. With the small and unavoidable oscillations of the stave, this circumstance is particularly beneficial, for no small gaps occur between the two stave images. On the contrary, the image of the graduation is invariably shifted optically under the image of the index-lines so that the reading is always possible.

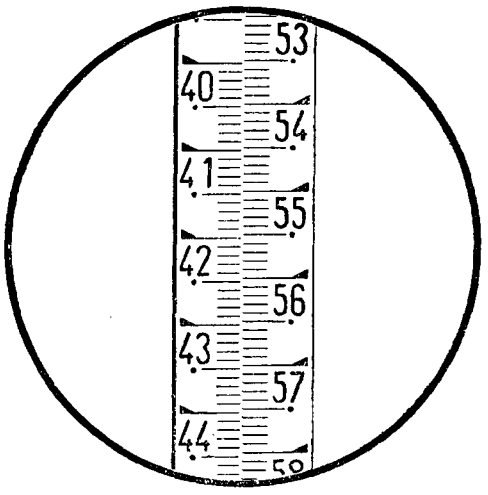

FIG. 3.
Telescopic image with the new stave. Sections right and left from upper stave half. Reading: 55.53 — 42.00 = 13.53 m.

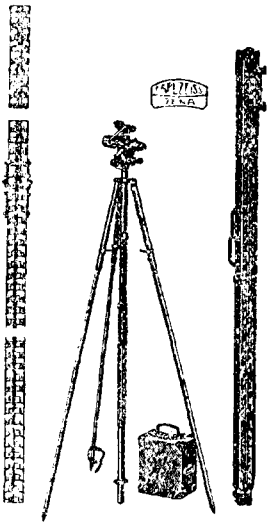

FIG. 4.
Kipplodis. Whole outfit with the new staves.

2. At short distances — about 30 m. — it will happen that the double image is composed merely of parts of the lower, or of the upper stave half. If the image is composed of parts of the *lower* stave half only, then the image separating edge must be set somewhat more accurately than in case 1. on the middle stave, so that no gap between the image of the shortened decimetre-graduation and the index-graduation occurs. This is, however, immaterial practically, for, precisely here, only short distances are involved, at which the image is sufficiently large, and the fine-setting of the image separating edge on the middle of the stave comparatively easy. Also, oscillations of the stave near the station point (= centre of rotation of the oscillations) have not the same influence as in the upper part of the stave. Furthermore, vacillation of the air makes itself hardly noticeable. In practice, there-

fore, this case means no aggravation of the difficulties. The stave image presents itself, with accurate lateral setting, as in case 1.; by setting too far to the right, as in case 3.

3. If the image is composed of parts of the *upper* stave only (Fig. 3), a gap between the two graduation images is not more likely to occur than with the old stave graduation. The decimetre-lines (unit-lines) are here long enough. As in this case also, one has to do with short distances only, the influence of vacillation of the air is just as small as in case 2. There are no fundamental changes as compared with the reading on the stave hitherto used. But the reading is facilitated by the heavier marked metre-lines and the somewhat greater thickness of the graduation-lines.

In test observations conducted with a work-shop model of the new Lodis stave (Fig. 4), all the observers present agreed that the clear image on the left-hand side (the "index-graduation") greatly facilitated work; this was noticed especially at greater distances — and for these alone the modification was made ! This was recognized as a great advantage. Stretches of 60 m. could be directly measured as 30 m. formerly, and occasionally even 70 m.

This innovation will certainly be appreciated by many a practitioner as a great practical advantage, and the more so as the optical topographic method of surveying is to be applied on a larger scale than heretofore in the new measurements.

Since the purely polar method of surveying was not universally adopted in the old Reich, as, owing to its more difficult execution, more and more objections were continually raised against it, now through the combination of Redta and Kipplodis, the possibility is given for the fulfilment of all the desires and practical requirements. The new Lodis stave can but exert a favourable influence on this development.