A double "E" is clearly seen one exactly over the other in such-wise that the lower limb of the upper "E" and the upper limb of the lower "E" coincide.

Careful examination with Placido's rings failed to demonstrate the slightest irregularity of the cornea, which was found with the slit-lamp to be absolutely normal.

The cause of the diplopia was clearly shown by an examination of the lens with the slit-lamp. A large fluid-cleft lay in the horizontal diameter right across the lens. It occupied the whole depth of the cortex being bounded before by the subcapsular line and behind by the surface of the adult nucleus. The rest of the cortex was normal except for a few striae. This cleft formed an optical opacity dividing the lens into an upper and a lower segment. These acted independently forming an upper and a lower image upon the retina.

TSCHERNING'S PHOTOMETRICAL GLASSES*

BY

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THE different methods of examination of the light-sense and of the adaptation for light, which the ophthalmologist hitherto has had at his disposal, are rather troublesome and incomplete. The most exact instrument is Förster's photometer which in its original form consists of a black, light-tight camera, in the front wall of which are made two holes, for the right and the left eyes respectively, through which the patient looks into the camera. On the inside of the opposite wall is fitted a white square, which is illuminated by the flame of a stearine candle, fixed on the outside of the front wall, and surrounded by a screen. The light enters the camera through an Aubert's diaphragm, by means of which the illumination is measured. The object of the examination is to secure the least illumination, by which the white square inside the camera can be observed. The examination must take place in a perfectly dark room. We have also other instruments constructed according to the same principles, such as the adaptometer of Nagel and Piper.

Another method is to take the patient into a perfectly dark room, in the shutter of which has been fixed a big Aubert's

*See also *Brit. Jl. of Ophthal.*, Vol. X, p. 231, 1926.—ED.

diaphragm. The vision is then examined in the usual way, but by decreasing illumination. The quantity of light is measured by means of the diaphragm in the shutter.

Seeing that these different methods are rather troublesome and require a perfectly dark room, the ophthalmologist will often satisfy himself with an estimation: By means of shutters or curtains the daylight is partly shut out and then the vision of the patient is compared with that of somebody with normal light sense. In this way we can manage rather easily, but the result is of course not quite satisfactory.

Professor M. H. E. Tscherning by means of his photometric glasses has provided us with an instrument that is easy to manage and also gives a surprisingly perfect and exact result. The instrument consists of a series of plain dark glasses, which can be fixed in a light-tight frame. These glasses are constructed in such a way that No. 1 lets through 1/10 of the light; No. 2, 1/100; No. 3, 1/1,000; and so on till No. 10. Thus the number of the glass indicates how much light it lets through according to the following formula.

$$\text{No. X} = \frac{1}{10^x}$$

If we take for instance No. 5, this glass will let through

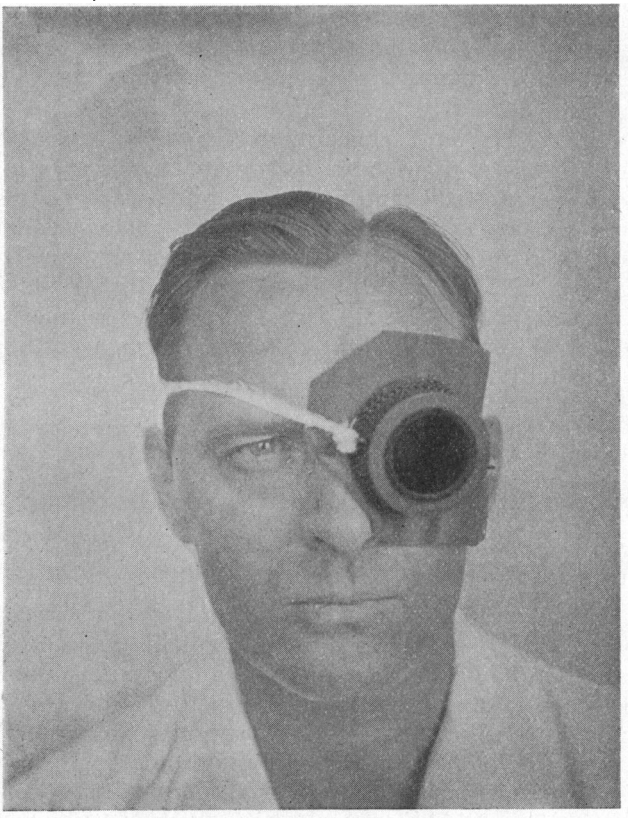
$$\frac{1}{10^5} \text{ of the light thus } \frac{1}{100{,}000}$$

The great advantage of this construction is that we can simply add the numbers. No. 2 + No. 4 are equivalent to No. 6. We have thus here a simple and exact standard, analogous to our standard for refracting glasses. Just as the refracting power is expressed in "dioptres" (D.) so Tscherning proposes to express the light-absorbing power of his glasses in "photopters" (Ph.); and just as we speak about the "amplitude of accommodation" of the eye, which is expressed in dioptres, so he proposes the new name: "amplitude of adaptation," which is expressed in "photopters."

The frame consists of two very short tubes. The one is applied light-tight in front of the eye by means of two narrow bandages. For hygienic reasons a piece of black silk-paper with a hole in it for the eye, is placed under the frame. In the second tube the glasses are fixed, and then it is pushed into the tube in front of the eye. The figure shows the appearance of the instrument. During the examination the other eye is covered.

As a source of illumination the flame of a stearine candle is used at a distance of half a metre. The room need not be dark but the light must not be too strong. The patient is seated with his

back towards the windows. We now proceed to find the darkest glass, with which the patient can just see the candle flame. The number of this glass corresponds with the amplitude of adaptation. If for instance the number of the glass be 8, then the amplitude



of adaptation is also 8 photopters. As is seen the examination is very simple and does not exact very much from the intelligence of the patient. I have applied it to a Javanese boy, aged 6 years, suffering from hemeralopia, and found without much difficulty the amplitude of adaptation, which was 4.5 photopters.

A differentiation must be made between the primary adaptation which takes place within 10 to 15 minutes, and the secondary which takes place within half to three-quarters of an hour. About the power of these two functions Professor L. Heine writes in Axenfeld's *Lehrbuch der Augenheilkunde*, p. 165, 1915, as follows:

"Diesen Teil der Adaptation wollen wir die primäre Adaptation nennen; sie beginnt momentan nach Eintritt in einen dunklen Raum, und erreicht ihr Maximum nach 10-15 Minuten.

"Die Empfindlichkeits-steigerung des Auges betragt in des höchstens das 50-fache vom Ausgangswert.

"Nunmehr, d.h. 10-15 Minuten nach Eintritt in einen absolut dunklen Raum, tritt eine rasche Empfindlichkeits-zunahme des Auges fur minimale Lichtreize ein, welche nach $\frac{1}{2}$-$\frac{3}{4}$ Stunde mindestens das 500-fache des Ausgangswertes erreicht. Diesen Teil der Adaptation nennen wir die sekundäre Adaptation."

When we now investigate the results we have attained with the photometric glasses we must be prepared for a surprise. In the prospectus accompanying the photometric glasses we read as follows:

"Die Adaptationsbreite des normalen Auges ist von 9-10 Ph.; nach einer halbstündlichen Adaptation kan die Mehrzahl die Flamme mit No. 10 sehen." (The breadth of adaptation of the normal eye is from 9-10 Ph.; after half an hour's adaptation the majority can see the flame with No. 10.) From this it does not appear clear how great the primary amplitude of adaptation of a normal eye is. I have found it to be 8 photopters. Instead of the two figures of Heine, 50 and 500, we get here 100,000,000 and 1,000,000,000 or even 10,000,000,000. How is this possible? The explanation is simple enough, and consists in the fact that in the examination with Förster's photometer the illumination is already enormously diminished before the examination takes place. The patient is first taken into a perfectly dark room and it takes a certain amount of time before he gets into the right position in front of the photometer. Then he must look at a not very big white square illuminated by a fractional part of a candle flame only. This is "der Ausgangswert." Thus it is only the very last end of the amplitude of adaptation, which in this way is secured, while Tscherning's photometric glasses secure the full amplitude of adaptation, showing at the same time, how perfect an optical instrument the human eye is also in this respect.

It is certainly a fortunate thought of Tscherning to measure the light in this way; but the accomplishment of his plan has been very difficult and has required much work and patience. To graduate a smoke-coloured glass-mass so exactly, must certainly be considered an impossibility; and besides that, such a glass will not allow the different rays to pass in the same proportion. Through a very dark smoke-glass we therefore see a candle flame coloured red. The object is attained by means of plates of gelatine, which can be stained very exactly. These plates are then fixed by means of Canada balsam between two discs of plate

glass. The glasses are constructed in such a way that the separate rays, notwithstanding the great difference of wave length, are allowed to pass nearly in the same proportion; thus the colour of the object is not changed.

In a lecture delivered by Tscherning in Copenhagen in December, 1924 (Ugeskrift for Laeger, 1925, No. 9, Copenhagen), he points out that a new method of examination will usually give rise to quite a harvest of scientific results, and he predicts that this also will be the case with regard to the photometrical glasses. May it be so.

The glasses are made by Fischer, whose ability and perseverance have contributed to the success of the work. From him the glasses can be ordered. There are two collections available, *viz.*: (1) the complete collection; and (2) the smaller collection. The prices are 200 and 85 Danish *kroner* respectively. The collections also contain glasses for the testing of the colour sense. The address is:—N. Fischer, Fabrikant, 32 Aaboulevarden, N. Copenhagen.

ANNOTATION

The Annual Report of the Metropolitan Asylums Board for 1926-1927 (Children's Section) gives a very interesting account of the success obtained in making efficient citizens from damaged material, and, what is even more important, of the measures adopted to prevent such damage occurring. Treacher Collins points out in his report on the treatment of eye diseases at White Oak that the establishment of schools for the isolation of contagious eye disease has served to stamp out trachoma from the Poor Law schools of London. As a similar policy has now been adopted in the London County Council schools, it is to be expected that, in the course of time, trachoma will disappear from these schools in the same way. As we noted last year (*Brit. Jl. of Ophthal.*, Vol. X, p. 651) the accommodation no longer needed for contagious disease is now utilized for such conditions as interstitial keratitis. Admission can be obtained for children under 15 years of age through the Board of Guardians anywhere in Great Britain, and in the London County Council area through the school doctor. It is to be hoped that ophthalmic surgeons will make full use of the facilities afforded in the treatment of this class of case which is notoriously unsatisfactory in the hospital out-patient department.