GRID OF POSITION AND GREAT CIRCLE CHARTS BY WIRELESS

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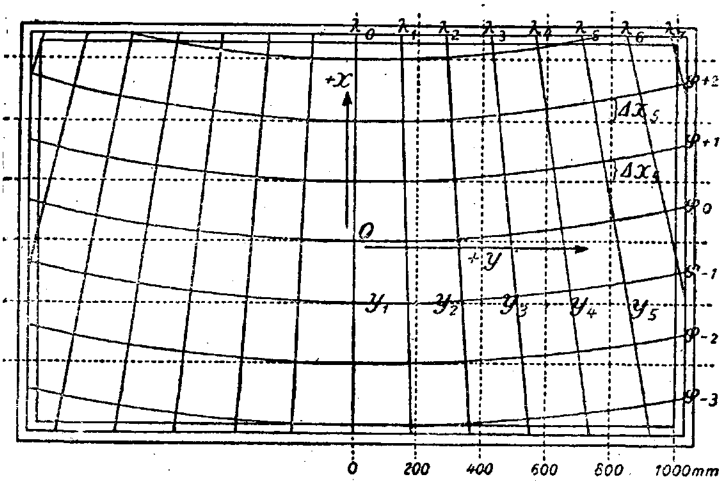
Radio position charts must be constructed in gnomonic projection, as great Circles at sea can only be represented by straight lines. According to text-books, geographical co-ordinates of the grid points of intersection (meridians and parallels) should be transformed into azimuth co-ordinates, referred to the chart principal point O, these being then plotted on the chart, according to its usual mode of drawing. This method involves a lot of unnecessary trouble and time, as, for lack of suitable transformation tables, small-meshed grid coordinates must be calculated trigonometrically with logarithms consisting of many figures. Moreover, the chart figures of meridians are straight lines whose drawing necessitates the knowledge of only two readily calculable points. Besides, these grid points of intersection are no guarantee of the correct tracing of the conic sections representing latitude no guarantee of the correct tracing of the conic sections representing latitude circles. We therefore indicated in the *Annalen der Hydrographie* for 1918, p. 263, a method for drawing these curves through their points of intersection with equidistant abscissae : At that time, we used seriate developments as more suitable for charts on a large scale and therefore of small extent. But as charts for whole oceans, and therefore on a small scale, are now required, we will extend the method so as to make it applicable to all cases, although demanding little of the calculator. Nautical tables are very convenient for calculating as they greatly facilitate passing from log sin a and log tan a to log $\sin^2 \frac{a}{2}$ and log sec a, which stand near to one another on the same page, and so avoid the trouble of turning over the leaves.



The x axis coincides with the middle meridian passing through O ; + x runs in the direction of the nearest earth-pole. The Y. axis coincides with the first vertical passing through O, + Y points eastward. M = RM', R is the earth's radius, M' the scale of the chart, φ_0 the latitude of O, φ that of any parallel. The parallel $\varphi + \varphi_0 = 90°$ is represented by a parabola, the parallels to the north of it by ellipses, to the south by hyperbolas ; the equator is a straight line. The parallel φ intersects the middle meridian at point $x = \tan(\varphi - \varphi_0)$, $y = O$. The distance Δ x (see fig. 1) over the abscissae by means of the ordinate y are found in

$$\Delta x^2 + 2 \sin \varphi \cos \varphi \sec (\varphi_0 - \varphi)\, M\, \Delta x = y^2 \sin^2 \varphi \sec (\varphi_0 - \varphi) \sec (\varphi_0 + \varphi) \cdot$$

which can be resolved in several ways. According as $\varphi_0 + \varphi < 90°$ or $> 90°$, an auxiliary angle a is introduced by sin a or tan a and thus, the three methods of calculation are obtained :

For ellipses

$$\sin a = y\sqrt{\cos(\varphi_0 - \varphi)\cos(\varphi_0 + \varphi)} : M\cos\varphi,$$

$$1)\quad \Delta x = M\sin 2\varphi \sec(\varphi_0 - \varphi)\sec(\varphi_0 + \varphi)\sin^2\frac{a}{2},$$

$$2)\quad \Delta x = y^2\tan\varphi\sec^2\frac{a}{2} : 2M,$$

$$3)\quad \Delta x = y\sin d\sqrt{\sec(\varphi_0 - \varphi)\sec(\varphi_0 + \varphi)}\tan\frac{a}{2}.$$

For the parabola

$$\Delta x = y^2\tan\varphi : 2M.$$

For the hyperbolas

$$\tan a = y\sqrt{\cos(\varphi_0 - \varphi)\cos(\varphi_0 + \varphi)} : M\cos\varphi,$$

$$1)\quad \Delta x = M\sin 2\varphi\sec(\varphi_0 - \varphi)\sec(\varphi_0 + \varphi)\sin^2\frac{a}{2}\sec a,$$

$$2)\quad \Delta x = y^2\tan\varphi\sec^2\frac{a}{2}\cos a : 2M,$$

$$3)\quad \Delta x = y\sin d\sqrt{\sec(\varphi_0 - \varphi)\sec(\varphi_0 + \varphi)}\tan\frac{a}{2},$$

a is always to be taken in the first quadrant. The sign of cos $(\varphi_0 + \varphi)$ is not to be taken account of. $\cos^2\frac{a}{2}$ may be substituted for $\sec^2\frac{a}{2}\cos a$, if an error of up to 1/2 mm. in Δx is allowed for at the side of the chart. For purposes of calculation, preference is given to formulae 2.