Physics. — *"The Removal of Errors Caused by Irregularities in the Registering Apparatus in Self-Registering Micro-Photometers."* By W. M. KOK and Prof. P. ZEEMAN.

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In the photographic diagrams made with a self-registering micro-photometer (e.g. that of MOLL), the position of the spectrum lines is determined by measuring the distance between a top and a fixed ordinate, and multiplying it by the magnifying factor determined separately. In the case of symmetrical distribution of the light intensities symmetrically situated points of the intensity curves will probably be chosen instead of the top.

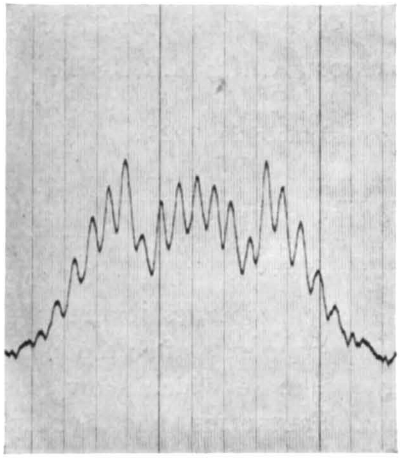
It should, however, be borne in mind that in all this it is tacitly assumed that the coupling between the original photographic plate and the paper on which the photographic diagram is projected, is flawless, and that it is overlooked that the paper may have been transformed during the development.

It is possible to make a very perfect screw for the slide, which works the slide with the photographic negative. But technically it is a very difficult problem to construct with the same accuracy the toothed- and the worm wheels which determine the coupling with the registering cylinder.

A very simple construction renders it possible automatically to register at the same time a scale division which eliminates all the difficulties described.

A disc, 33 cm. in diameter, slit radially 2 cm. deep at fifty places — every tenth incision of double the breadth, the fiftieth of four times the breadth — is mounted on the axis working the slide with the negative, the thread of which is assumed to have been cut very accurately.

An auto-lamp (in a tube with slit, 8 Volts 25 N. C.) is placed behind the disc, a lens (10+) is placed before it. The light of the lamp falls on a narrow mirror, mounted on the wall beside the galvanometer (± 120 cm. before the photometer). Via the mirror, the lens throws a greatly magnified image of the edge with slits on the front of the registering box. Every time that a slit of the disc passes the light slit of the lamp, the slit of the box is illuminated for a moment; then a line is drawn on the bromide paper, the tenth line is somewhat thicker, the fiftieth is still heavier.



If the galvanometer and the lamp illuminating the disc can be adjusted separately with a resistance at any tension between 4 and 8 Volts, scale and curve can be obtained of any thickness required; even of the sharpness of a hair, if the cylinder lens of the registering box is very good and accurately adjusted, and when it is covered except for the slit of ± 1 mm.

If the speed of the micrometer screw is 1 mm., if the paper runs 40 mm., the negative 1 mm. per minute, the lines on the paper will be at a distance of 0.8 mm.; this distance is the most convenient one for the eye; it corresponds with 20 microns on the gelatine plate.

If the scale division is very fine, it does not interfere with the determination of a top. The accuracy of reading may be reckoned to have become five times greater by this procedure. The method is particularly suitable for the comparison of two curves, which are photographed under each other. If care is taken that the arrangement for corresponding spectrum lines has almost the same position, the second not photographed scale may be assumed to coincide with the first.

As appeared to us later, the method described bears a close resemblance to a procedure due to S. GARTEN to register times on a diagram, which is well known to physiologists. In the literature we have, however, found nowhere mentioned the combination described here for removing errors in the registering apparatus in a microphotometer.

A diagram of the chromium line 4254 in a magnetic field, which contains the line system discussed here, may serve as illustration of the method. The chromium line in question is split up into $3 \times 7 = 21$ components by a magnetic field, and was photographed by Mr. J. VAN DER MARK in the laboratory at Amsterdam. It was already measured by HILDE GIESELER[1]) and has as symbol $4^7_{13} - 4^7_{22} = 4254{,}503$.

[1]) H. GIESELER. ZS. f. Physik 22, 228, 1924.