in which λ is the illumination of the pupil expressed in candles at 1 kilometre.

I the intensity of the light expressed in candles.

x the distance in kilometres between the lighthouse and observer.

a the coefficient of transparency per kilometre, i. e. the ratio between the luminous energies measured at two places in line with the lighthouse — distant from each other 1 kilometre — taking into consideration the law of the square of distances.

From this one can calculate, for all values of a comprised between 0.5 and 1, the distance at which a light will yield the same value of λ, comprised between 0.1 and 1, as another light located 1 kilometre from the observer.

This diagram may be used for values of λ greater than 1 or less than 0.1; it suffices to find for $\lambda = 1$, the range of light whose intensity is divided by the same value of λ.

The illuminations of the pupil may be expressed in lux; in which case $\lambda = 1$ would be written 10^6 lux.

DIRECTION FINDING BY SOUND.

(Extract from an article by Dr. W.S. TUCKER, O.B.E., Director of Acoustical Research, Air Defence Experimental Establishment, published in *Nature*, London, July 18, p. 111).

....

I will only give one example ......, which ...... deals with the direction finding of fog horns and ships' sirens at sea. The need of supplementing the human ear has been recognized by many navigators, especially as meteorological conditions sometimes baffle the listeners. Situations may also arise when the nearness of the foghorn involves hasty and definite action. The invention of

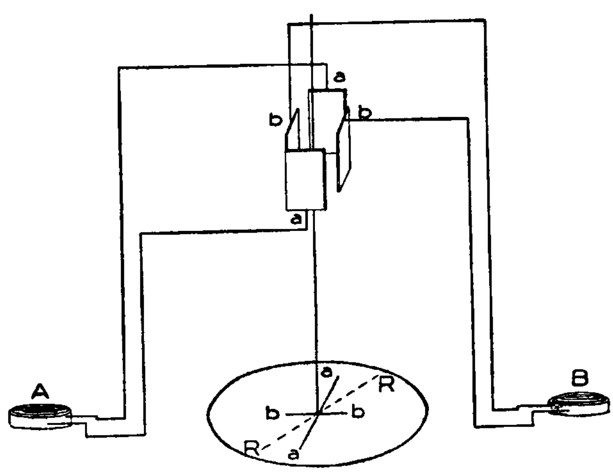

Diagram of Cathode ray oscillograph.

Messrs. W. and T.G. Hodgkinson is directed to the supply of accurate bearings (to half a point of the compass).

The devices tried out were of two types. The first and simpler form of direction finder consisted of a paraboloidal receiver mounted in a drum rotatable about a vertical axis. The axis of the paraboloid was horizontal and coincided with a diameter of the drum. At the focus of the paraboloid a contact microphone was mounted, and the mouth of the paraboloid was protected from wind by a perforated screen. Microphone adjustments were such that the noises of the ship on which it was erected and disturbances from wind produced little effect, but it would respond to horns and sirens up to ranges of three miles. The axis of the drum carried a commutator, and brushes were arranged so that, for sixteen positions of the drum, currents generated by sound in the microphone could light a lamp through the agency of a relay. Sixteen of these lamps were arranged in a dial to give the points of the compass against which any sound disturbance could be anticipated. For near foghorns, a group of lights might be shown on a definite arc, the centre of which would give the bearing. This instrument was used for a period on the Mersey pilot-service and on the Holyhead-Dublin mail service. A later pattern, where a much larger drum was used, avoided the operation of rotating the drum, the same effect being achieved by using a number of radial paraboloid receivers, each with its own light indicator. This was installed on S.S. *Victorian* of the Allan Line on the Liverpool-Montreal service. The instrument, though successful, was not brought into general use.

THE EAST AFRICAN ARC

by

BREVET-MAJOR M. HOTINE, R.E.

(Extract from an article published in *The Empire Survey Review,* N° 12, 14, 16, 18 (1934-1935).

This account deals with the geodetic triangulation carried along the eastern side of Lake Tanganyika during 1932 and 1933, under the direction of the author, Major HOTINE.

. . . .

The section on observation deals with instruments, methods of observation and records. The Tavistock theodolite is highly commended; the Wild, on the other hand, developed axis trouble. The interesting point is raised why surveyors in different parts of the world differ so widely in the number of measures considered necessary — varying from eight in South Africa to thirty in India. The author considers that the two essentials in observing are symmetry and speed. In order to ensure the former he recommends that observations should be made in such a manner that, if interrupted before completion, there shall always be a symmetrical set available; thus zeros should be taken 0°, 90°, 45°, 135°, 22° 1/2, 112° 1/2, etc. The second principle is based on the assumption that, whatever care is taken, the instrument, atmosphere, ground are all moving to some extent, and that the quicker the observations are taken the less movement there will be. All surveyors of experience will be disposed to agree.

Most of the observing was done at night, on lamps; and it is noteworthy that these were electric, the power being obtained from batteries. In discussing daylight work, Major HOTINE advocates observing (on helios) during the two hours after sunrise and the two before sunset. The recollection of the writer is that experience on the 30th Meridian Arc in Uganda was against this. It is true that lights appear clear and steady when the sun is low; but after some experience these conditions were viewed with suspicion, as there seemed to be a tendency to lateral refraction. On the other hand, although when the sun is high signals become very unsteady and observation much more difficult (necessitating a greatly increased number of pointings), the results appeared to be more reliable.
