

Bulletin 02.3 English summary

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Contents of the September 2002 Bulletin, nr. 80

- 03 The 2002 excursion: Utrecht A. Schoorel
 This year's excursion was to the capital of the province of the same name. Objects of interest were two vertical direct south dials on Jacobi Church, of which the left one is the oldest dated pole style sundial (1463). St.John's Cemetery is home of a large analemmatic dial (see B01.2.17), where the group picture was taken. Next was the south wall of Dom tower, which had a sundial long ago and is about to have one again, or perhaps two: a vertical south, and a horizontal on the balustrade. - Over lunch, Fer de Vries received a complimentary spoon and brick for his calculations for the Eenrum analemma (see elsewhere in the current Bulletin). Hans de Rijk called for designs for the Dom horizontal sundial. Fer showed a conical gnomon sundial (B02.2.12-15, 42) and noted that Italians have replaced the cone with a sphere. - In the afternoon there was a talk in the University Museum by president Peter de Haan, and a preview of things to come at the fifth lustrum celebration in 2003. On display were, among other things, a tellurium, a planetarium or orrery, and sundials.
- 07 Sundial projects, foreign meetings, various Secretariat
 The Solar Pyramid of Poolsbrook will consist of three stainless steel members, one 40m tall, the others 28m. The plane beneath it will carry a sundial, and a Foucault pendulum completes the installation. The project internet address is: www.solarpyramid.co.uk. - John Carmichael has turned the Kitt Peak solar telescope into a temporary but huge sundial. The observatory staff has become interested and may decide to make it a more permanent one. Kitt Peak: www.noao.edu/kpno; McMath-Pierce instrument: www.nso.noao.edu/nsokp/new_mp/mp2.html.
- 09 Meetings 2003 Secretariat
 Meetings on 18 January, 22 March, 20 September. An important Lustrum celebration is planned for [28] June.
- 10 The puzzle from last Bulletin F.J. de Vries
 Both Ton van den Beld and Govert Strang van Hees sent solutions. They are equivalent and their results are the same. It is a different solution than the one (based on an Italian paper) the author of the puzzle had in mind, and so theirs is published as well, using Ton's paper. Ton wrote: "Funny how little data you need to recover the sundial. Point E is not even necessary for the hour lines. What is nice is that the puzzle calls for construction, not calculation. - I wonder what this property is that you hinted at. I cannot imagine straight off what it could be." And Govert wrote: "I found this to be an entertaining problem. Mathematicians nowadays always want to solve things with algebra and no drawings. But in my experience, a drawing may give you fresh insight and new solutions." Still, Fred Sawyer did use algebra by solving for two simultaneous equations. While not counting for the puzzle, his method does have the merit of giving a solution even if the two hour points are not on the same declination line. - Rolf Wieland used yet another construction, and that may be published some time later. - Alberto Nicelli and Marco Rossi did send a solution using the property mentioned, but said they knew of the Italian paper.
- 11 The solution to the puzzle A.J.M. vd. Beld
Hour line construction: The dial is in the plane of the paper. Draw a perpendicular through III onto the meridian; D is the footpoint. Draw the circle around D through III. It intersects the meridian in F, north of D. Construct a line through F at 75° to the meridian, for instance by drawing an equilateral triangle on F-III and bisecting the angle at F. The intersection of this line and the east-west line through III is H. H is a point of the hour line for 17 o'clock (75°). This is true because on any east-west line, the co-ordinate of the intersection with hour line (t) is proportional to tan(t). - Divide the circle around D in twelve equal parts of 30° each. From F, these points are 15° apart. Draw the chords from F and determine the intersections with the east-west line through D (and D and H). The lines connecting S and the intersections are the wanted hour lines. This is all in fig. 1. We continue with fig. 2, copying the meridian and D, E, F and S, III, and the circle around D.
Angle j (latitude): We have for angle z between hour line and meridian: $\tan(z) = \sin(\varphi) \cdot \tan(t)$. Therefore, $\sin(\varphi) = \tan(z) / \tan(t)$. For III, $\tan(t) = \tan(45^\circ) = 1$ and so $\sin(\varphi) = \tan(z)$. And so the angle between the tangent from S to circle D and the meridian is equal to φ . To aid in drawing the tangent, construct the circle through D and S. Its intersections with the circle around D are points of the tangents.
Length and place of the gnomon: Only now do we need point E. Draw a perpendicular from E on one of the tangents just mentioned. The footpoint is T1. The projection of T1 onto the meridian is G. GT1 is the gnomon GT, rotated into the horizontal plane. Triangle ST1G is similar to style triangle STG.

Declination: although the puzzle did not ask for it, fig. 3 gives a construction to find the declination of the sun. Let T be the gnomon top, K the intersection of the hour line through III and the east-west line through E. We intend to rotate triangle T III K into the horizontal by rotating about the hour line through III.

Draw the perpendicular on G III and circle T1 around G to T2. Draw the arc about III through T2, and the arc about S through T1. The arcs intersect in T3. T3 is the gnomon top T rotated into the horizontal by rotation about the hour line through III. The angle K T3 III is equal to the declination of the sun.

Remark 1: The construction shows that the declination for III can be found without using V and vice versa. It follows that III and V need not have been measured on the same day.

Remark 2: I find $\phi=52$, GT (gnomon height)=15, declination= 21° or about 25 May.

13 Utrecht, Sundial City

J.A.F. de Rijk

There are 928 registered sundials in The Netherlands, of which 84 are in the province of Utrecht. The town itself has 20, outnumbered only by Amsterdam with 34. Utrecht has two very special dials: the oldest pole style dial, and the analemmatic in the pavement in front of St.Johns.

"De Zonnewijzerkring" (The Sundial Society, commonly referred to nowadays as The Dutch Sundial Society) was founded in Utrecht in 1978 and today counts about 200 members.

At their first Lustrum, the Society presented the St.Johns dial to the town of Utrecht, and held four public exhibitions. Schools carried the project Build your own Sundial, and "*The Sun as Clock*" was published.

2003 is the Society's 25th anniversary. It will be the year of Utrecht, Sundial City. Plans include several exhibitions and a book "*Sundialling for everyone*". Quite special is the planned new sundial for Dom Tower, and the sundial for the Botanical Gardens of the University Museum, for which a fine 18th-century pedestal will be used.

14 Solution to the puzzle from last Bulletin

F.J. de Vries

Draw the equinox through E, perpendicular to the north-south line. Draw a line through the hour points for 15 and 17 and find the intersection with the equinox. This is an hour point, X, for 10, which is the mean of 15 and 17 minus 6. The hour angle for 10 o'clock is -30 , therefore construct a line through this point making an angle of 30° with the meridian. Call the intersection D. Draw the circle around D with radius DE, and divide it sectors of 15° . This is the well known starting figure for hour line construction, fig. 3. Because we know not only these hour points but also the two originally given, we can draw two hour lines, for 15 and 17. They intersect in C, the centre of the sundial. Finally, fig. 5 shows the construction of the style triangle. Draw the circle around E with radius ED and the tangent EF. CFE is 90° . FG, at right angles to the meridian, gives the gnomon footpoint and CGF is the style triangle. CF is the pole style, and GCF is equal to the latitude, in this puzzle 52° .

The property that was hinted at in the problem is: *The extension of a straight line through two hour points on the same date line – except the equinox – intersects the equinox in a point on the hour line six hours from the mean of the hours of the first two hour points.* This is illustrated in fig. 6. The line through 6 and 10 on 21° cuts the equinox on the hour line for $(6+10)/2 +6 = 14$ o'clock. Likewise, 10 and 11 on -21° give $16\frac{1}{2}$.

The proof of this property is the subject of the rest of the article.

The Italian note that prompted the puzzle mentions another interesting property: *a line through an hour point on the equinox and one x hours ahead on a line for positive declination y, also passes through the hour point x hours behind on the line for negative declination y.* This property enables one to construct several points of declination line for $-y$ if a point on the declination line for $+y$ is known. Fig. 11 shows an example.

19 Encyclopaedia Groningana, entry 'Sundial'

E.L.H. Roebroek

The sundial entry in this encyclopaedia gives a good overview of the many types in existence, and explains the difference between apparent and mean time, and their variants.

21 Three-dimensional example

F.J. de Vries

Another picture illustrating the property on which the puzzle in last Bulletin was based. Fer finds it surprising that no modern texts exist about a fact that was known four centuries ago.

22 Town council sundials of 1625 and 1626

J.A.F. de Rijk

In 1625, the Utrecht town council ordered sundials to be placed on four churches to regulate the tower clocks to. A 1626 resolution shows that five dials were ready but not installed. The churches found them too expensive and the council decided to contribute in the cost, on the condition that the dials be installed within a fortnight.

Two dials are still in place, on Jacobi Church and on Nicolaas Church.

Bills from the time show that Nicolaas Church had a sundial in 1586. Probably two, one on the wall and one for the organist "To regulate the Clock by". By 1625, the dial was in such a bad state that it needed replacement. This 'new' dial was quite weathered by 1981, and a newspaper paid to have it restored to its present state.

The 1463 dial on Jacobi Church was quite serviceable in 1625, but may have been judged too small. The 1626 dial bears the number 1722, which is the year of its restoration.

- 23 Rotterdam 9 H.C. Wagenaar
 The drawing is an impression of the sundial the author discovered on Willemskade 23, part of the World Museum, in Rotterdam. Built in 1904, the building front is Jugendstil with yellow and blue tiling, depicting mediaeval castles and scenes from merchant shipping and fishery. The sundial is above the middle of five windows on the third floor. The style is missing.
- 24 An Introduction to Gnomonics, part 1 F.J. de Vries
 Fer de Vries has undertaken to write a basic course in sundialling. The first part starts accordingly with celestial mechanics. The year and the difference between solar and sidereal day lead to the concept of the sun moving along the ecliptic, divided into twelve parts of 30° each. Because of the slanted polar axis, the ecliptic and the equator are not parallel but for an angle of 23.5°, causing the sun to be higher or lower in the sky according to season. It also follows that sunrise and sunset are not, in general, in the east and the west. In summer, sunrise is in the northeast in our region and sunset in the northwest; in winter, southeast and southwest.
 A famous formula is $\cos T = -\tan \phi \cdot \tan \delta$ where T is the half day arc, ϕ is your latitude, and δ is the solar declination on that day. Sunrise is at time $-T^\circ$, or $(12 - T/15)$ hours; sunset is at $+T^\circ$, or $(12 + T/15)$ hours.
 The photograph shows, surprisingly perhaps, not a sundial. It is a demonstration instrument for celestial mechanics. Many sundials are derived from it.
- 28 The Eenrum Analemma E.L.H Roebroeck
 A monumental horizontal sundial, 8m in diameter, was unveiled on 21 June 2002. It has an analemma for 12 o'clock with a standard and a daylight saving time part.
- 28 "The Sun as Clock" in Rotterdam H.C. Wagenaar
 Sundials and sundialling are among the "extra" courses of which students choose two every year. After a slow start, this year 18 students took part in the sundial course. The course included calculations and cardboard model making, as well as an excursion to the vertical west dial on the Pilgrim Fathers church in Delfshaven. Many demonstration models by Fer de Vries were used. By kind permission of Hans de Rijk, the material included parts of his book "25 Centuries of Time".
- 29 A 1564 polyhedron sundial excavated F.J. de Vries
 Mr. Van Capelleveen sent photographs and sketches of the recently found multifaced sundial. The 30x36x12cm slab is sand stone from Bentheim. It is heavily damaged, but much of the patterns still shows.
 The large east and west faces each carry two dials; the west face is more difficult to judge but is apparently the mirror image of the east face (with appropriate numbering). The top dials read apparent solar time, the bottom ones read antique hours and have seven date lines. They are therefore point dials. The holes for the gnomons are clearly visible. – The narrower rim of the stone carries a number of other dial types, as fig. 2 shows. The north face polar dial shows initials GG and the year 1564.
- 32 Sundials in Nürnberg A. van der Hoeven
 An account of the annual meeting of the Arbeitskreis Sonnenuhren.
- 34 Spherical gnomon for Italian and Babylonian hour lines F.J. de Vries
 Picture and short description of how the cone gnomon on a Babylonian/Italian hours sundial can be replaced with a spherical one.
- 35 Again: "True" time H.W. van der Wyck
 Where it is argued that MET, GMT, UT and such acronyms are best left to scientists, while they leave the true solar time to us. They have our permission to regulate their artificial time to our real time once or twice a year.
- 36 Literature 1436 - 1445 D.L.J.M. Verschuuren
- 46 The ball on the church spire B.P.U Holman
 This ball contained a backup set of the church plans. Should there be a fire, the ball stood a good chance of falling and rolling away, so saving the plans.
- 47 Equation of Time and Declination for 2003 Th.J. de Vries
 Tables for the new year.