# LETTERS TO THE EDITORS

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## A New Type of Microphotometer

THE following note contains a short description of the principle of a new type of microphotometer, the details of which will be published elsewhere. The main feature of this new device is that it gives a practically instantaneous record of the blackening curve, that is, the distribution of transparency of a photographic plate or a similar object along a straight line, which appears on a fluorescent screen and therefore permits a quick visual survey of the blackening distribution in a whole plate. The new instrument is comparatively small, easily transportable from one place to another, and it contains no delicate or expensive mechanical parts. It can, if necessary, be put together in any laboratory workshop from parts of existing apparatus.

The instrument consists of two separate parts, the 'receiver' and the 'recorder', which are only electrically connected. The receiver consists of a light source (small incandescent lamp), a slit on which the light from the source is concentrated, a microscope objective which forms a reduced image of the slit on the plate under investigation, and a photo-electric cell (cæsium, gas-filled) on the cathode of which the light is finally concentrated. The plate is fixed to one prong of an electromagnetic tuning fork operated by 50 c./sec. A.C. so that it performs a simple harmonic oscillation in its own plane and normal to the direction of the beam.

The recorder consists mainly of a cathode ray oscillograph of commercial type with a two-stage linear amplifier for the deflecting potential in the vertical direction. The input voltage of this amplifier is taken across a high resistance in the anode circuit of the photocell. The deflexion of the cathode ray is therefore proportional to the transparency of the plate at the particular point just passing the slit image. The potential for the deflexion in the horizontal direction is supplied by the same A.C. which operates the tuning fork in such a way that the two oscillations, the mechanical one of the plate and the electrical one of the deflecting field, are exactly in phase. The horizontal deflexion of the cathode ray

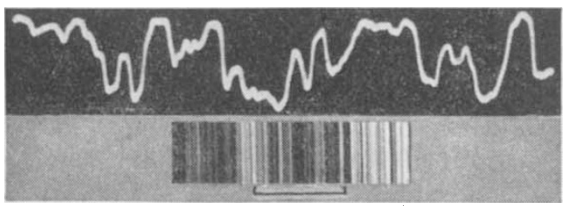

Fig. 1.
UPPER: BLACKENING CURVE OF A PART OF THE PHOTOGRAPH OF A BAND SPECTRUM.
LOWER: ENLARGED POSITIVE OF THE SAME BAND SPECTRUM, THE RECORDED REGION BEING MARKED BELOW.

is therefore exactly proportional to the displacement of the plate. Thus the recorder plots automatically the blackening curve along a line on the plate equal in length to twice the amplitude of its vibration.

The magnification of the instrument, that is, the ratio of the horizontal distance of two corresponding points on the screen and on the plate, can be easily and quickly changed by changing the amplitude of the vibration of the fork between about 25 and 500. It is obviously also easy to change the scale of the recording curve in the vertical direction. Hence the instrument can be adjusted to any particular object within a few minutes.

The whole vibrating mechanism can be shifted in the direction of the vibration by means of a micrometer screw. By this procedure the picture on the

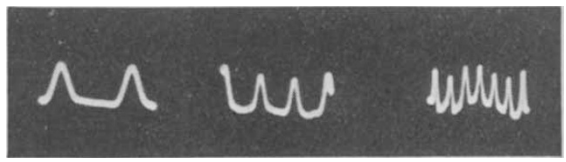

Fig. 2.
RECORDS OF THE BLACKENING CURVE ALONG A MICROSCOPIC SCALE, CONSISTING OF PARALLEL LINES 0·1 MM. APART, TAKEN WITH DIFFERENT MAGNIFICATIONS.

screen is bodily shifted in a horizontal direction so that different parts of the blackening curve come successively into the field of observation. In this way the blackening curve can be obtained over the whole length of the plate and, if necessary, along a whole set of parallel lines.

The different parts of the curve can, if so desired, be traced or photographed and afterwards put together for recording purposes. Fig. 1 is an example of such a record. The upper part represents the blackening curve along a certain part of a band spectrum shown in the lower part of the figure. The original magnification factor in this case is approximately 60. Fig. 2 shows the blackening curve along a microscopic scale consisting of parallel lines 0·1 mm. apart, taken with different amplitudes of fork vibration. The magnification factors were 380, 180 and 80 respectively. Although these curves perhaps show less detail than those obtained with the usual kind of microphotometer (mostly because of their thickness) this disadvantage will for many purposes be more than balanced by the advantages mentioned in this note.

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## Valency and Orientation

MANY rules have been given[1] with the object of summarizing in an approximate manner the directive effect of substituents on further substitution in benzene. The values of these rules are practical, theoretical and didactic. The instructive value of many of them is often slight because of their complexity, and it is primarily in an attempt to overcome this complexity that I wish to suggest yet another. It is based upon a simple valency rule I have proposed for use in the teaching of elementary chemistry[2]. Like this valency rule, the new orientation rule is in accord with the simple electronic theory of valency; in particular, it is an alternative expression of the simplicities of the somewhat complicated electronic orientation theories of C. K. Ingold[3] and R. Robinson[4]. It can be stated as follows:

If $X$ be the atom attached to the benzene nucleus in a compound $C_6H_5Y$, then the group $Y$ which contains $X$ is an *ortho/para*-directing group when the valency of $X$ is equal to or less than 4, and a *meta*-