Bulletin 99.2 English summary.

R. Hooijenga, T.Brandsmastraat 42, 1964 BV Heemskerk, Holland r.hooijenga@lvnl.nl

Inhoud *nr. 69, mei 1999*

Contents of the May 1999 Bulletin, nr. 69

01 Verslag bijeenkomst 16 januari 1999 *Secretariaat*

Account of the meeting of 16 January 1999

Professor H. Baudet, who lectured on the Lustrum celebration, has since fallen ill and passed away. He was eighty years old. The Society has offered condolences. - There is a finished concept for a supplement to the book "Sundials in The Netherlands". It will be an annex to a future Bulletin. - Ton Bron shows his motorised sundial. See article. - E. Roebroeck made some didactic sundials that show the connection between the hour lines on the different faces. -And more..

02 Verslag jaarvergadering/bijeenkomst 20 maart 1999 *Secretariaat*

Account of the meeting of 20 March 1999

This year's Summer Excursion will be in Groningen and is being organised by E. Roebroeck. - Plans for a time-museum in Ootmarsum are currently on ice due to municipal rearrangements, but still alive. - There are still some copies of "Zon & Tijd" by M.J. Hagen. For non-members ƒ25 ($15) plus p&p. Practice your Dutch! - The new treasurer is Hans Sassenburg. - There are plans for an analemmic dial in Asten. - Discussion: when does the new century begin. New twist: compare with hours. After 12:59 we start over with 1:00. - Fer de Vries talks on the principle of the hour plane dial, and shows a fine piece given to him by a North-American sundial lover.

04 Verslag van de penningmeester *Penningmeester*

From the Treasury. There are about 2.2 Florins to a Euro, and 80 Eurocents to the dollar, and.. Oh well.

05 Mutaties ledenlijst *Secretariaat*

Memberships: two resignations, four new members. Three changes.

A correction

There is an error in fig 13, p24 of "Het ABC van de Zonnewijzer", invalidating the explanation on p23. The author, H.W. vd. Wijck, supplies a correction sheet for the asking.

Aspecten van de Tijd

Aspects of Time

The Lustrum lecture by Prof. Baudet is published in book form (ISBN 90 12 08707 4). It is entirely in Dutch.

06 Reacties op artikel van R.J. Vinck uit bulletin 99.1 *Kragten/De Rijk*

Responses to the R.J. Vinck article in 99.1

Both Hans de Rijk and Jan Kragten disagree strongly with the "Re: Is the Sun in the wrong place?" article. Hans thinks the figures are misleading: one is a top view, the other a side view. Jan's reaction is more detailed. And both point out that the effect (the terminator seems not to be at right angles to the moon-sun line) is *not* negligible at first and last quarters but rather almost maximum, *and* is in the opposite direction.

08 Reacties op artikels van Roebroeck uit bulletin 99.1 *M. Hugenholtz*

Responses to two Roebroeck articles in 99.1

Mr. Hugenholtz thinks Mr. Roebroeck, in 99.1, is overly pessimistic about the sundial population in Groningen. Martin reads about several new items in the Bulletins and mentions some others.

In relation to the "Translation of the north-south line" article, Martin mentions a simpler method suitable for smaller sundials. He takes the southing time for the sun, at 5 degrees east, from Teletext page 718 and calculates a total correction for EOT and own longitude from it. The orientation of the sundial can now be checked and corrected using a little list relating clock time and sundial time.

09 Een gemotoriseerde zonnewijzer *A.G.M. Bron*

A motorised sundial

When a solar cell is turned into the sun we can find the sun's position from the voltage maximum. The author used the output from the cell to power a small electric motor that drove the cell away from the sun. While this worked, it was not at all precise. After a while new inspiration came and the author built a balanced design, with a shadow caster separating two cells driving a motor with opposite polarities. The shaft carrying the cells is now the diurnal axis. A set of gears drives hands (including a seconds hand) on a clock face.

The set-up works so well that the seconds hand is always moving. The device is self-training and will find the time again in five minutes after an hour of no sunlight.

The author is now building a bigger model that will be used out of doors.

12 Uurvlak-zonnewijzer op cylinder uit 1764 *F.J. de Vries*

Hour-plane sundial on a cylinder, dated 1764

The journal "l'Astronomie", vol. 112, Feb 1998, carries an article by Denis Savoie on an interesting Paris sundial. It was designed by Alexandre Guy Pingré and built in 1764.

The principle of an hour-plane dial is that the shadow of a filament in hour-plane **t** always falls on the hour-line that is connected with that plane. The shape of the filament (or edge of a body) is not important, as long as it is completely contained within that hour-plane.

Suppose on top of a 30-m tall cylinder, 3 m across, a horizontal sundial is constructed. All hour-lines meet in the centre. We extend them in across and outward of the cylinder into gnomons. Every single gnomon is now in a fixed hour plane **t**, and at that time **t** the shadow of only this gnomon will coincide with a matching hour line drawn on the mantle of the cylinder.

In Paris (latitude 48.9 degrees) the gnomons are of length 1.4 m, or 0.91 R. The hour line pattern looks like fig 2. The hour lines meet in the intersection of the cylinder mantle and the extension of the imaginary stylus of the horizontal sundial used in the construction.

Fig 3 shows the equator, and date curves for the solstices and the equinoxes. The curve for the summer solstice is not continuous, because the shadow of the gnomon tip sometimes falls off the cylinder. If we calculate the dial for latitude 52, we get fig 4. The summer solstice curve is now continuous. We could have accomplished that in Paris by taking a gnomon length of only 0.79 R.

Note that hour lines for the morning are on the east side of the cylinder, those for the afternoon on the west side. During noon they appear on both sides, but with higher latitudes or shorter gnomons, the lines do not intersect anymore. Fig 5 shows this for latitude 52 and g = 0.6 R.

The appendix outlines the calculation of the hour and date lines. *Hulpvariabele* = auxiliary variable, *straal* = radius, *gemeten langs omtrek* = measured along perimeter, *bovenrand* = (here:) top

16 Gnomonische modi als ordeningsprincipe *J.A.F. de Rijk*

Sundials arranged by gnomonic mode

In the 1980s the author described, in several inspired articles, a structured approach to the different gnomonic modes. Today, he consolidates the ideas in a more structured article. The concept is important enough to warrant careful consideration.

The ultimate goal of a sundial is to measure the Sun's hour angle. We can do this directly, with a pole style dial or a point dial. A point dial measures declination as well, giving us the date.

Many dials measure the hour angle indirectly, from other measured data. They were developed more or less by accident and not through any systematic investigation into the principles concerned.

A mathematical approach: there are five variables related to the Sun's position on the celestial sphere. We have the horizon system co-ordinates, altitude (h) and azimuth (Az). Then we have the equator system co-ordinates declination (δ) and hour angle (t). And we have the geographic latitude (φ) of the observer, fixing the horizon system with respect to the equator system.

The relation between t, Az, δ, h and φ is expressed in two independent equations, the nature of which is still to be settled. From these five variables, we can solve for two if three others are known. This leads to ten combinations, or *gnomonic modes*. These are listed in Table 1, *Mode* # solves for *unknown1*, *unknown2*:

1: t, δ; **2**: t, h; **3**: t, φ; **4**: t, Az; **5**: Az, δ; **6**: Az, h; **7**: Az, φ; **8**: δ, h; **9**: δ, φ; **10**: h, φ

The first four are the t-modes, meaning hour angle t is among the unknowns solved for. Then follow the four Az-modes, solving for azimuth. Note that mode 4 is both a t- and an Az-mode. A mode is not a sundial, but may be used to characterise a group of sundials.

Examples: a Vooght or Lansbergen quadrant uses mode 4. Latitude and declination are known, altitude h is measured and so is also known. The bead on the Vooght quadrant then tells us time and azimuth. - Mode 3 tells us a sundial exists that is independent of latitude but has to be oriented and adjusted for declination. Actually finding such a dial is a different matter; the author published his solution in 1983. A completely different one was given earlier by Freeman. - The time independent sun compass, the search for which led to this investigation, can be made using mode 4, in other words, the quadrant again. If we do know the time, we can use modes 5, 6 or 7 as well.
Formulae, and a figure illustrating their background, follow. Sun is in S. The angle at S is the angle between the plane through the Sun and zenith and the plane through the Sun and the pole. As it happens, S can be measured, giving access to the third formula, which uses it. In Fig 3, S is measured using the shadow of a forked style (a vertical gnomon combined with a pole style) on a plane V perpendicular to the Sun's rays (check with the pin: its shadow disappears when V is positioned correctly).
With three equations and three unknowns, there are now 20 different combinations, or modes (table 2). Reasoning that we often need but one unknown, the author then derives 15 formulae with each 4 variables (table 3). As an encore, he derives a complete sundial from the last one.
Fig 4 shows the forked style dial. In fig 5 we see that AC is sin S cos h, which equals sin t cos φ. As cos 52 = 0.62, the hour strip looks like fig 6. Fig 7 shows how the time is measured from the shadows of the forked gnomon.

23 Gecombineerde stijlzonnewijzer *J.A. Sassenburg*

Combined-style sundial

The author found a strange dial in the Spanish bulletin. After some puzzlement he understood what was going on in the design and did some calculations of his own. This sundial uses a dial face that is parallel to that of a horizontal sundial at the equator. In latitude φ the whole dial is inclined through φ. The design is further based on a combination of three principles:
A horizontal dial, which for the latitude = 0 situation has a horizontal style; an analemmic dial, of which the ellipse has degenerated into a line; and a Foster-Lambert dial, which has the hour points on a circle.
For the case where φ= 0 the movement of the style happens to be the same for the analemmic and the Foster-Lambert (fig 1). The combined style (horizontal, vertical, and 45 degrees with respect to the dial face) is shown if fig 2. The figure on p26 shows the dial face itself. The Foster-Lambert hour points are shifted to correct for legal time and daylight saving time.
This sundial can be used at any latitude (adjust the inclination of the face to φ) and is self-orienting (turn the sundial until all three shadows and sets of hour lines show the same time).
Some questions remain, says the author: 1) which combinations of sundials generate additional, not superfluous, information? Can it be shown mathematically? 2) Is a combination possible that will give position, direction, date and time without previous knowledge about those? What dependencies exist? 3) Is it possible to have the Sun shine at all times (that one was answered).

27 Zonnewijzers op een electronische veiling *J.A. Sassenburg*

Sundials at an electronic auction

The author has recently discovered the "Ebay" auction on Internet. He has already acquired some nice sundials there. He describes the bidding procedure. Interestingly this is largely automatic. A prospective buyer sets his maximum without necessarily winding up having to pay that maximum. When one wins the bidding, one pays only the largest other bid plus the minimum increment. Transfer of goods and payment is settled afterwards directly between seller and buyer. The author reminds us that shipping, handling and insurance can easily add from $10 up to $25. Having said that, he is very enthusiastic about Ebay and invites the reader to have a look at him while busy- except if we turn out to be competitors! - Ebay: http://www.ebay.com

30 Speurtocht naar een Wilberfoss zonnewijzer *J. Borsje*

The search for the Wilberfoss sundial

Mr. Borsje has asked around for information on a leaden sundial dated 1827, and the names Richard Wright and Thomas Colley connected with it. Four reactions have come in, and several people have worked to find the particulars. Mr. van der Wyck found the names in a clockmaker's book. Thomas Colley was an apprentice in 1772 at Graham, Barkley & Colley. Richard Wright is mentioned as in Manchester ca 1820. This is not far from the place Wilberfoss. The author thanks all the people who helped him.

32 Zonnewijzer op Mars *W.T. Sullivan III*

Mars sundial

The article by Prof. W. T. Sullivan III is in English.

33 *Interessant schilderij in de Martinikerk* *E.L.H. Roebroeck*

An interesting painting in Martini Church

Three separate illustrations show the A-Church around 1670 with clock faces vertical, but on an 1834 painting by G.K. de Jonge the clock faces are inclined towards the viewer. Mr. Roebroeck feels that the painter must have depicted them like that not for nothing or out of sloppiness, but to make a statement. The parallax reading error on a single hand clock could be as much as ten minutes. Inclining the clock face will remedy this to some amount. The painter was possibly hinting at the pending introduction of Mean Time in Groningen. This happened in 1835/36.

36 Uit "Onze Taal" H.W. van der Wijck

From "Our Language"

The figure shows an "equinoctial compass". I have ventured to translate the accompanying verse. [Perhaps I can help the master: I think it is a sundial that can be used even above the Pole circle, where the sun can shine for 24 hours and run its azimuth through all 360 degrees. That, and its adjustable φ, would make this dial just right for seafarers.]

The pupil, foolish, brazen, shouts
"No compass, but a sundial here,
that makes our guess quite sound!"

The master, in his wisdom, doubts
"Well, why then does the scale of hours
go all the circle 'round?"

A pupil I, then master,
An answer have I not
Can help me any reader,
or readster, with this knot?

37 *Zonnewijzers in Nederland* *W. Coenen*

Sundials in The Netherlands

Remarkably, new entries keep being added to our sundial files. **KA.NH.01**: A sculpture by Daniëlle Orelia. A dancing bird, the long beak casts a shadow on forward bent wings. Placed in the centre of a ring-shaped box hedge where the previous owner of the villa had an antique sundial. **Wassenaar 4**: The Bernhardt-sundial, described in 98.3 p11-13. This is a precision sundial, which reads Legal Time to the minute. For EOT correction two banister shaped styles are used [one from winter and up, the other from summer and down]. **Leidschendam 2**: Metal vertical dial, 30cm (1-ft) diameter, design by H. van Winkel. The designer has recently applied, by e-mail, for membership of De Zonnewijzerkring. **Sint Oedenrode 2**: A stylised stainless steel sundial at the Ahrend Company offices. This dial was in Geldrop until 1992 and placed here in 1994. Member J. Kragten points out that the dial is 23 minutes fast and should be rotated right through 5 degrees. Quite possibly the N-S line was determined using a magnetic compass. **Mesch**: In the garden of a 1745 farm, an eight-sided slate horizontal sundial. The style is at 55 degrees, but this could be due to the slate being slightly off the horizontal. According to the owner, Mrs. Smeets of 87, the garden design, which was famous, dates from 1830 and so does the sundial. Garden and dial featured in the Austrian August 1998 "Kraut und Rüben".

41 *Literatuur 1323 t/m 1333* *D. Verschuuren*

Literature. As always, too many to summarise. Some items that caught my eye:

1326.3 A sundial reading sidereal time. Pity it does not work at night. **1328.3** Un Error de Pedro de Enguera.. Juan de Arfe, in his "Varia Commensuración para la Escultura y Arquitectura", devoted a chapter to the construction of sundials. His book was published from 1585 to 1906, but from the 1736 update has always contained a serious error in the design procedure for declining sundials. One wonders how many defective vertical decliners were built between 1736 and 1906; or did those designers spot the error too? **1332** Schriften des Historisch-Wissenschaftlichen Fachkreises... Band 37. 208 pages, of which 105, in 13 articles, are devoted to Scientific Instruments and Sundials. **1333** If you haven't yet, read the Pete Swanstrom article in The Compendium. His Analemmic-Equatorial Sundial generated quite a discussion on Internet, as I remember. **p48** shows a new sundial by Yvon Masse. Check his Internet pages (there is a link on the De Zonnewijzerkring page).