The British Sundial Society

BULLETIN

VOLUME 11 (iii) OCTOBER 1999

Front Cover: *Sundial on Tower Hill, London (Photo, M. J. Kenn)*
The plaque reads; 'The Tower Hill Sundial was Commissioned by London Underground Limited and unveiled by Denis Tunnicliffe on 3rd August 1992'

Back Cover: *Saxon Sundial, St. Batholomew's Church, East Riding, Yorkshire (Photo, Dr. J. Wall)*
The inscription reads: +VLF HET ARCŒRAN CYRICEFOR HANVM-, FOR GVNpARA SAVLA
which may be translated:
+ Ulfo ordered the church to be built for himself and Gunwara's soul

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MUS

VOLUME 11 (iii) - OCTOBER 1999

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BULLETIN

OF THE BRITISH SUNDIAL SOCIETY

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VOLUME 11 (iii) - OCTOBER 1999

EDITORIAL

In introducing the final issue of the BSS Bulletin of the current millennium, I should again like to thank all the contributors who send articles, photographs, comments, designs, poems and all else which fill our 52 pages three times a year. In this issue, I commend especially to readers' attention the discussion by Dr. Wall of the problem of exactly where the next millennium will start; the author seems eager to Be There, as some of our members were determined to be on the Line of Totality on August 1999. Perhaps our first issue of A.D.2000 will contain offerings from eclipse-viewing members.

I enjoy all incoming material for the Bulletin, and it is a particular pleasure to receive contributions from BSS members who have never previously written one-or even sent a photo. If you have the germ of an idea at the back of your mind, bring it forward and let it grow! If you are wondering where to start, look at the new version of 'Guidelines for Contributors' on the last page of this issue; then set pen to paper or finger to keyboard.

THE SUNDIAL OF ST MARY'S, STOKE D'ABERNON, SURREY

K. H. HEAD

The article on 'Sundials in Anglo-Saxon Enqland' by David Scott in the February 'Bulletin' prompts me to add a few comments on the sundial of St. Mary's Church, Stoke D' Abernon, in Surrey.

St Mary's dates back to the seventh century, and most of the south wall is the oriqinal Saxon construction. The church is particularly renowned for its ancient memorial brasses, especially the full-size effigy of Sir John D' Abernon 'The Elder' which is believed to be the oldest memorial brass in the country, dated 1277. The building also contains many other historic treasures which deserve to be better known, including a very fine Elizabethan pulpit and a remarkable collection of medieval glass.

On the south wall of the church is a circular dial (Fig 1) with markings similar to those on the dials at Great Edstone and Kirkdale as depicted by Scott. It has a central horizontal gnomon. Below the dial is an inset stone bearinq the inscription "This sundial remade after a fall May 1933" We had no other information about the original dial which the present dial replaced, so last year I undertook an investigation.

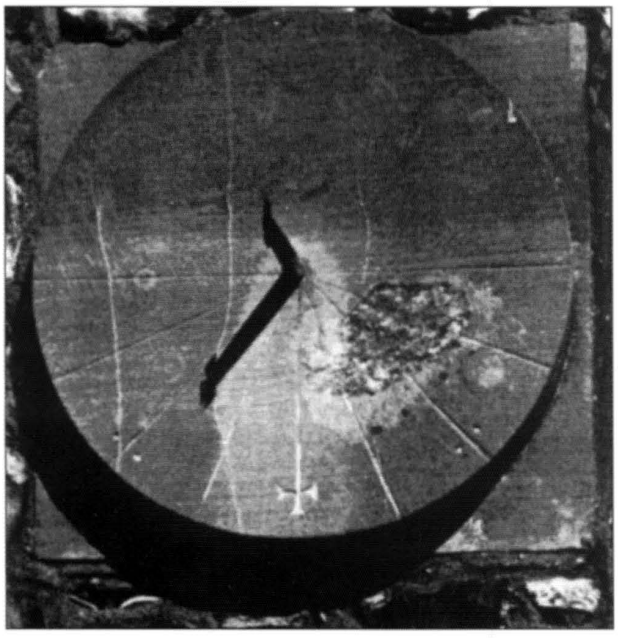

Fig. 1 The sundial on the south wall of St Mary's, Stoke D' Abernon, Surrey. The inscription reads "THIS SUNDIAL REMADE AFTER A FALL MAY 1933".

From available literature[1] it seemed likely that the present dial would have been based on a Saxon prototype. I eventually obtained the loan of a copy of the comprehensive book by Mrs Alfred Gatty[2] , in which I was delighted to see a sketch of the dial as it was in the late nineteenth century (Fig. 2). Her comment was that the dial was almost certainly of pre-Conquest origin. This was confirmed by Johnston[3], who also provided a sketch as shown in Fig 3. He described the dial as being of calcareous sandstone, standing out about three inches from the wall and "much worn by the weather of perhaps a thousand years". When it fell in 1933 it probably disintegrated into little more than a pile of sand and stone fragments.

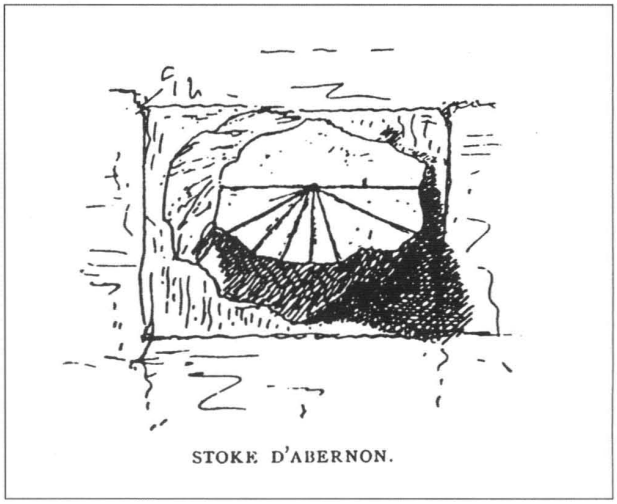

Fig.2 The original dial, as drawn by Mrs Gatty

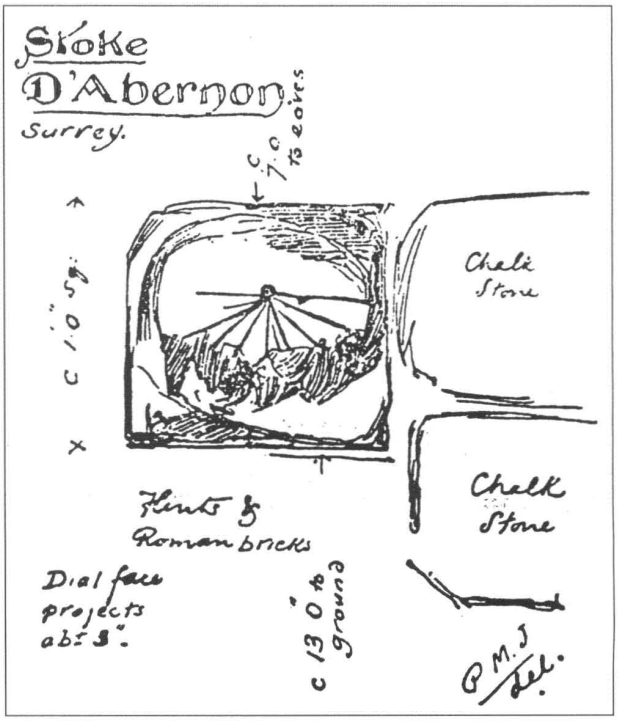

Fig.3 The original dial, as drawn by P M Johnston

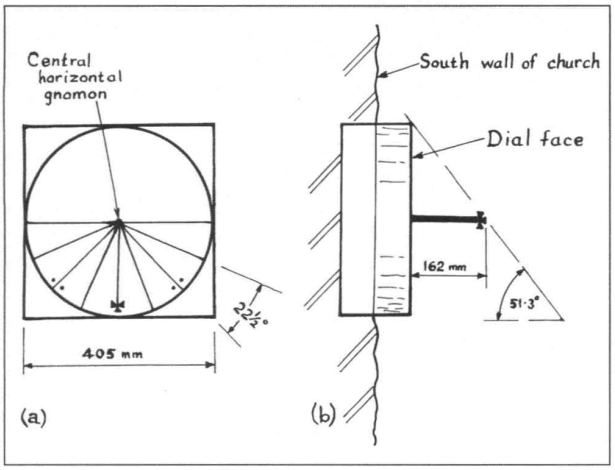

Fig. 4 Details of the present sundial
(a) front view (b) side elevation

Both authors show dial markings based on the octaval system, with some intermediate lines, which seems to be consistent with a Saxon origin. But we still do not know whether the dial was made at about the time the church was built (about 690 A.D.) or during a later period up to about 1060 A.D. Perhaps someone can shed some light on this problem. The present dial installed in 1933 is obviously an idealized replication of a typical dial of the pre-Conquest era. The Secretary of the BSS[4] believes that it is unique in being the only known replica of a Saxon dial on a church wall in this country. Careful measurements made for me by our Verger reveal an interesting feature. An imaginary line from the tip of the gnomon to the topmost point of the dial circle is inclined to the horizontal at 51.3° (see Fig 4), which is equal to the local latitude. This is of no practical significance in this situation, and in any case the south wall faces about 6° east of south. It could be fortuitous, although we like to think that the craftsman who re-made the dial was aware of what he was doing.

12 Stoke Road
Cobham, Surrey,
KT11 3AS

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4. D. A. Young: Personal Communicaation, 1995.

TWO SUN DIALS IN ANDOVER, HAMPSHIRE

PETER RANSOM

I visit Andover nearly every fortnight to see what the local auction house has to offer. Last September I noticed that a local guidebook to the town referred to a sundial on the wall at 33, London Street. This surprised me at this was the street where the auction rooms are to be found, and I had not noticed it before! When I saw it I could not imagine how I had missed it, as it is a quite imposing dial above the door of a local mortgage centre occupied by Maurice Beale and partners, estate agents.

By measuring a brick, and counting up the side of the dial plate I estimate the dimensions of the actual plate, not including the equation of time at the top, to be 95 cm wide and 68 cm high. The dial declines slightly to the west, and uses arabic numbers. Above the dial plate is a motto: Respice Finem (Look to the end), the initials W. H. H. with date 1846 and the equation of time in the form of a table of values headed by 'The Clock Set' over two pairs of columns. One of these columns is titled 'Faster' the other 'Slower'. The sundial is divided into quarter hours, and the ledge on which it stands is inscribed '6 Min Faster for London Time'. Since the longitude of the dial is 1° 29' west, the adjustment is correct.

When I recorded this dial I was disappointed not to know who W. H. H. was as the dial was a rather fine one, and the maker deserved more than anonymity. He was not to remain anonymous for long! In February the Nursling & Rownhams History Group had a Mr. G. Gregory come to talk to us on Hampshire Curiosities. At the end of the talk I asked him if he knew of any sundials in Hampshire, and he mentioned that he had recently come across one at the back of the Savoy Cinema in Andover. He sketched a map for me, and I was amazed that it was so close to the other dial I knew. Soon afterwards I visited it and was delighted to find a name on that dial that solved the puzzle of the initials on the other dial.

This dial is in poor condition. The plate has been broken into four pieces at some time during its history, and the iron gnomon affixed to it does not appear original, despite being in the correct position. Brick measurement and counting

Fig.1 The sundial at 33, London Street, Andover

Fig. 3 Situation of the sundial on the Savoy Cinema, London Street, Andover

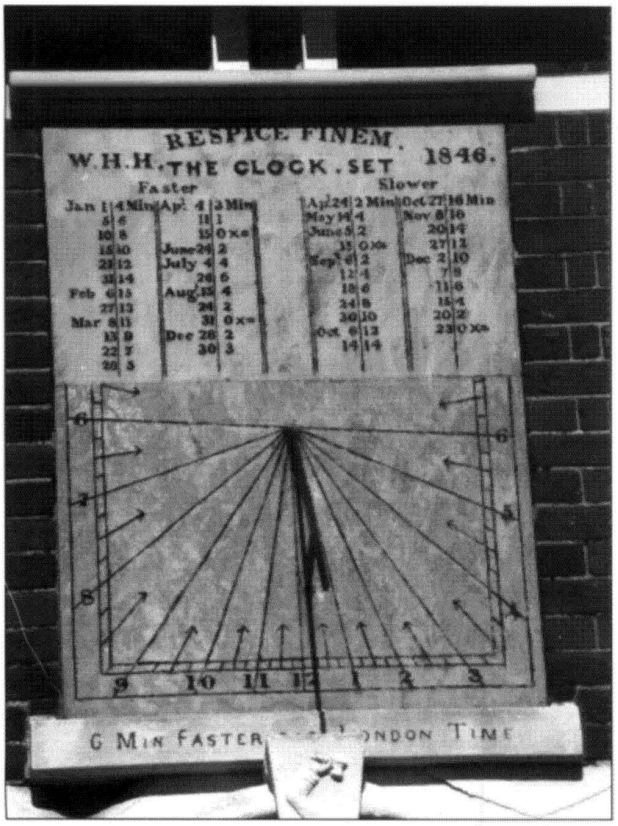

Fig. 2 Detail of the sundial at 33, London Street

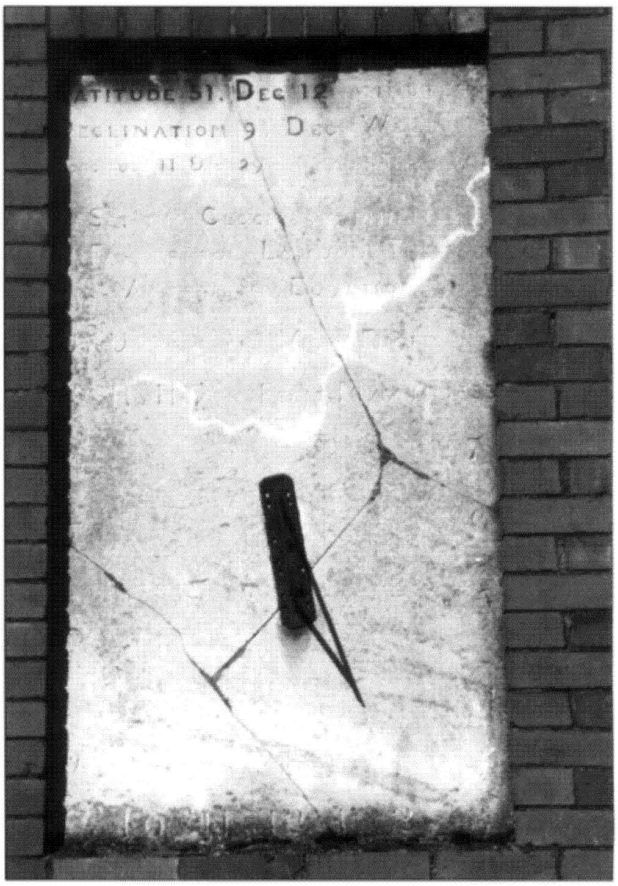

Fig. 4 Detail of the sundial on the Savoy Cinema

estimates its size at 88 cm wide by 158 cm high, and nearly half of this is taken up with the barely legible inscription which follows.

LATITUDE 51 DEG 12 MINUTES
DECLINATION 9 DEG WEST
LONGITUDE 11 DEG 29 46 MINUTES IN TIME

SET THE CLOCKS SIX MINUTES
FASTER FOR LONDON TIME
AFTER THE EQUATION

UT UMBRA SIC VITA FUGIT

W.H.HEATH FECIT MAY 19 1833

Now I think I understand most of this, but I do not see why the longitude is 10° out. The longitude of the dial is 1° 29', which explains setting the clocks six minutes faster for London time, but the evidence of the longitude given suggests working from a meridian at 10° east. Can anyone help explain this anomaly?

The motto means 'As a shadow so doth life fly', and the name W. H. Heath solves the earlier riddle of the initials, being close in time to the other dial. There was still time on the day I saw the dial to visit the local library in Andover, and the help given there was most impressive. Within a few minutes they had found references to William Hawkins Heath, and the microfiches of the Hampshire trade directories around that time.

William Hawkins Heath (1787-1861) was the seventh child of eight born to Charles Heath (1740-1810) and Elizabeth Blose. Charles came to Andover around 1771 taking up a property in London Road (now London Street), formerly an inn called the Star and Garter, and founded a brewing business next door. Over the years Charles gradually brought his sons into the business, passing it over on his death in 1810 to a co-partnership of the three out of four that survived infancy. The bank, which Charles founded in 1791 along with Thomas Gilbert, a wealthy Andover landowner, and Walter Pyle, a grocer and tallow chandler, was also passed on to the three sons. The co-partnership of Charles' eldest son, Charles jnr., Thomas, and William Hawkins Heath, continued from Charles' death in 1810 until 1836, when it was dissolved, its interests at that time being a Brewing, Banking, Wine and Spirits and a Coal Merchants business.

Charles Heath jnr. was the driving force behind the brewing and banking side, and made quite a name for himself as well as a great deal of money, when he obtained a contract to supply beer to a large militia camp stationed at Winchester in anticipation of a French invasion. The news of this contract appears to have upset his friends of the same religious beliefs (They were all Quakers.).

A remark made by a member of the Heath family in a letter to Edmund Parsons, a local historian, says, "From the dining room window of Heath House, you could see the brewery, as well as those who passed by to the counting house." (The bank was immediately opposite the house.). Heath House was eventually demolished and the site redeveloped as the Savoy Cinema in 1934; the sundial was saved and was built into the south wall where it remains to this day. It is written that Charles, apparently, also had a 'thing' about sundials, having one placed on Heath House and another over the entrance to the bank, but I wonder whether this was William, as they have his name on the sundials! William had two periods of office as mayor of Andover: 1840 and 1851.

The story of William Hawkins Heath should not end here. I cannot imagine that he had only two sundials erected, and feel that there should be more. I have written to the Andover Advertiser and Andover Local History Society for help in locating more dials and information about William, but none had been forthcoming by the time of writing this article. If anyone has any information, please get in touch!

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V. Emery: *The Story of Savoy Chambers, Andover 1770-1982.* Crest Estates Ltd.

A. C. Raper: 'The Heaths of Andover' *Test Valley & Border Anthology* 214-219 (date unknown)

Peter Ransom,
29 Rufus Close, Rownhams,
Southampton,
SO16 8LR

DIAL DEALINGS

MIKE COWHAM

The Summer period is traditionally quiet in the salerooms, so I thought that I would start this edition with telling you about my holiday, and showing some holiday snaps.

We went again to Austria to see the mountains and the picturesque villages. As you may know, Austria has so many wondeful sundials, particularly in the Tirol. It is worth a visit for the dials alone.

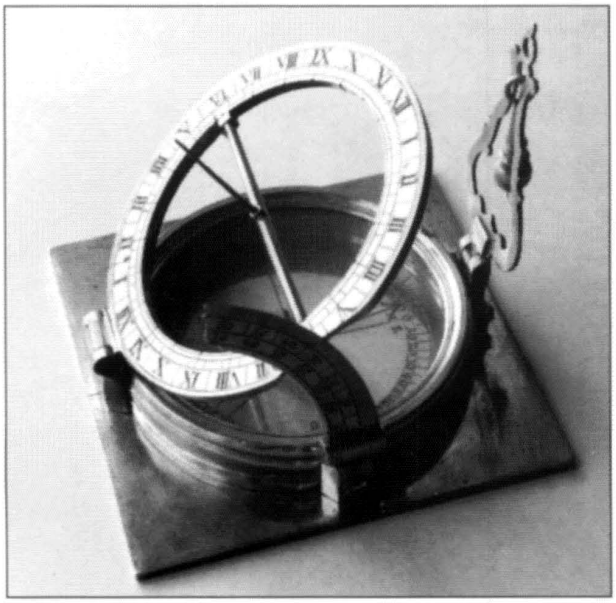

Fig.1. Austrian Pocket Dial.

During our visit we spent a day in Salzburg. It is a great place to visit, and has a wide selection of antique shops. The day was therefore spent going from shop to shop, with a break for apfel strudel and a glass of Budejovice (the REAL Budweiser).

One shop had a small selection of dials, mostly of the Butterfield style, and is worth a visit next time that you are in Salzburg. This is Antiquitäten - Hiko Antik, at Gställengasse 2. However, one dial took my attention. (Fig. 1.) Although unsigned, this brass dial was almost certainly the work of an Austrian craftsman. This can be seen from the list of towns shown on its back. (Fig.2.) Notice, in particular, Tirol 46° 38' and Viena de Austria: 48° 22'. The spellings of most towns are in French and not as would at first be expected, in German. However, French was the 'intellectual' language at the time throughout much of Europe, and the maker has used it to impress his esteemed customer.

Fig. 2. Towns engraved on the reverse of the Austrian Pocket Dial.

There have been three sales, all at Christie's with a good selection of dials. On 9 June, Christies King Street sold the statues and garden sculpture for the Secret Courtyard, the SEAGO Collection, in Pimlico. Amongst this collection were many garden sundials, mostly with their plinths. As soon as a plinth is added, the price goes up. It is no longer a 'sundial', but a 'garden ornament'. There were 30 dials offered of various styles making from £161 to £12,650 plus VAT, with only one unsold. Although many did not have makers' names, those noted were Dolland, Francis Barker, Thomas Mills, T. Ribright, Nairne & Blunt, Peerage?, Thomas Heath, Johannes Thos... Ebar... 1710, Richard Melville, Pilkington & Gibbs, And.w Cochran 1815, Troughton & Simms, Francis Barker, Thomas Cave - Dublin, Austin & Seeley & Co, and J. Molson. The Melville was a horizontal slate dial with 4 subsiduary dials, similar to many seen from his workshop. It was wrongly described as a 'wall' sundial! It was the only sundial not sold. The Pilkington & Gibbs Heliochronometer made a healthy £1265, no pedestal. The dial that particularly interested me was a 24" square horizontal stone dial complete, showing declination lines for each month, and the times in Constantinople, and Boston, New England, around its perimeter. (Fig. 3.) It sold for £2530.

On 10 June, Christie's South Kensington had a few dials in their Scientific Instrument sale. A rare Dutch compass/sundial by Anthony Sneewins, 1660 made £4140. (Fig.4.) It carried monthly calendar scales on its lid and underside. An unsigned Pilkington & Gibbs heliochronometer made £862. (Fig. 5.) A dipleidoscope by Secretan à Paris made only £172. (Fig. 6.)

Fig. 3. Large Stone Sundial in Christie's 'Secret Courtyard' sale.

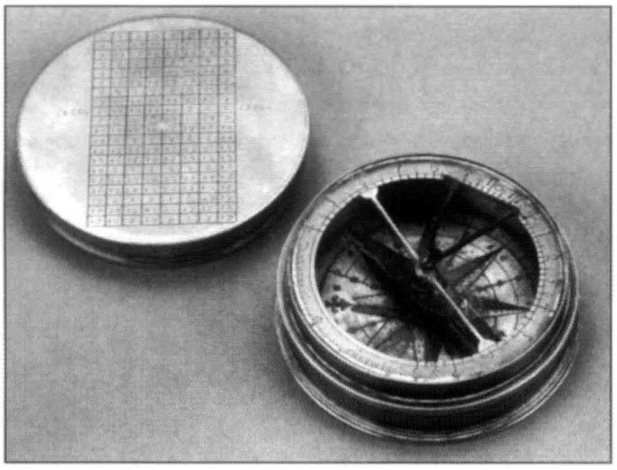

Fig. 4. Pocket Dial by Sneewins.

Fig. 5. Heliochronometer.

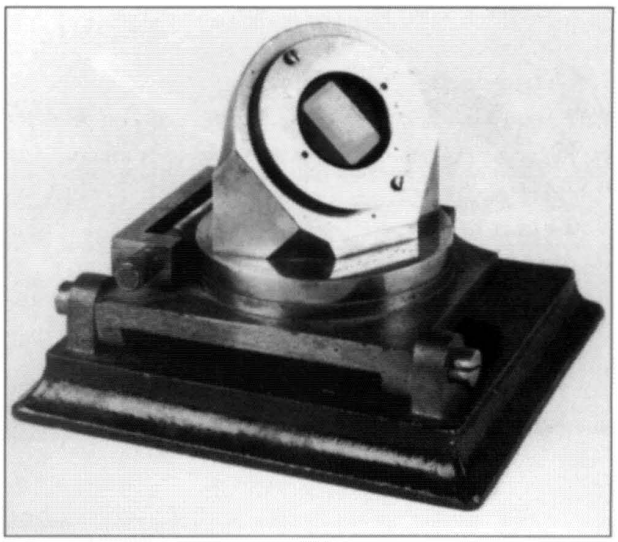

Fig. 6. French Dipleidoscope.

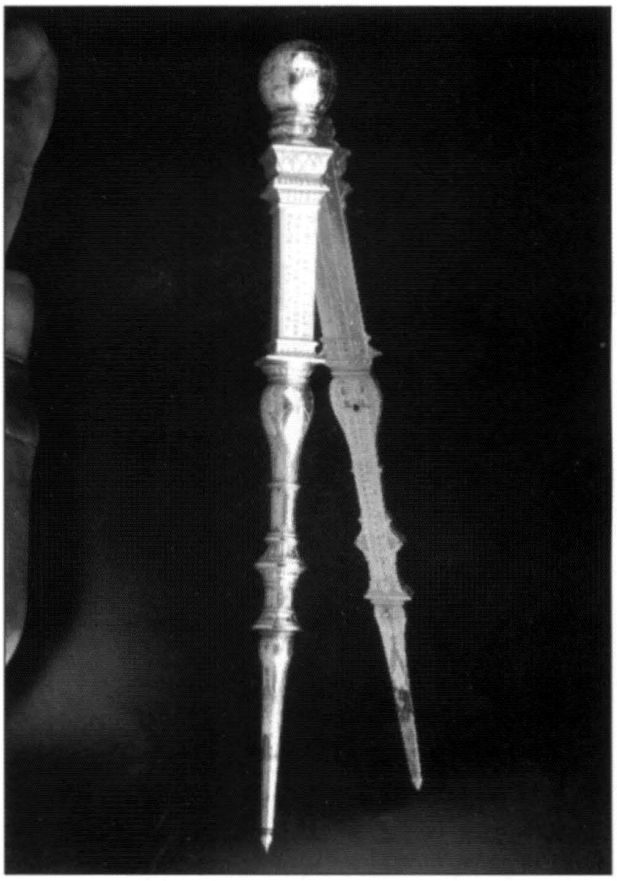

Fig. 7. Dividers by Christopher Schissler.

THE 'Sale of the Year' at Christie's King Street had to be that of the collection of The Barons Nathaniel and Albert von Rothschild. The sale was well reported on TV and attracted much attention. The viewing was extremely busy, but it was a once-in-a-lifetime opportunity to see, and in some cases, to handle some great works of art. The sale included around 225 lots covering all sorts of treasures. Lots 153 to 184 were scientific instruments, out of which were many sundials. I can only pick a small selection of these to enthuse about. Needless to say, the top estimates

were often exceeded by 2 to 3 times! A German brass and silver minute dial by Gottfried Weiss, estimated £25,00 to £30,000 made a good £42,000 plus premium and VAT. An unsigned 16th Century gilt brass astronomical compendium estimated £30,000 to £40,000 went for its top estimate. The real star of the sale, for me, was a pair of dividers by Christopher Schissler (senior), date 1587. (Fig. 7.) Inside the legs of these dividers are two vertical altitude dials, (Fig. 8.) The last pair of these sold, around two years ago made around £72,000 and these £130,000! I hope that they have gone to a good home where their beauty can be appreciated. There were two ivory diptych dials, one in book form by Thomas Tucher making £22,000, actually below its bottom estimate, and the other by Hans Tucher, 1571. It exceeded its top estimate of £20,000 making £70,000. The other item in the sale that had me mesmerised was an astrolabe by Thomas Pregel of Zwickau, 1629. Its rete was so fine and delicate, I could not figure out how it was fretted out. In places the thickness of metal was probably less than $^1/_4$ mm, just a few thou to old engineers like me. There had been a few repairs, but otherwise it was in excellent condition. It too exceeded its top estimate of £100,000 making £175,000. Some detail of this may be seen in Fig. 9.

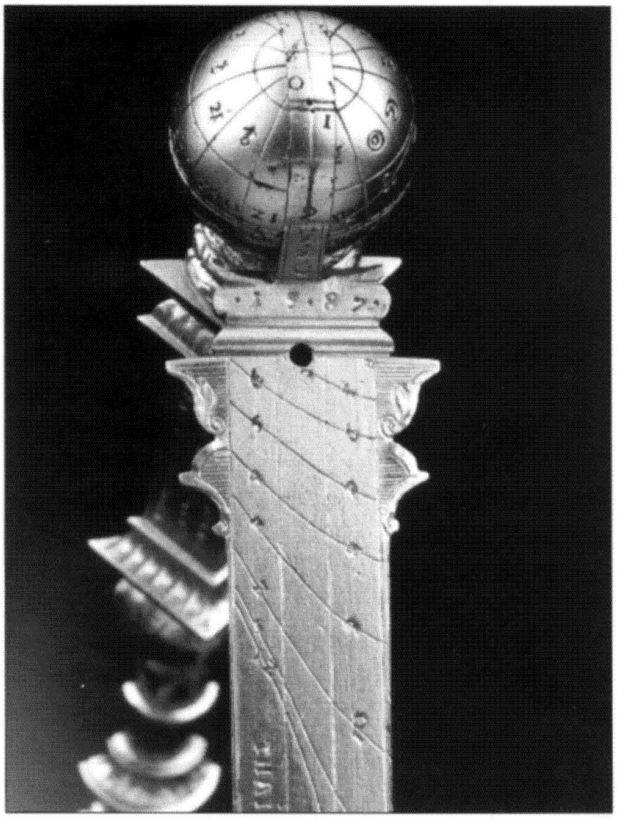

Fig. 8. Dial on inside leg of Dividers.

Whatever I describe now has be an anticlimax, but this one item was affordable. It was found in the Snape Antiques Fair in July. It is an engraved copper printing plate showing the image of Rev. William Oughtred. (Fig. 10.) Oughtred

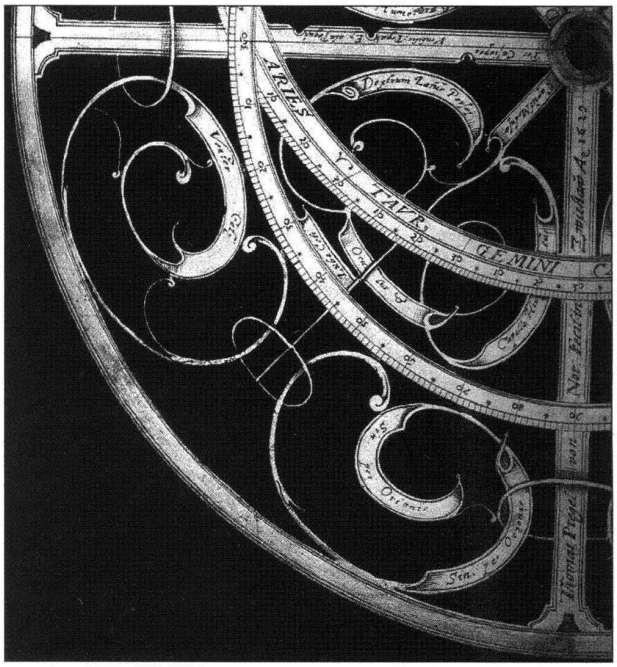

Fig. 9. Part of the Rete on the Thomas Pregel Astrolabe.

Fig. 10. Printing Plate showing Rev. William Oughtred.

is well known to diallists for his invention of the Ring Dial. See the book by Henry Wynne of 1682, 'The Description and Uses of the General Horological-Ring' where he attributes it to being 'the invention of the late Reverend Mr. W Oughtred'. He was born in Eton in 1573, was at King's College Cambridge in 1592 and his invention of the ring dial was published in 1631. He died around 1660. Oughtred is equally well known as being the inventor of the slide rule. It was a great find. I couldn't resist it. If I can find more information on Oughtred and this portrait in particular I will pen a short note for a future edition of the BSS Bulletin.

CALENDAR OF SALES for the remainder of 1999.
Note that some of these dates are tentative and may change. You are advised to contact the various salesrooms to verify the dates given.

Christies South Kensington.	Jeremy Collins - 0171 321 3149 9 December
Sotheby's	Catherine Southon - 0171 293 5209 2 November
Philips	James Stratton - 0171 629 6602 ext 364 14 September, 7 December
Bonhams	Jenifer Middleton - 0171 393 3950 16 December
Scientific Instrument Fairs, Radison SAS Portman Hotel, London.	Peter Delehar - 0181 866 8659 27th Fair - 27 October.

ACKNOWLEDGEMENTS.
I would like to thank the following for permission to use their photographs. These remain their copyright. Christie's King Street, Fig. 3., Christie's South Kensington, Figs. 4 - 10.

'ALL THINGS ARE FLOWING..'

Heraclitus

The time-chart on the schoolroom wall
with lines, numbers, arrows, letters,
arrogantly slices the continuum
into bite-sized pieces for feeding children:
Minutes-hours-days-years-decades
centuries and millennia, flowing
slippery and without edge,
are forced into shapes.

Names make aeons palatable:
'Classical Age' 'Middle Ages' 'Age of Reason'
absurdly packaged.
What flavour has our Age?
NOW's name?

In B.C., a whole millennium
is but a morsel.
In the here-and-now a decade
is a huge indigestible lump.

The Noon-Line!
Fixed point on sky and clock.
The children, sated, run down the minutes,
and the teacher
rolls up the centuries

M.S.

ODE TO VIAGRA AND LOVE

(as spoken by a weary gnomon)

I was a tired old bit of brass
Doing my best to stand erect,
Casting only a shadow image on the dial.

As I aged and my shine wore off
Clearly declining with the passing years,
I could not point as sharply as before.

Now with the aid of your welcome ministrations
I find at least I am still in place,
And in sight of one who loves me.

Jackie Holland

UNDER THE FULL MOON

I always had an interest
In Sundials, as a boy.
I thought but little of them,
Just a gardener's toy

I met with Ian Wootton
By accident you see,
A promise of enlightenment
Soon recruited me.

Three times a year I'm waiting
To hear the postman call
And get the plain white envelope
With Bulletin and all.

I read the words of Allan Mills
As regular as can be,
John Moir, with Shadowy Secrets
Always amuses me.

I've been to Newbury meetings
Which seem quite genuine,
But now I am suspicious
As to what 's beneath the skin.

I've come to the conclusion
That this is all a blind,
There's motives far more sinister
And of a secret kind.

By studying the Bulletin
It's plain for me to see,
The heavens are controlled
By this Society

Daniel is the Master
Of this astronomic plot,
With Somerville and Stanier
And all that back page lot.

There is a continental
And a transatlantic link,
Fred Sawyer and his cronies
Are all involved, I think.

It is these covert diallers
That the universe obeys,
Polaris on their orders
In the Northern sector stays.

The sun takes its instructions
From their gnomons on the ground,
Without the junta's say so
The world could not go round.

They've moved the Nought meridian
By giving it a tug,
And they're the folk responsible
For the Millennium Bug.

Please, ordinary members,
Do not be alarmed,
I'll free our heavenly bodies
Intact and quite unharmed.

I've taken counter-measures
To foil them, every one:
On the eleventh day of August
I'm going to hide the sun.

A.F.B.

Received 20 July 99

A DESIGN FOR A HORIZONTAL SUNDIAL ADJUSTABLE BY ROTATION AROUND A POLAR AXIS

ALEXANDER C. SCOTT

Frank Cousins, in his comprehensive book 'Sundials'[1] devotes a chapter to the 'Displacement of the Dial from the Earth's centre and the General Theorem'. He describes the latter by quoting from the succinct treatment by Atkinson[2], as follows :

> 'If two identical dials are computed and made for any given place, and one of them is set up correctly there, the other can be taken to any other place on the Earth, and provided it is set up parallel to the first one in every way, it will always record the same apparent time as that one

at the same absolute instant. The two must of course be truly parallel, and the line which is horizontal and north-south on the one will not in general be (locally) north-south or (locally) horizontal on the other. But if they really are parallel, the Sun's rays will always strike them both in just the same way at any given instant, and the shadow of the style will fall on the plate in just the same way in both cases. The theorem we have stated has a considerable variety of application in detail. For example, if we have a sundial which is correctly computed and set up at some station, and if we want it to read the standard time for the zone (after applying the Equation of Time, of course) instead of the local time, we need only rotate it about the slanting style-edge, through an angle equal to our longitude difference from the standard meridian; it will then be truly parallel to an identical sundial correctly set up on that meridian and will record what that one would. Quite generally in fact, if any correctly-computed sundial is rotated about its style-edge through any angle θ (degrees), its readings at any given instant will be changed by $\theta/15$ hours, whatever the actual time or date may be. Thus if we construct it with suitable bearings to give this kind of rotation, and if we limit the rotation to two suitable positions 15° apart, we can set it over to the east, in spring, so that it will read Summer Time, and can set it back again in the autumn, at a touch. It is really just like setting a watch. Alternatively, we can provide the rotation with a scale and pointer, and set it day by day (or week by week) so that the dial readings are always corrected for the Equation of Time. The scale can, if we wish, be marked out in terms of the dates when the Equation reaches certain values.'

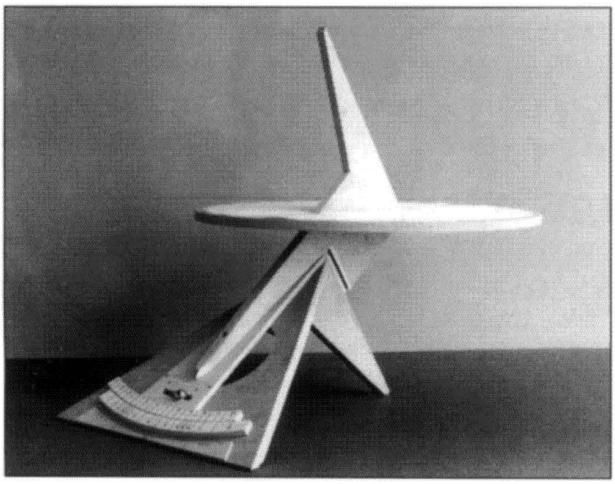

Fig.1: General view showing the Equation of Time and Longitude scales.

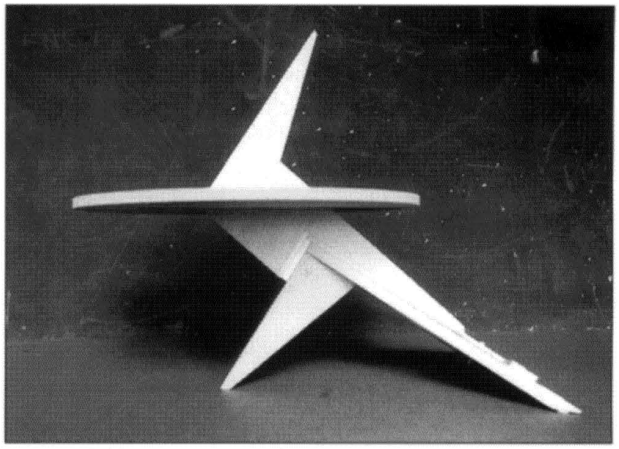

Fig.2: General view from side showing the gnomon-spine and bearing.

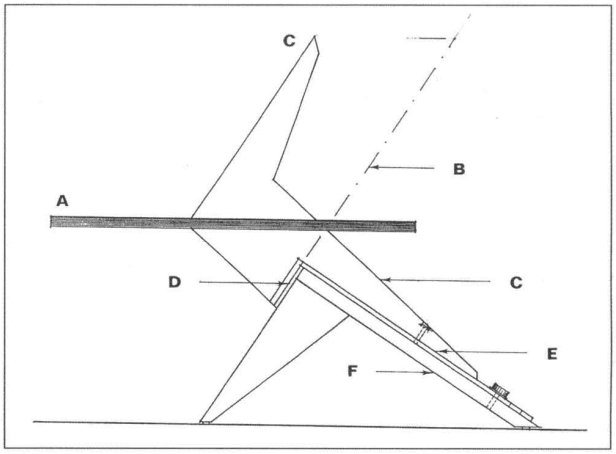

Fig.3: Side view showing the gnomon-spine and the position of the displaced axis parallel to the gnomon's style-edge.

These letters apply for figures 3-6:

A: Horizontal Dial Plate.

B: Rotation Axis displaced parallel to Style-edge on Gnomon.

C: Gnomon-spine clamped to Connecting Plate according to Longitude.

D: Bearing about which rotation adjustments take place.

E: Connecting Plate containing Longitude Scale and Twelve-month Scale.

F: Base Plate.

G: Vernier-like Equation of Time Scale on Base Plate

Although Atkinson says 'we need only rotate it about the slanting style-edge', it is clear that a rotation about any axis parallel to the slanting style-edge will achieve exactly the same result. Indeed, it could be quite difficult to construct a sundial in practice which could be rotated about its style-edge. What I have designed is a horizontal sundial with the facility of adjusting the dial for Equation of Time and Longitude by rotation about a *displaced* axis passing through a bearing. The main features are shown in the photographs in Fig.1 and Fig.2. The model consists of a

head and a base. The head comprises the horizontal dial-face together with its gnomon-spine and a pointer to measure the amount of Longitude rotation applied. The base has the support for the rotation bearing and a scale for measuring the Equation of Time. The head and base are linked by a connecting plate containing the Longitude scale and the Twelve-month scale; this plate is clamped to the base by a thumb-screw for regular Equation of Time adjustment and to the head's pointer by a grub-screw for setting the initial Longitude. Fig.3 (Side View) shows the location of the bearing - below the horizontal dial face - around which the combined dial-face and gnomon-spine can be accurately rotated to achieve a true adjustment for Equation of Time and/or Longitude.

Both Fig.4 (View from behind) and Fig. 5 (View from above) show the connecting plate and indicate the pivoting of the head during adjustments. One of the goals in this design was to make it simple and clear for a user to set the dial for different longitudes within any time zone on the same latitude and to provide Equation of Time adjustments on a regular basis as advocated by Atkinson.

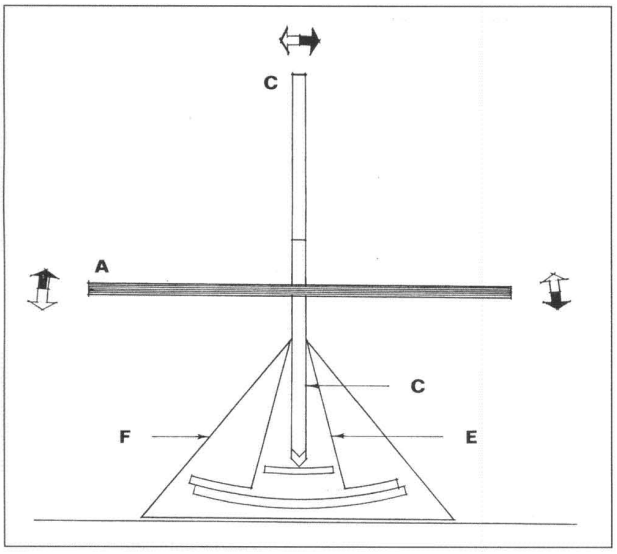

Fig.4: View from behind showing the connecting plate and indicating the pivoting of the head (gnomon-spine and dial plate) during adjustments.

The offset bearing configuration makes the adjustment practical. The simplicity and ease of operation is achieved by the use of a Vernier-like scale of greatly magnified extent. Unlike most Equation of Time scales which range over only a few degrees, the solution adopted here uses an arbitrarily large scale which could be spread over as much as 180 degrees in other configurations. An example is shown in Fig.6. For regular adjustment, the user simply aligns the two marks that correspond to the same chosen month or mid-month, one on the scale on the base and the other on the connecting plate. As the months progress the user causes the head with its dial-plate and gnomon-spine

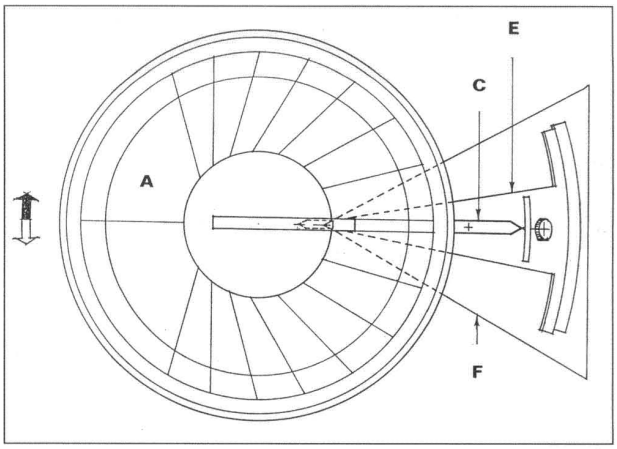

Fig.5: View from above showing the dial-plate, connecting plate and scales, and indicating the pivoting of the dial-plate during adjustments.

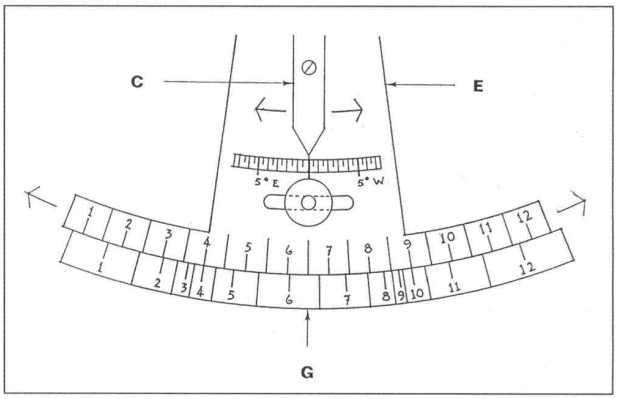

Fig.6: View of the connecting plate with the Longitude Pointer clamped to it by a grub screw; a thumb screw clamps the connecting plate to the base plate in the appropriate position indicated by the Vernier-like Equation of Time scale on the base plate and the Twelve-month scale on the connecting plate.

to pivot on its bearing up to its maximum tilt on one side and then back again to its maximum tilt on the other side, and back again, and so on.

ACKNOWLEDGEMENTS

My thanks go to John Amson for mathematical comment and for introducing me to the science of dialling.

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THE SUNRISE LINE

JOHN WALL

I have long been fascinated by what I will call (pro tem) 'The Sunrise Line', but recently I was obliged to focus on this phenomenon more closely when I produced a paper on 'Timing the Millennium: When and Where?' There are four different criteria by which any territory might claim to be the first to greet the new millennium, and one of them is the time of sunrise there on 1st January in the year 2000. It is, I hope, self-evident that the time of sunrise is not the same for all territories along a line of longitude, because the axis of the earth's rotation is at an angle of c. 23.5 degrees to the plane of its orbit round the sun. The 'sunrise line', along which all sundials spring to life in the same instant, is indeed a great circle, but it never coincides with a line of longitude, which is also a great circle, and one of the factors by which we measure time.

Of course, the Sunrise Line itself moves round the globe once every twenty four hours, not because the sun moves, although it appears to do so, but because the earth rotates. There is something quite magic about that moving line, on one side of which there is the light of day, and on the other side the darkness of night. It is sublimely expressed in that great astronomical hymn of John Ellerton (1826-1893) which begins: 'The day thou gavest, Lord, is ended, the darkness falls at thy behest'. Ellerton gives poetic expression to the Sunrise Line in such couplets as:

We thank thee that thy Church unsleeping
Whilst earth rolls onwards into light...

As o'er each continent and island
The dawn leads on another day...

The sun that bids us rest is waking
Our brethren 'neath the western sky.....

Yet the subject is not as simple as it seems. The first problem has to do with terminology. In my innocence I thought that there must be a single, succinct word to stand for this phrase 'The Sunrise Line'. '1sochron' will not do because that is a more general term which means any line which joins places of equal solar time. It is not confined to the Sunrise Line, which is only one of many possible isochrons. In a personal communication H.M. Nautical Almanac Office, based at the Royal Greenwich Observatory, was good enough to define the Sunrise Line as follows:

The boundary between day and night on a planet or satellite is known as the *Terminator* (italics mine). On one side of a planet it joins together all those points witnessing sunrise at a given time. On the opposite side of the planet at the same moment it links together all those points witnessing sunset.

Very good - but for my purposes there are two obvious drawbacks to that definition. The first is that positively off-putting and unappealing name '*Terminator*'. It puts one in mind of the 1984 science-fiction horror film of the same name which starred Arnold Scharzeneger. I'm afraid that I cannot feel comfortable with *Terminator*.

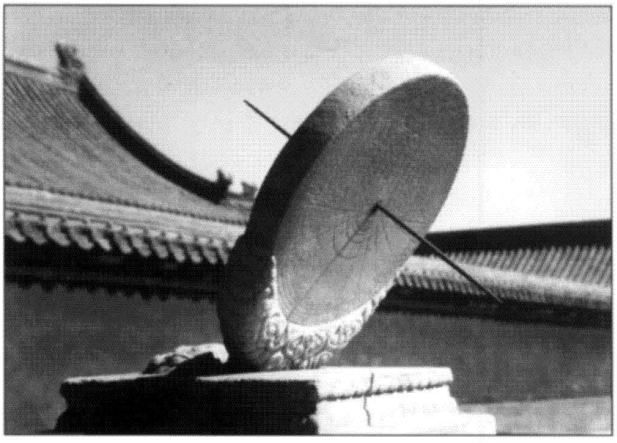
The second drawback is that, strictly speaking, the Sunrise Line is only one half of the Terminator - the other half is the 'Sunset Line'. Since a search of the literature failed to come up with any alternative, I deterrnined to fashion one word which encapsulates the meaning of the Sunrise Line and came up with soloriensorbis- literally (from the Latin) 'sunrise semi-circle'. Alas, the referees for my paper pointed out that since there is no such word they would prefer *Terminator*.

There is another problem with the Sunrise Line (hereafter referred to as soloriensorbis come what may) and that is its shape. Clearly it is a semi-circle when it girdles the three-dimensional earth, but how does it appear on a two-dimensional map such as a Mercator's projection? Initially, and thoughtlessly, I assumed that soloriensorbis would appear as a straight line intersecting lines of longitude in its path at an angle of c. 23.5 degrees. For a number of reasons I felt it necessary to rig up a simple experiment in a darkened room in which a school globe simulated the spinning earth and the narrow, horizontal beam of a torch on the opposite side of the room, directed at the globe, simulated the light of the sun. Closer inspection revealed that my simulated soloriensorbis line intersected the lines of longitude in its path at different angles. When plotted on a two~dimensional projection the shape is akin to a shallow capital S. I am not even sure if soloriensorbis retains this shape throughout the year. No doubt there is a mathematical computer programme somewhere which would enable it to be demonstrated on a monitor screen.

In fact, in a corner of the Time Gallery of the Old Royal Observatory at Greenwich there is a so-called Geochron, a back-lit World Time Map on a Mercator's projection. It is described as 'a moving transparent map of the world which, reflecting the earth's rotation round the sun in the course of

a year, shows those parts of the world which are in daylight and darkness'. Behold, when I saw it, the division between the two was a shallow capital S! At the foot of the map is a linear scale of dates, with the current date in the middle. Among many intriguing features the map exhibits and explains the passage of the soloriensorbis around the globe on every day throughout the year. If an observer sat in front of it for a whole year he would no doubt see if it changed its shape, or he might prefer to employ a time-lapse camera, or reward the attendant for keeping an eye on it, and achieve the same result.

Now let us return to the contentious question of when and where the new millennium begins. I will not reveal which inhabited territory, in my judgement, will be the first to see the sunrise on 1st January in the year 2,000. Even that is not as simple as it seems because of such complications as Time-Zones and the position of the International Date Line. Readers with a mathematical bent and possessed of a good atlas and a copy of Whitaker's Almanac may care to try the exercise for themselves. Again, I will not reveal the identity of the territory which, in my judgement, and taking into account all four criteria, including soloriensorbis, has the most plausible case for claiming to be the first to greet the new millennium. Suffice to say that it involves climbing to the top of a mountain in an island in the Pacific. That is where I want to be at about 5.29 hours on 1st January 2000, having set up a portable equinoctial sundial, adjusted for that latitude, in order to record the precise moment of the millennium sunrise there. My reticence in identifying the place is so that it will not become too crowded.



Equatorial Dial, Palace of Terrestrial Tranquility, Beijing.

Which brings me to my final problem. I am not even sure how a horizontal sundial on top of a mountain performs at sunrise - that is, well above the point at which the upper limb of the sun appears above an unobstructed sea horizon. I have never before been inclined to be in a position to observe such an event. (Perhaps a latitude-adjusted version of the 17th century leaning stone sundial outside the Palace of Terrestrial Tranquility in the Forbidden City, Beijing would answer the purpose - see illustration).

I would therefore be grateful if knowledgeable readers of the Bulletin could answer the questions which still trouble me:

1. Does the 'Sunrise Line' change its shape throughout the year?

2. Is there already a suitable alternative word to Terminator for the 'Sunrise Line'?

3. If not, would soloriensorbis be appropriate?

4. And if it is, how do we get the scientific establishment to accept and use it?

5. How does a sundial on top of a mountain perform at sunrise?

In any event, a happy new millennium to you all, whenever that is, and wherever you happen to be!

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BOOK REVIEW

THE INEQUALITIES OF SUNDIAL TIME
Dr. Eilon Saroka. Privately published, Rishon LeZion, Israel, 1999

This is a peculiar work, unique in the corpus of dialling and - maybe - even in the general literature of science and technology. In external appearance it resembles a Ph.D thesis, being A4 in size, an inch thick, and nicely bound between leather-and-gilt hard covers. In style, content and illustration it belongs to the 19th century, although produced by modern desk-top publishing methods.

The first chapter, entitled 'Astronomical Background', occupies 73 pages and fills about a third of the text. Here, in mind-numbing detail, Soroka considers every known cause of deviation from perfect constancy in the movement of the earth in space. Precession, nutation, polar motion, the changing length of the day with (geological) time, the difference between ephemeris and universal time; mean solar, sidereal, atomic and global positioning times - it's all here. But the reader has got to search, for there's no index! Personally, I found the over-frequent use of bold and italic scripts rather annoying, as were the Latin phrases larding the text. The abbreviation 'tg' in formulae is disconcerting until one realises that this is replacing the usual 'tan'. This, and other infelicities, suggest that English is not the author's native tongue.

Chapter 2 explains that the sundial yields local apparent solar time, and subsequent chapters consider terrestrial factors that could disturb a 'true' indication. We meet gravitational deflection of the vertical; atmospheric refraction and its variation with altitude; elevation, pressure and humidity; diurnal aberration and geocentric parallax. One would expect a blizzard of references to modern professional astronomical and geophysical journals, but David Hughes' well-known l989 paper on the Equation of Time is the only citation to Monthly Notices of the Royal Astronomical Society. The Astrophysical Journal and Journal of Geophysical Research are conspicuous by their absence. This is inexcusable in a work of this nature, with its tacit claim to be comprehensive. Simon Newcomb was brilliant in his day, but advances have been made since then - as is made obvious by a perusal of Astronomical Abstracts.

The work becomes unique when the author cheerfully admits that, so far as sundials are concerned, almost all the factors that have been examined at such length are irrelevant - it's all a waste of effort for the diallist! Apart from atmospheric refraction, the totality of all these minuscule deviations produces a theoretical error of less than one second either way in the reading of a sundial. Even refractive error, which can reach a value of 3 minutes when the Sun is on the horizon, is not really relevant - we do not need a sundial to tell us when the Sun is rising or setting! It's all a matter of an instrument being appropriate for its task. The greengrocer does not employ a chemical balance sensitive to a milligram to weigh out potatoes, and his customers are happy to accept their order to the nearest whole potato. The sundial is neither intended nor suited to measure time to a second. For one thing the Sun is not a point source, so does not throw a razor-sharp shadow. The book is strangely silent on this fundamental fact.

At last, well past the half-way mark, the author comes to the Equatlon of Time and the analemma, and things improve. These are relevant to sundials, but the presentation is still so complex and encyclopaedic that it is only suitable for resolving a point of detail in discussions between experts. Putting this work in the hands of anyone who has made an innocent enquiry would be enough to put them off sundials for ever! It appears that Soroka's academic desire to understand everything in quantitative detail gave intense personal satisfaction, but ultimately overwhelmed him. (Hence the absence of an index?) This is a pity, for a great deal of effort has obviously been lovingly dedicated to this opus. In my opinion the author needs the advice and assistance of an experienced and ruthless editor to help him divide the work into two potentially valuable monographs:

I : 'Inequalities of the Earth's Motion'

This title would not impute false errors to the humble sundial. An acceptable treatment would require proper reference to modern astronomical and geophysical literature.

II : 'The Equation of Time and the Analemma'

Again, proper search and reference to primary professional journals and appropriate secondary literature (e.g. Sky and Telescope) needs to be made, but the author must make up his mind on the audience he is seeking to reach.

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JOURNAL REVIEW

Compendium, Journal of NASS,
Vol.6 No.1 (March 1999)

This issue of Compendium opens with an interesting article by James Ludwig of Peoria, Illinois, about a stone sundial: cube of 4 dial faces surmounted by a stone sphere. It is now in a cemetery in Deland, IL, and the writer has traced its many adventures, starting perhaps around 1650 at Ross-on-Wye or Trelleck in Britain, at 52°, the latitude for which the gnomons are set. It was acquired by a wealthy philanthropist and art-collector, Robert Allerton, (1873-1964) and adorned his garden near Monticello, IL, until 1927 when he replaced it with a statue and gave the dial to the cemetery.

Fer de Vries writes about the Capuchin Dial and then goes on to explain how the Capuchin can be combined with an Apian Dial to give a universal (card) dial available for any latitude. The author gives us a glimpse of the history of the Capuchin Dial and its variants since the 15th century.

The 'Sightings' section from Steve Woodbury gives photographs and a description of a fine sundial - a monolith in the White Point Garden in Charleston, S.C. The dial is a vertical, slightly declining, about 2 feet in diameter, on one face of the monolith. This is a memorial erected in 1954 to 176 sailors of the U.S. Navy, from U.S.S Hobson. During naval training exercises in 1952, their ship was in collision with another U.S. naval vessel, and sank in 4 minutes. The plinth on which the monolith stands is made from stones from each of the 38 home states of those who died.

Compendium, Vol.6 No.2 (June 1999)

In this issue Steve Woodbury's 'Sightings' section offers us three horizontal garden dials. The first is in the Herb Garden of the Denver Botanic Garden in Colorado, put up in 1974 to commemorate the designer of the herb garden in 1964. The second is at Oatlands, Leeburg, Virginia, in a garden that now belongs to the National Trust for Historic Preservation. In the photograph the dial looks a handsome affair, the plinth and capital well carved in Tennessee Marble, but incorrectly aligned; though an old photograph in a nearby barn shows the dial properly aligned. The third dial is in the herb garden of Cornell Plantation, Ithaca, New York, and was erected in 1974; it is made of local materials and the base is an old mill stone from a nearby village.

Jan H. Praetorius of Cape Elizabeth, South Africa, offers an ingenious 'sundot polar dial'. He explains the advantage of a light-spot, as compared with a shadow, in the accuracy with which dial can be read. His dial is a hollow cylinder, fixed at the latitude angle, and pointed towards the celestial pole. Series of three small holes in the wall of the cylinder positioned above the equinox lines produce light spots on the lines inscribed on the inner wall of the cylinder. The layout and making of this dial is simply explained, and many readers will surely be trying their hands at this design. I hope that some readers who have joint BSS and NASS membership will produce at least a mock-up of this dial, to show us at our next Annual Conference.

Yvon Masse of Pontoise, France, invites us to a game of Shadow Tag: three vertical gnomons must be placed on a horizontal surface in such a way that during the course of a single day the tip of the shadow of each touches the base of the other two.

The 'Notes , Queries and E-mail' printed section is often of general interest. One reader asks about making sundials from wood. What kind of wood is best? He received ten replies (including 3 or 4 from Britain). Teak seemed to be favoured. Another reader asked about finding a wall's declination: three good suggestions here.

This issue also announced the date of the next NASS Annual Conference: 8th - 10th October, 1999 at Hartford, Connecticut. The delegates will go on a bus tour to 7 interesting sundials, and to Albert Waugh Collection of dialling books, now at the University of Connecticut.

M. S.

SUNDIALS IN ANGLO-SAXON ENGLAND PART 3: THE MIDDLE PERIOD - DARLINGTON AND PITTINGTON

The widespread destruction of churches during the Danish wars in ninth century England was followed at the beginning of the tenth century by an ecclesiastical revival, which may be taken as the middle period for the classification of Anglo-Saxon sundials. Figure 5 shows how the sundials at Darlington and Pittington, respectively 27km south and 5km north east of Durham, and believed to be from this period, may have been related to other Anglo-Saxon sundials and to those in Italy, Byzantium, Germany and Ireland.

Sundials in Anglo-Saxon England were derived ultimately from the Graeco-Roman hemicycle, Figure 6. It is said to have been invented by the astronomer Berosus, who lived on the Greek island of Kos during the fourth century BC. It divided the period between sunrise and sunset into twelve equal parts, which were indicated by the position of the tip of the gnomon's shadow, as it moved in a curve over the hollowed surface. Sundials of this type have been found all over the Mediterranean region, but we are reminded by Derek de Solla Price[11] that their primary purpose was not necessarily the measurement of time, but rather the aesthetic or religious satisfaction derived from making a device to simulate the heavens.

The hemicycle was a portable instrument, albeit a heavy one, requiring an unobstructed view to the north east and north west, making it unsuitable for mounting on the south wall of a building. The early Christians in Italy, perhaps acting on pope Sabinian's edict about placing sundials on the walls of churches, may have taken the pattern of lines as seen from the front of a hemicycle, and transferred it to a plane surface, giving the familiar protractor-like semicircle. The tip of the gnomon's shadow no longer moved over the surface in a series of concentric arcs, and it must be supposed that the whole shadow became the indicator by its direction, giving unequal divisions of the day. A sundial of this type was found at Ostia Antica in Italy, and may have been the kind illustrated in the books brought to England from Rome by Benedict Biscop towards the end of the seventh century.

The early English church probably adapted the protractor-like sundial to meet the needs of Anglo-Saxon communities, incorporating a pre-existing and familiar four-part division of the day. This was also convenient for marking the times for Terce, Sext and None as they were then celebrated, but above all it was used to illustrate the unending passage of time. The sundials at Escomb and Corhampton seem to have been of this type.

A circular wall-mounted sundial, overlooking the graveyard of a church at Fulda in Germany, has survived from the Middle Ages, and is one of a number of similar sundials in the Hesse region. It is dated by Karlheinz Schaldach[12] as from the twelfth century; its function he believed was, at least in part, to act as a reminder of the brevity of human life: a function similar to that proposed for the early Anglo-Saxon sundials. The lower semicircle has four main divisions, each subdivided to give a total of eight, and the design is thought to have been derived from direct contact with Rome. But it seems possible that the English missions to Germany in the eighth century took the Anglo-Saxon sundial with them, and Boniface of Wessex may have placed one with four divisions on the wall of the monastery which he founded at Fulda. The circular eight-division sundial still in existence could have evolved from Boniface's time.

At about the same time as the English missions to Germany, the simple semicircular sundial was carried across to Ireland, where it emerged with distinctive line terminations, such as the one at Inishcaltra. But there are those who believe that the simple sundial originated in Ireland and was carried across to England, rather than the other way round. The Danish raids on England at the end of the eighth century mark a clear break, and the early Anglo-Saxon period may be taken as coming to a close.

By the beginning of the tenth century only a few sundials had survived in England, often lying among the church ruins. The sundial at Darlington, which seems to belong to the revival period, is divided in the early four-section tradition, extended to eight to depict day and night. The stone block on which it was carved is now on display against a north pillar in the nave of St Cuthbert's church, Figure 7. According to A. R. Green[13] the church was built between 1192 and 1195, although he felt confident that the sundial was the work of an Anglo-Saxon mason. The block has been roughly trimmed, which, according to D. H. Haigh[14] may have been done to form the sill of an aumbry (a recess in the wall of a church for the storage of sacred

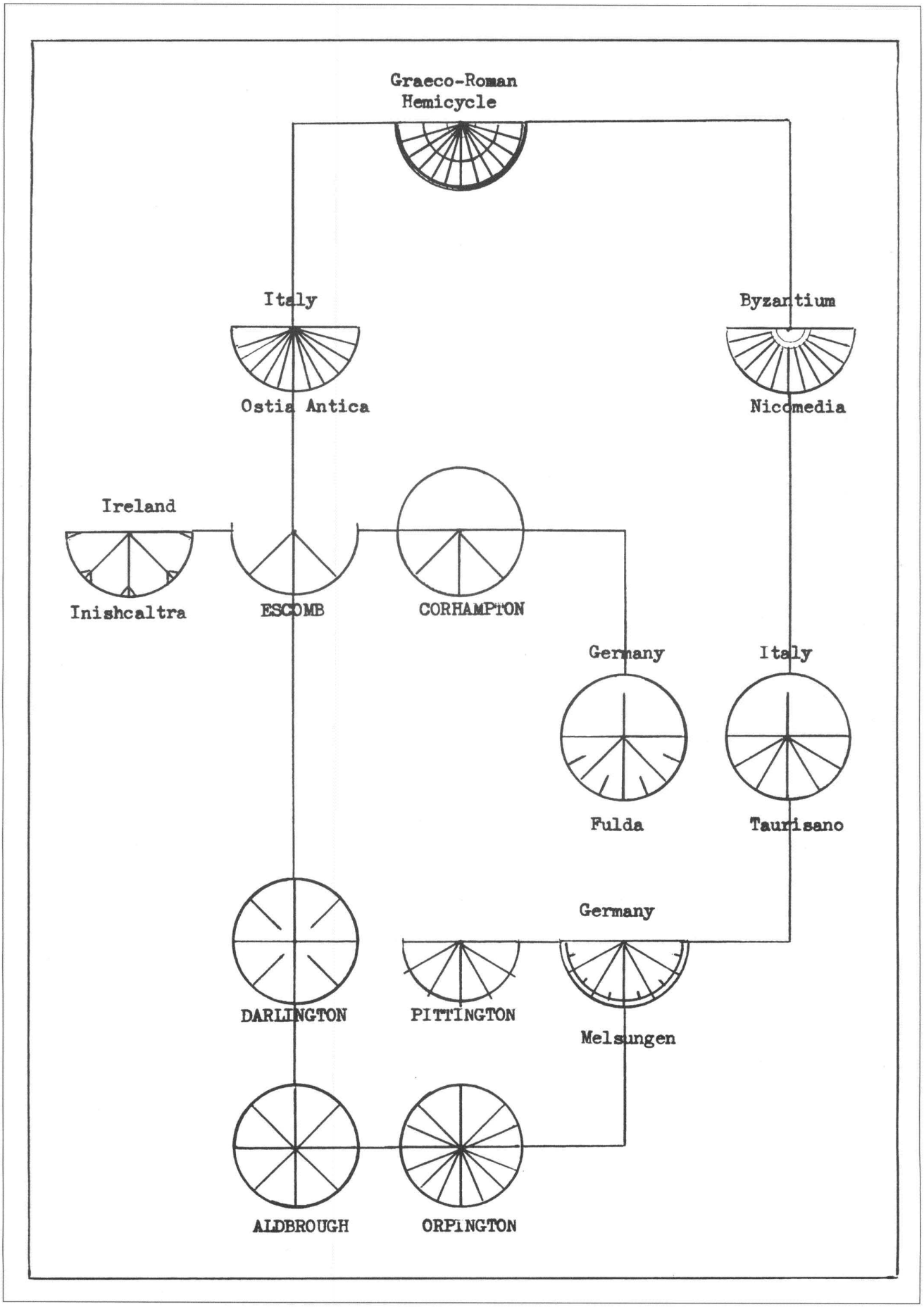

Fig. 5 Darlington and Pittington. Possible relationship to other sundials

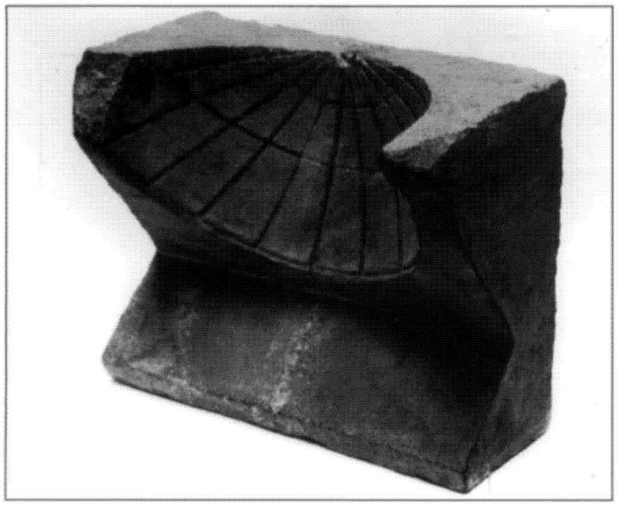

Fig. 6 Graeco-Roman Hemicycle – Citta Lavinia (Copyright The British Museum)

Fig. 7 Sundial on display in St Cuthbert's church Darlington (Photograph: Noel C Ta'Bois)

vessels), presumably for the existing church. This suggests that the block when found was unrecognised as a sundial, or at least regarded as of no importance, and valued merely as a useful piece of building stone.

We know from Rosemary Cramp[15] that the stone block has a sundial cut on both front and rear faces, and Figure 8 shows how they may have appeared when new. Green believed that the one with six circles as displayed in the church was cut by the mason in error; so he turned the block over and carved the eight-circle sundial, which Green thought was the intended one. The block is about 24cm thick, and originally perhaps 67cm square, so that it weighed approximately 550kg, a heavy object for a wall-mounted sundial. Haigh thought it had been made for horizontal use, and seemed unaware of the second side. But it could have been the upper part of a free-standing pillar, which could explain the two faces but not the different number of circles.

The radial lines are not spaced at 45°, although at first sight they seem to be; but this may be no more than lack of care in setting-out on the part of the mason, and had no special significance. Haigh thought the three inner circles, on the six-circle face, were marked by the length of the gnomon's shadow at mid-day at the solstices and equinoxes, but the relative distances of the circles from the base of the gnomon do not support this idea. Some of the lines have been crudely overscored, by contrast with the original engraving which is neat; it is not known when this was done or why. The gnomon holes are small round and smooth and show no signs of damage caused by violent removal of the gnomon, so often found on Anglo-Saxon sundials. Indeed the holes may be no more than the centre points used to draw the circles.

If the sundial was horizontal, the shorter lines may have marked sunrise and sunset at the solstices, for these seasonal checkpoints were of interest from the earliest times, for practical and superstitious reasons, as we know from the alignments in stone circles such as Stonehenge. In times closer to our own the fascination with solstice points was continued with the heliotrope, an obelisk located to mark the summer solstice as seen from a particular position, by observing the changing position of sunset on the horizon.

Haigh considered the outer circles at Darlington as mere decoration, and mentioned, as did Green, a curious symbol in one of the segments, which he believed marked an early event in the day, but it cannot be seen in a modern photograph. Most old stone sundials are covered with pits and scratches, which were accidentally made but imagined to have some kind of special meaning.

The two sundials on the stone block at Darlington may have been representations of the universe as it was then believed to be. The earth, symbolised by the central hole, was thought to be at the centre of all things. The curious mark, if it existed, might have depicted the daily journey of the sun round the earth, while time itself was illustrated by the rotating shadow of the gnomon as it moved over the radial lines, assuming that a gnomon was used. We know from Peter Hunter Blair[16] that the earth was believed to be surrounded by seven heavens.

First came air, aether, Olympus and fiery space, and beyond these lay the firmament, the heaven of the angels and the heaven of the Trinity. The circles may have represented the boundaries between the heavens, the eight-circle sundial depicting each heaven between successive circles. This seems less appropriate than the six-circle alternative, (if Green was right about one being in error,) for here air

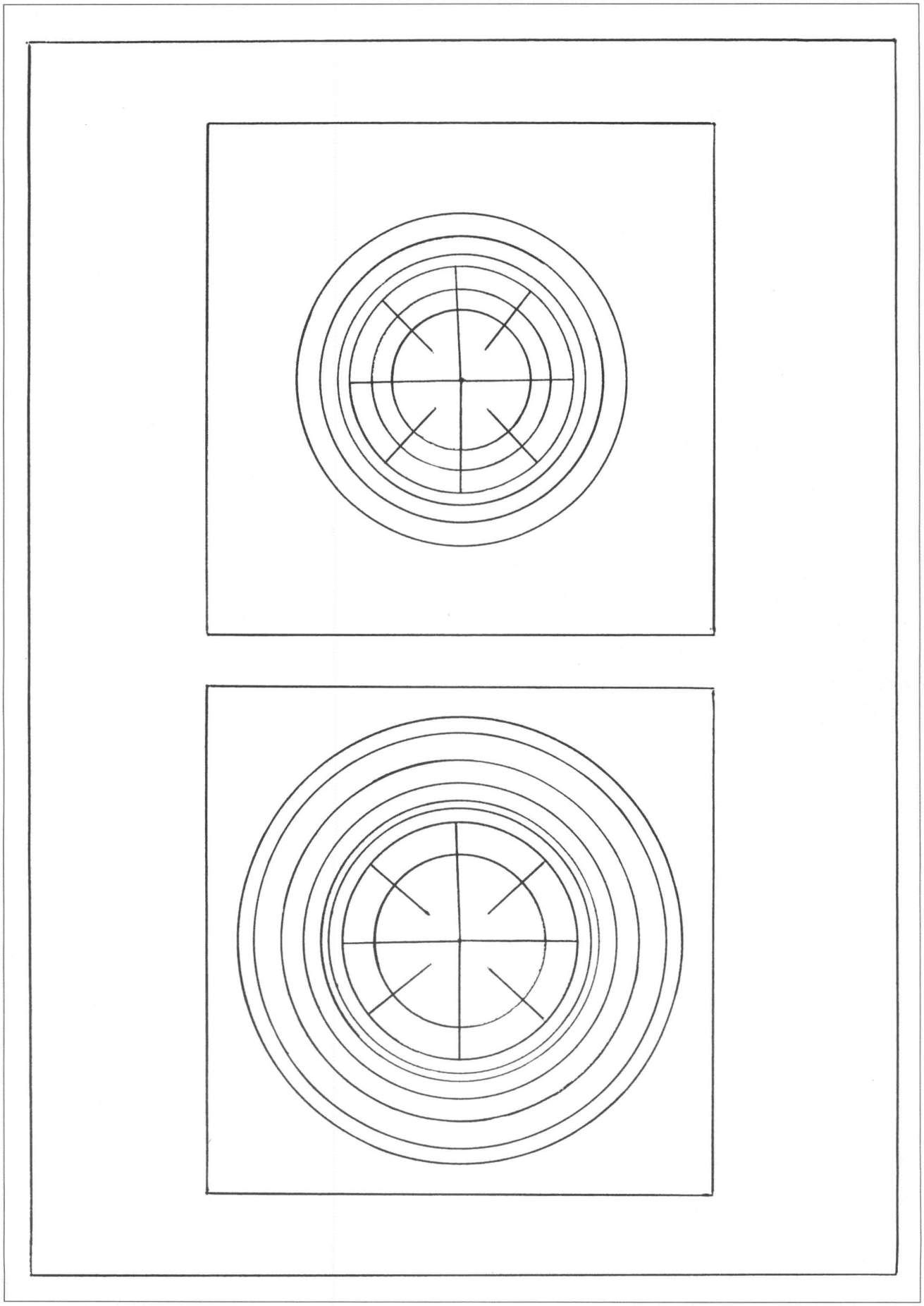

Fig. 8 Front and rear surfaces of the sundial at Darlington

comes between the earth and the inner circle, and the heaven of God beyond the outer circle, which would be infinite. If that was their purpose the six-circle sundial seems preferable.

The early period sundials, although Christian era devices, may have marked for convenience the pre-Christian four divisions of the day, but they also marked the end of each third hour of the ancient Graeco-Roman twelve-hour day. The development of all forms of art, which we may take to include sundials, was interrupted by the Danish wars, and the inspiration for its revival came, at least in part, from Italy and Byzantium by way of Germany. The sundial at Pittington, Figure 9, is the earliest example of division by six in England and seems to have entered the area from an outside source.

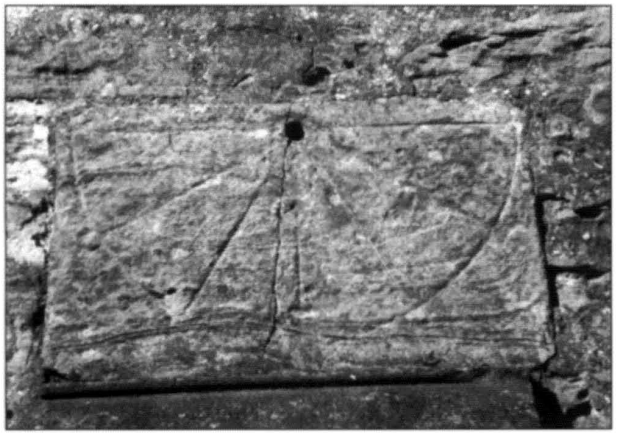

Fig. 9 Sundial on Pittington church (Photographer unknown)

The eastern half of the Christian church also developed a plane-surface sundial from the hemicycle. One example of such a dial was found near Alexandria at the base of Cleopatra's needle. It has twelve spaces marked with Greek letters, and Sharon Gibbs[17] believes these to be in the Byzantine style. A plane-surface sundial found not far from Istanbul also has the spaces marked with Greek letters, together with stylised day curves such as those found on most hemicycles; though these on a plane-surface sundial would have no meaning. A circular sundial at Taurisano in southern Italy has the lower semicircle divided into six, with the lines other than the vertical again marked with Greek letters. It has been pointed out by Mario Arnaldi[18] that these are the initial letters of the canonical hours, with Terce and Sext now at the end of the second and fourth hours, and None and Vespers at the end of the eighth and tenth hours. In southern Italy and other Mediterranean countries where it is hot at mid-day during the summer, it may have been found preferable to leave the middle of the day free from the obligation to celebrate Divine Office, while still keeping to the sacred number of seven for the whole day, as first drawn up by St Benedict. The Spanish word siesta, which we know as a mid-day rest in hot countries, is derived from sexta hora - the sixth hour. This may have been the origin of dividing the sundial, and thus nominally the day, into six intervals. The sundial at Taurisano also carries two epigrams, one of which states 'The hours of the day', which we may take to mean the 'Canonical Hours'.

Germany had enjoyed contact with the civilisations of Italy and Byzantium during the ninth century. The sundial at Melsungen, 25km south east of Kassell, has six main divisions much like Taurisano; this may have been a result of these contacts. (The dial is subdivided into twelve, perhaps a joint influence from Italy and Byzantium.) The makers of the Melsungen sundial may not have known the reason for division by six at Taurisano. During the ecclesiastical revival in England there had been regular exchange of clergy between Germany and England and this could explain the similarity between the sundials at Melsungen and Pittington.

Figure 10 shows details of the sundials at Taurisano, Melsungen and Pittington, each of which is divided by six, with mid-day marked by a cross or cross-bar, and the canonical hours , which originated at Taurisano, marked by a Greek letter, cross or rectangle at the end of the lines.

According to J. Barmby[19] there may have been a log-built church at Pittington when Aidan was bishop at Lindisfarne, but the earliest part of the church dates from the Norman period, possibly part of a Benedictine abbey attached to Durham. The sundial is cut on a block of stone 54cm by 32cm, and has a crack running from the gnomon hole down to the left of the vertical line at the circumference. It also has meandering parallel lines scratched across the lower half. The stone block may have been buried, accidentally or deliberately, after the destruction of the Anglo-Saxon church, and the scratches made by a farm implement such as a harrow. Sometime later, perhaps in relatively modern times, the sundial was rescued and placed in its present position above a buttress on the outside wall of the south aisle.

The sundial at Melsungen has crosses at the ends of five lines within a double circumference; they are wedge-shaped and Germanic in appearance. We do not know whether the rectangles at the end of the lines at Pittington contained crosses, for the stone is much eroded; but Haigh thought that the sundial was reminiscent of a stone-circle arrangement found at Wallsend during the nineteenth century. It consisted of a horizontal slab, formerly a Roman altar, on which radial lines had been engraved, surrounded by a circle of twelve equally-spaced stone blocks, at some

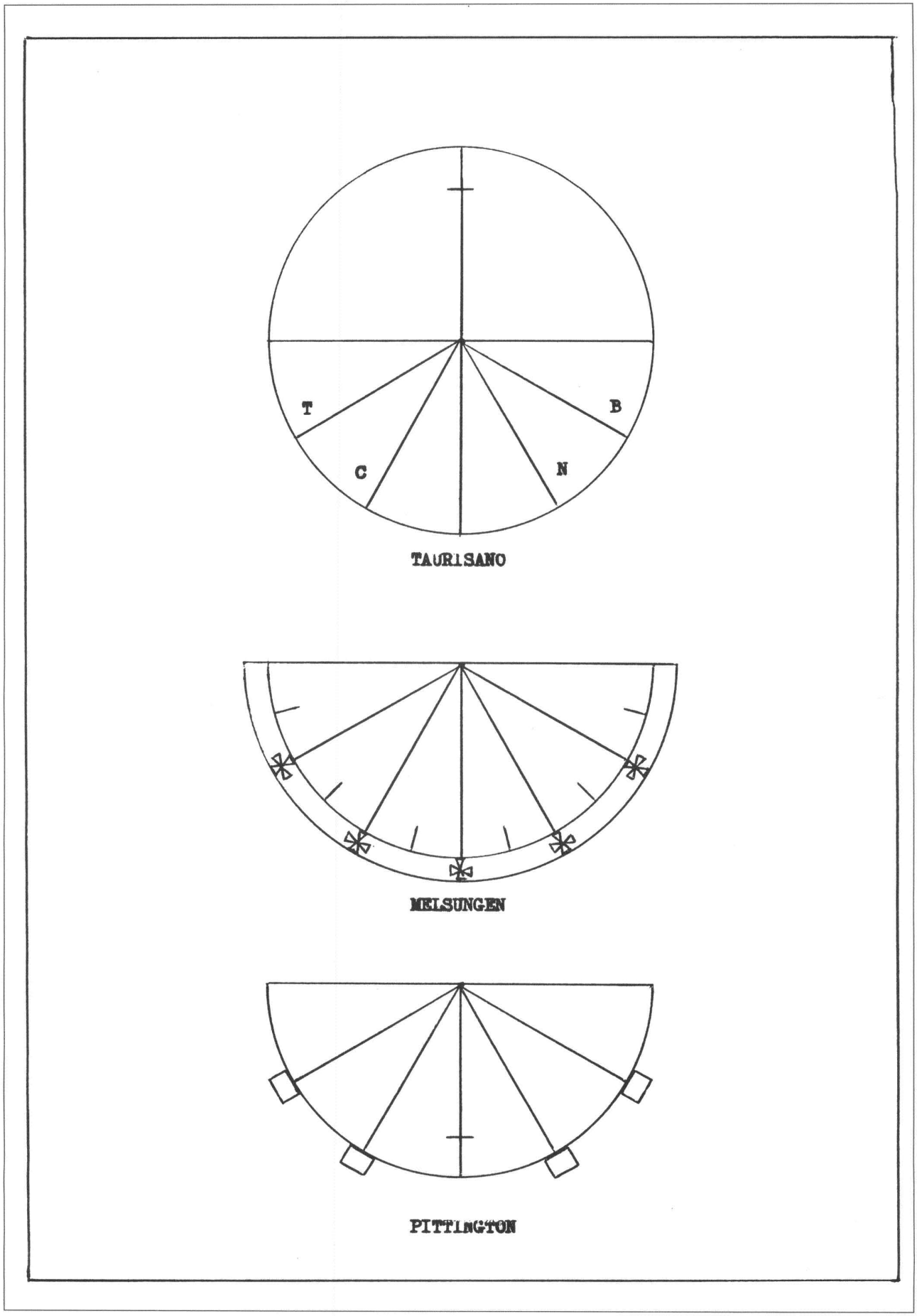

Fig. 10 Sundials at Taurisano, Melsungen and Pittington.

distance from the slab, which he believed were time markers. But no trace of this arrangement can be found today. Six-division sundials have been described as 'bi-hourly', but it is difficult to see any use for them other than the rearrangement of the canonical hours, the supposed reason at Taurisano.

There is little to suggest that the Anglo-Saxons of the middle period made any attempt to measure time, as we understand the word measurement, and they were in some ways using sundials more as expressions of folk-lore than as embryonic precision instruments.

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READERS' LETTERS

A DIALLERS' GLOSSARY

I have often wished that I could obtain a 'Diallers' Dictionary'. This would have been particularly useful when I joined the B.S.S. and often on occasions now, one would be handy for reference. This feeling was reinforced when I loaned the Bulletin to a potential dialling recruit. He returned it having 'given up', as the normal English Dictionary gave normal English usage of the words and not the precise dialling definitions which is of course what he required, to make sense of the articles. If there is not already such a dictionary in existence, could we as a Society produce one?

I realise that this would be a task which one person might not be prepared to take on, but perhaps it could be shared.

If the alphabet were to be divided into three sections, (i.e. A→H, I→P, Q→Z) members could be asked in the October issue to submit as many dialling words, in alphabetical order, as they could think of. These could then be collated and a reasonably complete list obtained. Then someone more knowledgeable than myself could add definitions.

They could be published in the February issue, and an appeal for the next eight letters would be made. These could be published in the June Bulletin, and the following ten letters in October, 2000. By this time we would have a complete 'Millennium Dialling Dictionary'.

This could then, perhaps, be printed as a booklet at some future date-when members have had time to add or suggest changes. If such a Dictionary does exist, I am sorry that I have wasted your time. If it does not, maybe the Council would consider it.

A.F.Baigent
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Goring-on-Thames
Reading RG8 0HL

EQUINOX AND SOLSTICE TRACKS

The question of determining equinox and solstice tracks for reclining/declining dials was raised by John Davis ('Satellites and Sundials', Bull. BSS,11,77-80).

A short-cut approach to the problem is as follows.

The dial, with its gnomon at a known angle α to the substyle, can be recalibrated as a horizontal dial for latitude $\phi=\alpha$, and hence the positions of equinox and solstice tracks, relative to the substyle, can be found. (A special case is the well-known equivalence of vertical and horizontal dials for complementary latitudes.)

To complete the story, the equinox line on a horizontal dial lies at a perpendicular distance Lsec ϕ from the root of the gnomon, where L is the gnomon length from root to nodus. And on the solstice curves, each intersection with an hour-line lies on a circle of radius Lsin ϕ cotA, centred on the sub-nodus, where A is the sun's altitude at that hour. (SinA = cosϕcosDcosHA ± sinϕsinD, where HA is the hour-angle and D=23.4°.)

John Singleton
The Old Coach House
Salcombe Road
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RGl4 6ED

SUNDIALS IN ANGELSEY ABBEY GARDENS, CAMBRIDGESHIRE

The photograph of the dial at Blickling Hall (Bull.BSS **11,** p37) prompts me to send this photograph of a sundial at another National Trust house, Anglesey Abbey, Cambridgeshire. It also is wrongly placed. (Fig. 1 a and b). From the guidebook by the National Trust we learn that this dial in the care of Father Time actually came from Stowe. It must be placed purely as a garden ornament. The dial actually points North East, and is in Father Time's shadow for most of the day. But if Father Time were to be rotated to enable the sun to shine on the dial (which would need to be adjusted anyway) he would present his naked backside to visitors entering the garden, hardly a dignified posture or even stylishly appropriate to his reputation! (See Fig.1b: Father Time should be turned to smile at the sun, as I am)

Strangely, a delightful and accurate sundial in the garden is not even mentioned in the guidebook. Only the statue standing on it has a mention: 'A statue of the Saxon god Tiw by J.M.Rysbrack (1694-1770) which came from the gardens at Stowe, presides over a generous green lawn...' As you can see (Fig.2) the four-sided dial is a wonderful piece of work. It is inscribed: FEARE GOD OBEY THE KING. I had to wait till about 1 p.m. sun time to get a shot showing readings of the time on the two faces available during the normal opening times of the establishment.

The Anglesey Abbey gardens have a great many statues which enhance the charm of the garden, and no doubt they are all placed to show as decorations not as practical

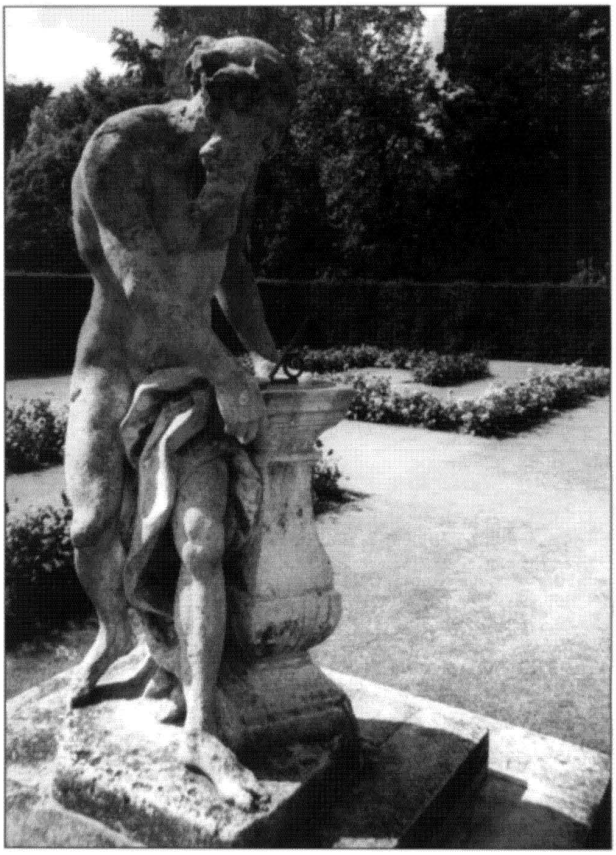

Fig.1a Dial in the shadow of Father Time

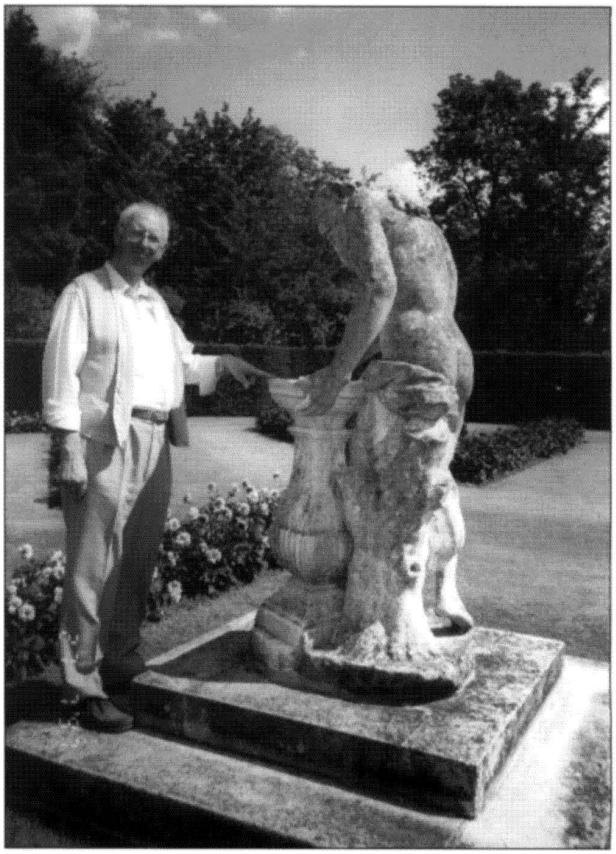

Fig.1b Father Time and me: the whole should be turned to face the other way smiling at the sun as I am.

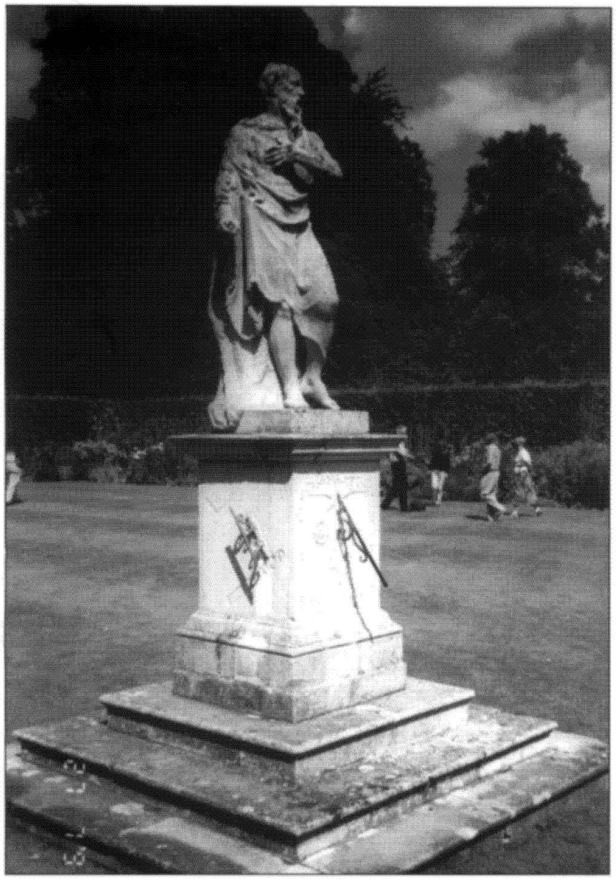

Fig.2 Multifaced dial

Fig.3 Horizontal dial near the house

timepieces. There is a delightful dial near the house and the rose-garden (Fig.3) which does not appear in the guidebook. This dial is correctly positioned to show sun time.

The National Trust attitude to sundials does I think vary with the local management. I had a very charming response from the Head Gardener at Mottisfont Abbey Hampshire on the comment I made on the inaccuracy of the armillary dial in his rose garden. (Unfortunately it was stolen about a month later!). Barrington Court ignored my correspondence. Thus it is the local management not the organisation as a whole which provides the care or otherwise of the sundials in its possession.

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ABBREVIATIONS & SYMBOLS IN GNOMONICS

I would like to reply to K.H.Head's query about symbols for such quantities as azimuth, altitude, declination, etc.

An authoritative book on the subject is The Explanatory Supplement to the Astronomical Ephemeris (E.S.), which is used internationally. It gives : -

A = azimuth, measured from north through east in the plane of the horizon.

a = altitude, measured perpendicular to the horizon.

h = hour angle, measured westwards in the plane of the equator from the meridian.

α = right ascension measured from the equinox eastwards in the plane of the horizon.

δ = declination measured perpendicular to the equator, positive to the north.

ϕ = latitude of the observer, positive to the north.

These are some of the main standard angular measures. It is unfortunate that the term declination has two totally different meanings in gnomonics.

Head's letter is indeed timely, as I have just read John Davis's interesting article on Satellites and Sundials, two fields in which I have worked for over 40 years, though my main field has been astronomy. The article quotes several equations from another source, Satellite Broadcasting

(S.B.), which illustrate the existing confusion about nomenclature. In particular the definition of azimuth given in the E.S. is used extensively in the fields of astronomy, navigation, surveying and artificial satellites, yet the one given by S.B. can give only a value between 0 and - 90 degrees. Admittedly, the problem is simplified for a geostationary satellite since the declination may be assumed to be zero. To obtain the correct azimuth using the E.S. definition for geostationary satellites the equation

$$A = \arctan\left(\frac{-\sin \Delta\lambda}{-\sin\phi \cos \Delta\lambda}\right)$$

where $\Delta\lambda$ = observer's longitude – satellite longitude can be used, the correct quadrant being found by adding 180 degrees to the azimuth thus found, if the denominator is less than zero. Thus, for example, for an observer at longitude 0°, latitude N52° the difference of longitude (observer - satellite) for Astra 1 satellites is – 19°.2 and the azimuth is 156°.2 (or approximately SSE).
The S.B. definition, using no sign for λ , gives -23°8.

In gnomonics there appears to be little or no standardisation of symbols, and I confess that I have been guilty of going my own way in the past. I can only plead that I have been in good company. I suggest to our Council that they should consider the idea of setting up an international committee to consider standardisation in the field of gnomonics. Most or all the work could be done by correspondence, proposals could be printed in various journals for comment, before any final recommendations are made. This would take time to do the job properly but I feel it would be worth while.

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East Sussex, BN27 3UT

NOTES FROM THE EDITOR

SALES OF BSS MATERIAL

Please note that the sales of the Society's material (back issues of the Bulletin, the Society's tie etc) are now being handled by:

Margery Lovatt
Studio 5
Farndon Mill
Harlow
Essex, CM20 2 HP
Tel: 01279 452974
Fax: 01279 419368

Bulletin back numbers: £6.50, BSS Tie, (dark blue with symbols) £8; BSS Lapel badge £3.50. News of the cost of the 'BSS Register of Fixed Dials, 1999' will be available soon.

Full list of items and prices can be obtained from the address above.
Prices include p & p in UK and Europe; cheques: 'British Sundial Society'

DUNCHURCH LODGE GROUP PHOTOGRAPH

(see p.152)

B/W copies of the photograph (10ins X 51/2ins) can be obtained from William Hall, P.O. Box 1249, London N6 4TW, price £5 including postage, with a percentage being donated to the Society.

IS IT IN THE REGISTER?

Our energetic Registrars (Patrick Powers for Fixed Dials, Tony Wood for Mass Dials) are always on the search for New Dials, new Old Dials, and Ones that Got away. You see a dial while zooming past by car, (a Thingey on that Whatsit, as Colin Thorne would say);. and you think 'I wonder if that one is in the Register?' Well, make sure it *is.* Send a postcard to the Registrar: 'Lincolnshire, Market Deeping, vertical on the Town Hall' Or 'Oxfordshire, Chesterton, horizontal on the village green'. The Registrar, even if that dial is already on the list, will be glad to know that it is still there, and still visible; and updates on the current condition of already-listed dials are always desirable. This is especially important in the case of Mass Dials. All those poor little things will vanish eventually under weathering and air pollution, and their rate of disappearance should be chronicled. A dated postcard to Tony Wood: 'Cambridgeshire, Thriplow Church porch,

only 3 hour-lines now visible' would contain valuable information. Don't hesitate on the grounds that you have none of the official recording forms: just do it!

We have received the following note from the National Maritime Museum, Greenwich:

GCSE ASTRONOMY COURSE AT THE NATIONAL MARITIME MUSEUM

Adults with an interest in astronomy will be able to study for a GCSE in Astronomy from this October at the most famous observatory in the world: the Royal Observatory Greenwich. This special Open Museum course aims to prepare students for the examination over a period of nine months. Topics will include the earth and the moon, the solar system, stars, galaxies and observing techniques. Students will be able to use the Observatory's 28-inch refractor, the seventh largest of its type in the world, and a Meade LXlO Schmidt-Cassegrain telescope. Astronomical events which can be seen this year include a possible Leonid meteor storm, a total lunar eclipse and the sun at sunspot maximum.

Assessment will be primarily by examination in June 2000 (although students who do not wish to sit the exam will also be welcome). Practical project work, some of which can be carried out using equipment at the Observatory, comprises 25% of the assessment. The tutor for the course will be Dr Robert Massey, Astronomy Information Officer at the ROG.

The fee is £100 for the three term course, which begins on 6 October (7pm-9pm). Please note that the course fee does not include the cost of the examination fee (£27), which is payable during the spring term. Students on low income are eligible for a reduction (telephone 0181 312 6772). For a free Open Museum prospectus or further information, contact Joy Affection on 0181 3126747 or Susan Baylis on 0181 312 6772 Further information is also available on the NMM web site: http://www.nmm.ac.uk.

SUN, MOON AND STARS: TIME MEASUREMENT AT SEA

PROFESSOR DAVID WATERS

(Formerly of the National Maritime Museum, Greenwich)

THE ANDREW SOMERVILLE MEMORIAL LECTURE, MAY 1999

Professor Waters outlined the background to his lecture as Maritime History, in which he was a pioneer.

Historically it has been seen that the growth of City Ports in Italy and Western Europe was linked with trade and transport round the Mediterranean. Early trading was largely coastal, but the independent Western discovery of the magnetic compass, together with the lack of tides, enabled longer voyages to be made out of sight of land. Trade from the Crusades and rich mineral deposits, both requiring long journeys to the eastern Mediterranean, finally prompted some to brave the Bay of Biscay and trade with the British Isles with its flourishing wool manufacture and export trade.

The key was navigation; Professor Waters suggests it was possible that the early Nordic explorations to North America were sundial assisted and that the alternative time-keeper, the sand-glass, was used in the Mediterranean. The appellation 'horologia del mare' is an indication of both its origin and use. The earliest illustration in 1350 shows that by then regular use of a sand-glass was assisting ship navigation.

The ship's log, literally a log originally, with a knotted rope to measure the speed, enabled the merchant seamen of the day to work out distances once an accurate timekeeper became available. A map of the Mediterranean coastline was compiled which was remarkably accurate and the subsequent trade and transport is plausibly linked to the rise of a wealthy class of merchants and others sufficiently independent of Church and Crown. It is a short step to argue that such a class, for the first time, had sufficient leisure and wealth to engender the Renaissance. This approach of Economic History, and 'all History is Economic History', so ably presented by Professor Waters emphasises what Britain subsequently owed to invention and maritime skill.

Western Europe, where ideas could grow to renaissance and revolution was perhaps created by medieval sailors learning their way round the Mediterranean

A.O.Wood

CAKE & BALLOONS AT NEWBURY: Report of the Newbury Meeting, 22 May 1999

JOHN MOIR & PETER RANSOM

It is many a moon since most of us attended parties with balloons, iced cake and ball-and-string games, but that is exactly what Newbury 99 had to offer - but more of that anon. Forced to pick an alternative venue this year, David Pawley selected an equally delightful place, the Mary Hare School for deaf children. He also got the sun to shine!

Peter Ransom, who showed slides from what he called his "Ooh la la" collection, gave the first short talk. Many of these French dials combine carved figures holding a vertical sundial. His examples included an angel figure (Amiens cathedral), a soldier (Gourdon) and the "Old man with a sundial" at Strasbourg, dated 1493. This latter dial was, according to Rohr, the earliest known dial to show non-temporary hours.

"Funny things on church walls" was not only the title of the next fascinating talk, by Tony Wood, but also his explanation for his late arrival, having detoured to inspect four churches on the way! His slides showed many examples of inscribed holes, dots and patterns which may have had gnomonic significance - or were they just mason's marks, on-site sketches of proposed dials or (a hard one to swallow) - holes for counting sheep? Plenty of room for research here.

We then saw a video that recreated Eratosthenes' experiment to measure the Earth's diameter using a shadow cast down a well. This was followed by a recent T.V. interview with our Chairman, Secretary and Margery Lovatt. Those acquainted with The Big Breakfast Show might have expected a rough ride for our gallant trio, but in the event they were more than a match for the sharp interviewer, Johnny Vaughan.

BSS members, assisted by pupils at the Mary Hare School, Newbury, inspect a portable dial.

Another view of the portable dial

Next, Michael Maltin, using basic geometry, demonstrated the concept of eccentricity in ellipses, and showed that the Earth's orbit is almost circular, even though in our minds we picture a much more "elliptical" shape. He then shattered another of our perceptions - how far the Earth moves in its orbit in an average day. He represented this, in scale, by two cricket ball 'earths', separated by almost 50 feet (15 metres) of string, dramatically tugged out of a box, foot after incredible foot, by a most able assistant.

The final talk of the day was given by clockmaker/balloonist Peter Meecham who described the history of his balloon "Tempus Fugit" (What else could he possibly call it, you may well ask!) before we all went outside to inflate it. This was an experience for us all (especially for the one member who got his foot caught in the ropes as the balloon started to move!) - unpacking the balloon and inflating it, though fortunately we had the necessary equipment and did not have to resort to using our own hot air. Floating majestically into the sky, watched by BSS members and pupils of the Mary Hare School, all it lacked was a suitable gnomon. Despite offering to take some interesting photographic shots I was not allowed to ascend, and after we had admired and photographed Tempus Fugit she was deflated and packed snugly into her trailer with enthusiastic help from all those who still had breath left.

There was a delightful variety of exhibitions on display. Maurice Kenn celebrated the 10 years of the BSS with his drinks sundial based on a bottle cooler. It was disappointing to note that as the refractive index of gin is not suitable (or so it is alleged), Maurice and Rosemary had disposed of it earlier.

John Moir exhibited the NASS double horizontal dial, and a picture of the immense dial at Settle formed by a cliff face. Peter Ransom had photographs from Dunchurch, including the fantastic group that had been kindly and swiftly processed by Bob Sylvester. He also laid out his collection of crested china sundials, so members were able to preview his recent article in the Bulletin.

A US army bubble sextant, one of David Pawley's boot sale bargains, was passed around for advice on how to get it working. A good job we knew where we were, as no progress had been made by the end of the day! Tony Wood had sample pages from the proposed mass dial register as well as photographs from some of the mass dial safaris.

If you have a Pringles' cylinder, hang on to it. Andrew James has a sheet that converts this into a modern day shepherd's dial. He also bad a superb photographic display and range of assembled cut-out models. Colin Davis laid out an incredible range of sundial ephemera, from a greetings card with a person's crested haircut acting as a gnomon, to a book called 'The Old Sundial' looking as though it dated back to the twenties. A more recent book, Anno's Sundials, contained pop-up sundials.

At last I've seen Gregory the Gypsy dial by Tony Baigent. What a superb piece of craftsmanship this is! The Singleton brothers with their equation of time machine showed us some more ingenuity. They have combined wheels with 58 and 63 teeth differentially to produce one revolution of 365.4 days.

Throughout the day John Moir, with his little stick of chalk, supervised the laying out of a meridian line on the tarmac. All this needs is a vertical pole, chalk, string and patience. Despite one or two cloudy moments this was successfully completed.

Oh, the cake! David Pawley brought along the slab of yellow iced birthday cake from Dunchurch, and he and Anne Somerville, as society senior sundiallists, sectioned this sultana surprise for those present.

Our thanks to David Pawley for organising another superb one day conference at Newbury. We never know what we are about to hear, see or experience at Newbury and perhaps that's what keeps pulling us back. David has the magic that makes things happen - well done David!

MILLENNIUM FEVER

(FROM OUR OWN CORRESPONDENT)

Along with bugs, the Millennium has produced a country-wide fever to commission dials to commemorate this arithmetical milestone. Two such commissions which have caught the eye are:

LOTTERY LARGESSE

Those members who attended the 1998 Dunchurch Annual Meeting (or First Battle of Dunchurch) will remember the visit to the two new dials at Foxton Inclined Plane on the Grand Union Canal. The team which produced these has gone on to win an open competition run by Harborough District Council and British Waterways for a "community sculpture", as part of the refurbishment of the canal basin at Harborough. This sculpture is to take the form of a horizontal dial, with a gnomon 10ft tall, which commemorates the use of the basin for waterways transport. The design is original, apt and memorable. Even more memorable is the fact that the cost will be about £15,000, assisted by Lottery Funds.

ENGLISH PHLEGM

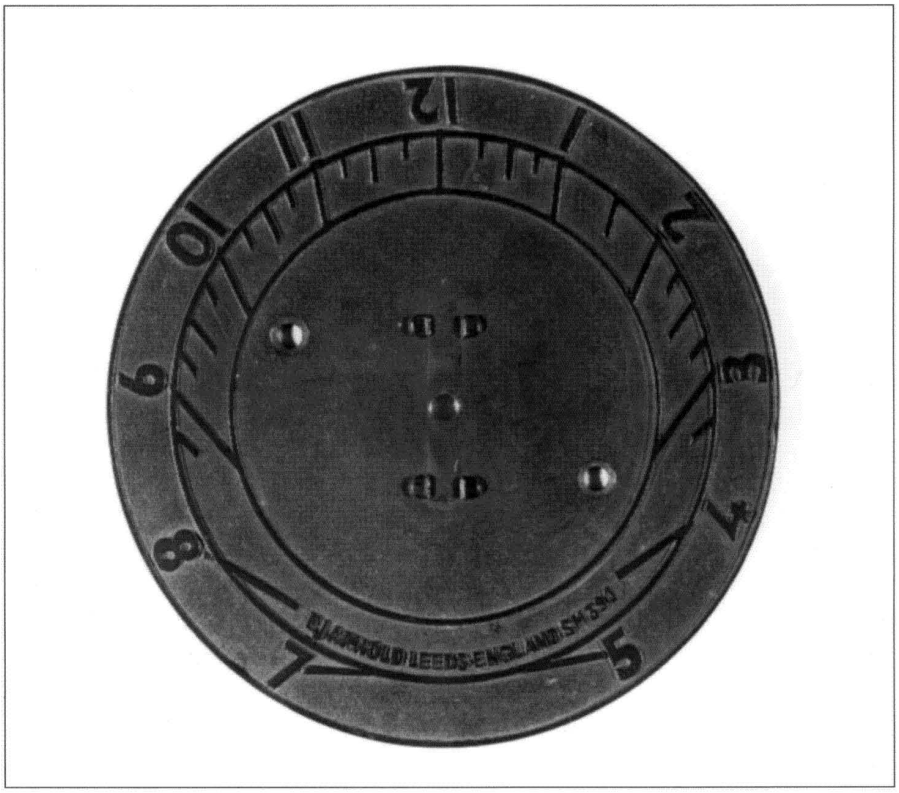
Another interesting project is a memorial (commissioned by Rimpton Parish in Dorset) , which consists of two standing slabs, of local stone, both about 8 ft. high, at right angles to each other, positioned so that a 50mm slot between them is orientated to sunrise on 1st January 2000. Even though seeing the sun at that time and date is unlikely, and that few people are at their best at 8.30 am on New Year's Day, the intention is to attend at the appointed time at the (windswept) spot and break open the champagne, irrespective of the presence or absence of shafts of sunlight. Furthermore, it is hoped to establish this as a yearly ritual. Thus are English traditions established.

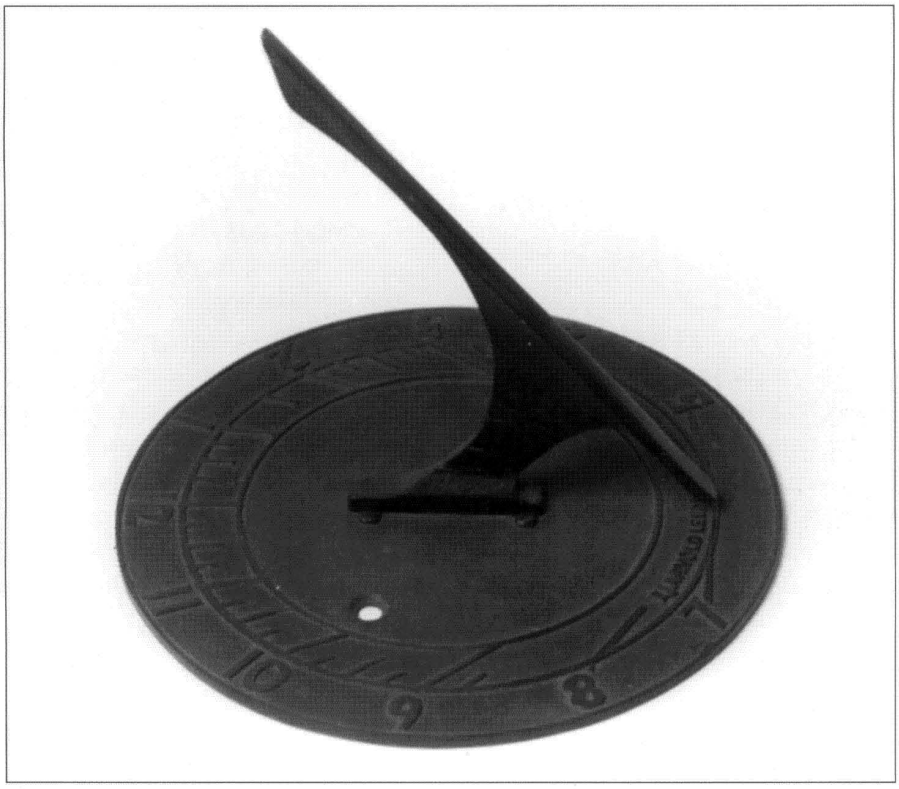
R.A.N.

A NONDIAL FOR SCHOOLS

The object shown here was obtained from the well-known educational suppliers E.J.Arnold & Son of Leeds by a Leicester primary school in 1969. The cast brass dial is 7" in diameter, and bears an elegant 51° gnomon with $\frac{1}{4}$"wide stile. Pity about the hour-line calibration!

A.A.Mills





DUNCHURCH 1999: TENTH ANNIVERSARY CONFERENCE

Blessed by good weather and held again at Dunchurch Lodge, the Annual Conference proved highly successful. An innovation was to hold Group meetings on Saturday afternoon and the pace of the meeting was sufficiently relaxed to allow exploration and discussion.

As it was our tenth anniversary, two specially commissioned cakes appeared on Saturday and toasts to the next ten years were drunk whilst they disappeared.

The lecture programme comprehensively covered the world of sun dialling: its history, construction of new dials and a glimpse of the future.

Mike Shaw opened with an entertaining account of the history of the calendar in Europe from Roman times until today, and how it has been subject to religious and political pressure. January (Janus, looking forward and back) was surprisingly late as choice for the first month and diary makers must have been in confusion with the lost days of the Julian/Gregorian changeover.

David Young next gave us a blow-by-blow account of the struggling inventor and his new dial. He may have started with a biscuit tin but the final result - a remote reading sundial - justified his endeavours. He had his creation up and running in the display area with a light bulb standing in for a sun.

John Davis rounded off Friday's lectures with an account of a search for a lost stained glass sundial, originally at Wenden Lofts church just in Essex. The church itself was practically lost and only found with difficulty. Luck, playing hunches and perseverance are essential ingredients, as anyone who has tried even gentle historical research will tell you. John's patience and letter writing was finally rewarded and the dial discovered and re-recognised at nearby Elmdon in the church. (A possible solution to the problem of two gnomon support holes has been suggested by dial maker Mr E. J. Swingler from Fowey. Apparently the glass of the day was so thin that the gnomon needed additional support to cope with bird landing and take-off loads!).

Saturday was certainly a busy day. The lecture session opened with a survey of Greek and Roman sundials by Allan Mills. The derivation of predominantly scaphe or hemi-spherical dials was explained, indicating a much more sophisticated approach than 'stick in the ground' or 'nail in the wall'. Numbering of the hours was ordinal i.e. 1st hour, 2nd hour... and there is evidence that both the Greek number system (based on the alphabet) and the more familiar Roman numerals were in use, if only occasionally. By way of relaxation Chris Mackay took us on a tour of postcard sundials. As a subject they turn out to be surprisingly popular and are invoked for far more than the usual 'foreground interest'. Although sentimental songs featured there is some solid history in there as well. One of Mrs Gatty's Saxon dials appeared on a card sold in our auction and this may help to resolve its origin.

More solid social and sundial history came next, hidden within a gentle facade, behind an inconspicuous door and under the lino. Doug Bateman guided us on a tour of the Nottingham Subscription Library and its Noon Line, set across the floor and finishing up the wall in a store room. Ramsgate's Noon Line was shown for comparison. How many more are there around the country? Jill Wilson, with her List of Sundial Makers to hand, managed to provide a link by finding that it included the maker (Whitehouse of Derby) of one of the longcase clocks in the room with the line.

The afternoon was intended to be a gentle break. The Group photograph provided Robert Sylvester with exercise and Council Members were provided with chairs for the first time, a sign of age - or maturity.

The experiment of Specialist Group Meetings seemed to work well with the e-mail/internet option being specially relevant as a new sub-committee has just been created to cater for the Society's and members' requirements. Portable dials, mass dials and wall declination were also on offer whilst the truly lazy were allowed a free afternoon prior to a strenuous round of birthday cake cutting, tenth anniversary dining and toasting (very formal dress, I noted) and finally, Grand Auctioning.

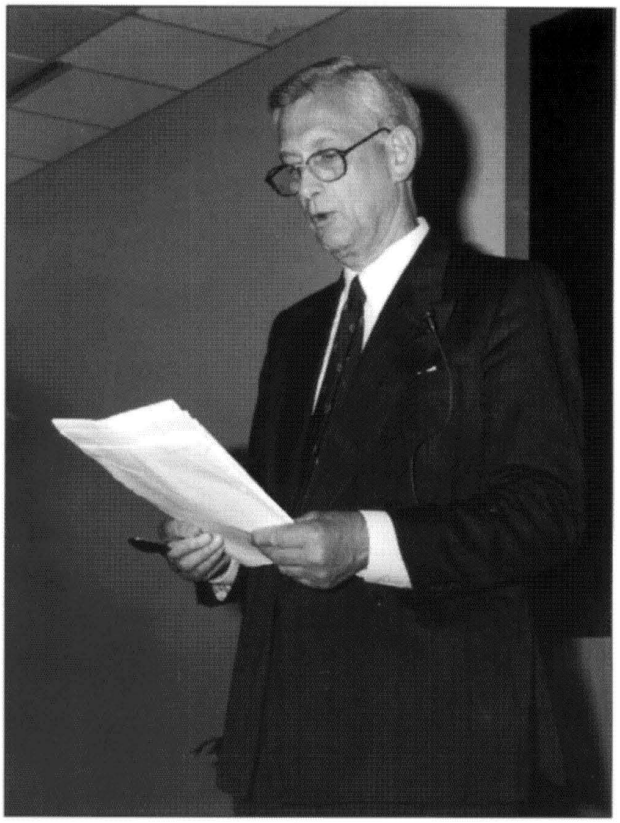
The Auction persuasively conducted by our Chairman raised about £720 and featured several eyebrow raising anonymous bids. The new treasurer was also seen to be bidding generously!

Cutting the birthday cake....and drinking a toast. Dorren Bowyer, Christopher Daniel, Anne Somerville, David & Lilli Young

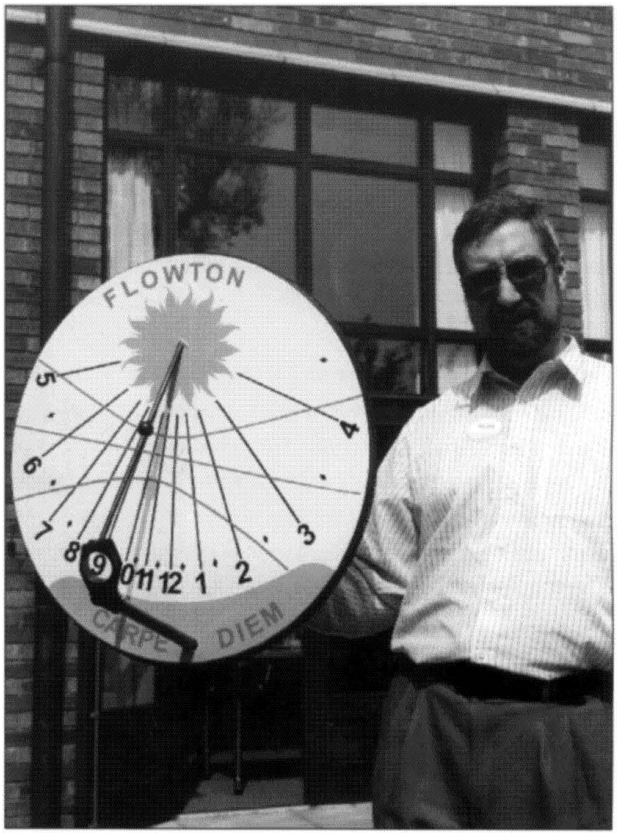
Cutting the birthday cake....and drinking a toast. Dorren Bowyer, Anne Somerville.

Finally retiring to the bar for a quiet night-cap and learned conversation, those assembled were treated to a fireworks display with our busy Chairman in charge of the blue touch paper. Another display in 2009 is confidently expected.

Sunday was the serious day and following two lectures firmly in the present and future came the Andrew Somerville memorial lecture by Professor David Waters (see separate article).



Chairman - Auctioneer



Satellite Dish Sundial and its creator John Davis

John Davis described the construction of a sundial based on a satellite dish: a triumph of mathematics since the dish is 'reclining and declining' to point at a satellite. It is also a triumph of craftsmanship in modern materials; John finally used heat-shrink model aircraft covering to let BSkyB through safely, and produced a striking dial using a laser marker to plot the declination lines. A wooden gnomon and perspex nodus completed what should be a very different register entry when installed.

The glimpse of the future was, of course, the forthcoming eclipse. It will be total in Devon and Cornwall; David Le Conte's enthusiasm for 'being there' came over in a beautifully illustrated lecture complementing the generous donation of Greenwich Observatory eclipse booklets to all delegates. The pictures said it all and the 11th of August, 11 o'clock, just has to be fine and sunny.

At the Annual General Meeting a new Treasurer was elected, Peter Ransom stepping into the shoes of 'Nick' Nicholls who has kept finances in excellent order for many years. Also retiring will be David Young, our Secretary and first point of contact for many of us. After ten very busy years he will be handing over to Doug Bateman who will certainly be facing an active retirement.
Ongoing 'side-shows' included Anne Somerville's bookstall, a PC with eclipse graphics, sundials from Patrick Powers' proposed pictures, and Rogers Turner's Scientific Books.

Service from the Lodge catering and staff was excellent and our thanks were conveyed by the Chairman after the Sunday Lunch.

Leafing through Mrs Gatty, I see Dunchurch church has a dial. It will have to wait - too busy enjoying ourselves!

A. O. Wood
5 Leacey Court
Churchdow
Gloucester

OLD SUNDIALS ON THE TERRITORRY OF FORMER SOCIALIST FEDERAL REPUBLIC OF YUGOSLAVIA

MILUTIN TADIĆ

At the Congress of the mathematicians, physicists and astronomers of SFR Yugoslavia in 1985 a decision was made to start a catalogue of the fixed sundials on the territory of Yugoslavia. Before the catalogue was made the state had been reduced to the half of the former territory (Federal Republic of Yugoslavia), while on the other half four new states were formed. From the point of view of gnomonics the same number of sundials remained; the only change will be that instead of one there will be more catalogues. Until these catalogues appear I have written this supplement to include the whole territory of former Yugoslavia.

Once upon a time there was a state by name SFR Yugoslavia. Up to 1991 I have known and seen 214 fixed sundials on its territory. In this article the sundials will be listed not according to the type of dial (the scientific approach), but according to the territory to which it belongs. This survey will concentrate on chosen examples, which may be interesting for admirers of gnomonics in Western Europe.

FEDERAL REPUBLIC OF YUGOSLAVIA

As far as it is known there are about 30 sundials on the territory of present Yugoslavia that comprises Serbia and Montenegro. The Roman sundial from Sremska Mitrovica (former Roman Sirmium) is distinguished among them for its outstanding sculptural solution. This sundial is the crown of the triad comprising the figures of Atlanta, Heracles and Zeus (Ephicles?) in natural size (Fig. 1.). A third of the spherical excavated sundial with five hour lines halved by the projection of the celestial equator is preserved. The latitude of Sirmium = 45°

The oldest preserved Serbian sundial, and a clock, is placed against the south portal of the Virgin Mother church of the monastery Studenica which was built by the end of 12th century. The hour scale comprises a brim semicirde (r=21cm) divided into 12 equal sectors. The face bears Cyrillic alphabet signs; the last three are missing. Of course, it is an improvised mediaeval sundial and its base has no exact calculation. Such sundials demanded a special hour system, different from the temporal one.

Apart from the Studenica sundial, the painted wall dial in Sombor is important for the history of Serbian astronomy. It was made in the middle of the 19th century by a monk, Jovan (Julijan) Cokor, who is considered to be the first Serbian amateur astronomer. Also important is the horizontal sundial of the Astronomy Observatory in

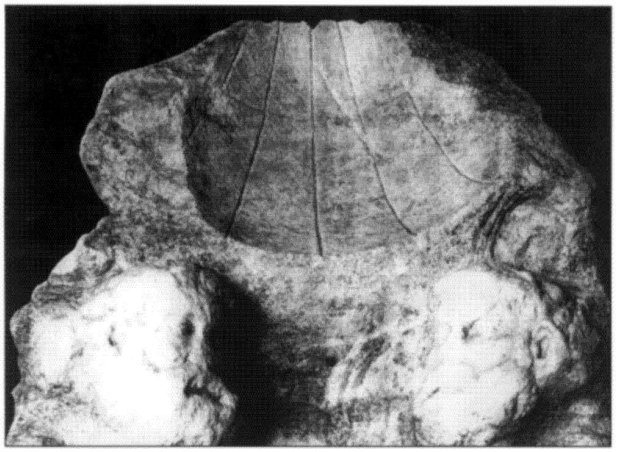


Fig.1 Sundial from Roman Sirmium

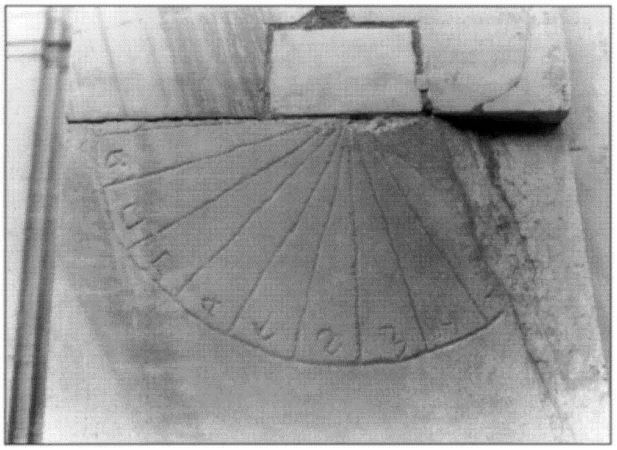


Fig.2 Studenica Monastery

Belgrade made in 1930, as the only sundial known to be made by the professional astronomer Vojislav Miskovic, manager of the observatory of that period.

The scarcity of sundials on the territory of Yugoslavia is the consequence of the disconnection of the Balkans from West European civilisation due to the reign of the Turks. Sundials are rare in Macedonia and Bosnia and Herzegovina for the same reason.

MACEDONIA

The name of this newly formed state has not officially been acknowledged yet, so it is called "The Former Yugoslav Republic Macedonia". There are four sundials altogether on its territory; three of them are antique. One of them has an inscription of the donor on the pedestal, and it is in the museum in Bitoli; the second is in the museum in Prilep, while the third, only found and not yet studied, is in the city museum in Skoplje. The fourth example may only possibly be a sundial (Fig. 3). Or, to be more precise, it is something that may be taken as a predecessor of a sundial. The square block is about 0.5m long with a carved vertical groove, one hole and two shallow circular recesses. It is on the south wall of St. Sofija church in Ohrid, near the ground; so it may be its secondary position only. In his survey of the old sundials placed on European buildings, E. Zinner mentions 8 sundials, 3 on the territory of former Yugoslavia (Zinner, 1961), among them the sundial in Ohrid.

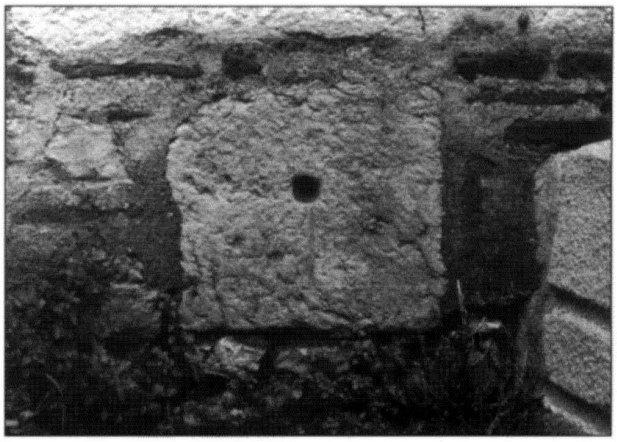


Fig.3 Church at Ohrid

BOSNIA AND HERZEGOVINA

This newly formed state has two entities on an equal footing: the Serbian Republic and the Muslim-Croatian Federation. Sundials are a rarity. I have already written about the antique sundial from "Zemaljski muzej" in Sarajevo (Bulletin, 1991.1). The main facts about the second antique sundial, which was inscribed on the half-uncovered buttress in Sarica Struga, were stated in Bulletin 1992.2. This sundial has attracted many admirers of gnomonics because it conflicts with the opinion that sundial-semicirdes are mediaeval "inventions". As far as the other sundials are concerned, the wall sundial of Ali-Beg's mosque in Travnik is very interesting; it was constructed (probably in 1785) for a 'la turka' hour system (Fig. 4). It is the same hour system as old Italian, just with the double contemporary marking-off (two times from 1 to 12 hours). The horizontal gnomon 12.5 cm long casts a shadow. Daylight hours are read from the tip of the shadow, on the hour net comprising hour lines fitted into 15m, closed between the projection of the celestial tropic. There is a line for a noon Islam prayer (the vertical) among these lines, as well as an afternoon Islam prayer that corresponds to the Christian prayer-time at the ninth hour. The purpose of the sundial was to determine the beginning of the Islam daylight prayers. It is a typical representative of the Arabic way of construction - which is very pleasing in its simplicity.

CROATIA

Croatia has recently become an independent state; it is situated on the territory that has been under the reign and influence of its present neighbours - Italy, Austria and Hungary.

The Italian influence may be noticed on the Adriatic coast and the islands where the mediaeval sundials sculptured in

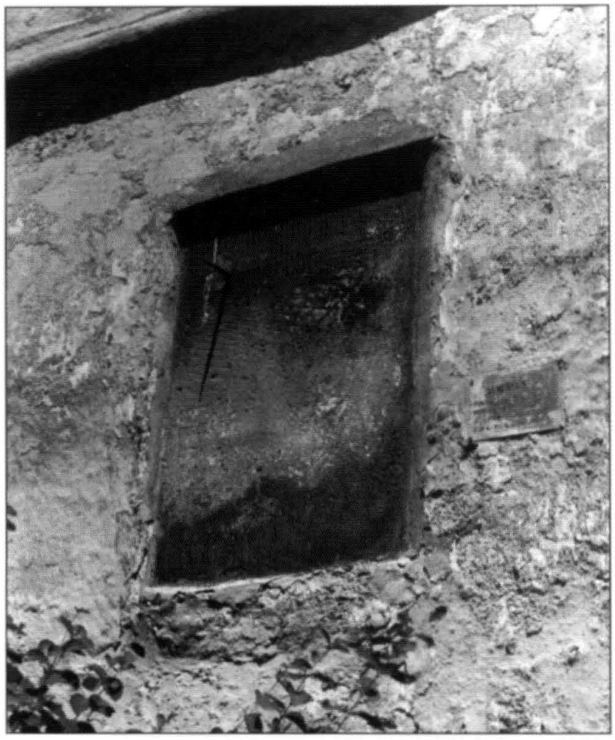


Fig.4 Mosque at Travnik

Fig.5 Dubrovnik

stone in the form of hollow half-circle and those constructed for the old Italian clock system may be found. These half-circle sundials are in the monasteries of the former Dubrovnik Franciscan - province (Tadic, 1997). They were made in the 15th and 16th centuries. The shadow of a long horizontal bar is cast on the frontal section of the hollow half-circle that is divided into 12 equal parts, and its direction shows the period of the day (Fig. 5). Of course, the sundials are not appropriate for the local height of the celestial pole. These sundials are improvised, unskilful copies of the antique sundial of Berosos type.

The most famous Dalmatian sundial for the old Italian clock system is in the Franciscan convent in Dubrovnik. Actually, it is a sundial with two scales; the upper one is for the contemporary hour system, while the lower one (span-width 16 - 22 hours) is for the old Italian hour system (Fig 6). The shadow on the upper scale reads the hours by its direction; and on the lower scale the hour is read by the shadow's tip.

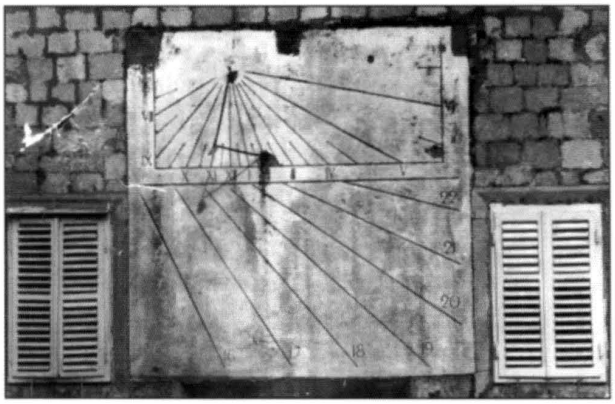


Fig.6 Franciscan convent, Dubrovnik

From the total number of 100 sundials in Croatia, E. Zinner mentions six of them in his survey. The sundial of the Franciscan church in Varazdin from the 18th century is among them. It is the most valuable sundial among those that may be classified as a result of mediaeval cultural influence. The sundial is painted with the Virgin Mother as a central motif. The shadow reads the daylight hours, solstices and equinoxes, duration of the daylight and sunrises.

The remains of five antique sundials are kept in the archaeological museums of Croatia: Split (2), Pula (2) and Zagreb (1). All of them are examined in S. L. Gibbs' catalogue (Gibbs, 1973). A part of the sundial of Berosus type in Split is interesting because it has cuts for the halves of hours, which is exceptional for Greek and Roman sundials.

SLOVENIA

As far as independence and cultural influence is concerned Slovenia is the same as Croatia. Among 40 sundials we know of, there are some examples on walls, with very good paintings, but nothing particularly interesting for the admirers of gnomonics in Western Europe. A typical representative for example is the wall sundial in Maribor

made in 1908 (Fig.7). The Roman sundial of the 'arahna' type from Gorica museum in Nova Gorica is an exception. This supplement should be considered as the shortest possible survey of the fixed sundials in the territory of the state that no longer exists. By writing this survey I have taken the risk of being called "Yugo--nostalgic", not acceptable in any of the newly formed states.

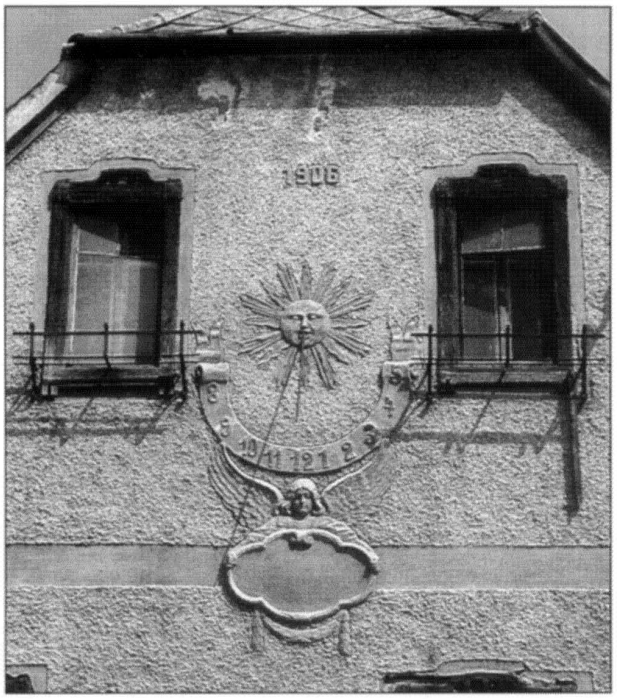


Fig.7 House in Maribor

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B. S. S. NORTHUMBRIAN SUNDIAL MEETING

GERALD STANCEY

When Friday 11 June dawned it was dull. It was still dull when we reached Tynemouth and the indications were that we would not see any working dials this weekend. That is the bad news over and done with; the rest of this report is all superlatives.

We were greeted in the hotel foyer by Frank and Rosemary Evans who handed us our detailed briefing packages, each personalized in Rosemary's exquisite calligraphy - this was obviously going to be a quality trip. After a video on Durham Cathedral we dined and socialised.

Next morning we boarded the bus and began the real business by visiting the Saxon Dial at Escomb[1,2]. Then back to the bus to find that light refreshments had thoughtfully been provided for us. Our hosts were obviously taking care that we would not suffer from mal-nutrition. On to Hurworth to look at dials created by William Emmerson (who declined an FRS!)[3] and C. Hunter. Here we had a pleasant lunch at the Bay Horse Inn which is adorned by an Emmerson dial carrying some very strange lines. The significance of these lines defeated the assembled cognoscenti who were only too pleased to accept Frank's explanation. This was that some decorators had accidentally obliterated the dial and then been forced to "restore" it!

Fortified we continued to Dalton-le-Dale[2] to view the Anglo-Saxon Dial and to ponder the stone roman numerals that appear on the inner north wall of the church. Could these be used in conjunction with one of the windows in the south wall to form a sun dial? A project is here for somebody.

Next to Pittington[1,2] where it was sad to see that the dial was in very poor condition. Then onto Durham Cathedral where there are two items of interest to diallers. The first is the dial on the south buttress where one face of the buttress

has been specially built to ensure that the dial faces due south. The second is the meridian line on the floor and the wall of the cloisters[4]. It is most regrettable that this exhibit is virtually ignored by the Cathedral authorities. There is no line on the floor and the stone which marks the Summer Solstice shows all the signs of having been moved to an incorrect position during some repaving work. The end of the meridian line which is on the wall clearly shows calibrations (but no lines) at 5, 10, and 15 minutes past noon in case you were late for the noon sighting or cloud cover spoilt it.
Back to the hotel for dinner where the usual BSS practice of sitting with different people at each meal ensured plenty of varied and excellent company.

Sunday dawned bright. This looked more promising as we set out to view the large 20 foot high sundial that crowns an artificial knoll in the Silverlink Park[5]. This dial, which is far better than the much hyped Angel of the North, is the work of member Tony Moss whom we were very pleased to have with us. On reaching the dial we were lucky. For a brief instant the sun shone which surely shows the power of the presence of the designer.

Back to the coach for more refreshments (these Evans sure know how to organise trips) and on to see the dial that George and Robert Stephenson (of Rocket fame) made to adorn their cottage at Killingworth. Being better engineers than mathematicians they corrected for the declination of the cottage wall by wedging the dial plate out from the wall[6].

On to Newcastle - no slacking allowed on this tour - to see the dial on the early 18th century Keelman's Hospital. This is a fine brick building which was paid for by the keelmen for the benefit of the aged and infirm amongst them. In the days before the Tyne was dredged, the keelmen rowed boats loaded with coal down the Tyne to be loaded onto ships moored at the entrance.

A short walk brought us to the Trinity Maritime Centre which had been specially opened for us. This is a new nautical museum and the prime attraction, for us, was the restored dial that used to adorn the storehouse at the old Neptune ship yard[7,8]. It was very pleasing to see the dial beautifully restored and in loving hands back on the Tyne where it belongs.

After lunch at the museum we departed for Morpeth. There we saw a nice direct dial on the church and an analemmatic dial in Morpeth Park. Jane Walker will be pleased to know that this dial had originally been laid out in chalk by children, aged 8-9, in a local play-ground.

Then back to the hotel via Bothal[2] where we saw two scratch dials. It appears that these dials, along with the medieval stained glass, are now deteriorating rapidly. This is possibly due to pollution from Blyth power station.

Well that's how 22 members spent a most enjoyable week-end in the North-east. Frank and Rosemary Evans are to be thanked for all their hard work. I hope they thought it worthwhile because the rest of us certainly did.

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22 Peterborough Avenue,
Oakham, Rutland,
LE15 6EB

The Northumbria Group on a wet morning, off to search for Sundials

A LIGHTWEIGHT LASER TRIGON FOR LAY-OUT OF SUNDIAL LINES

JOHN DAVIS

It was while building my satellite dish dial[1] that I realised that I needed a laser trigon. Mechanical dialling has a long history, and the trigon and auxiliary equatorial dial are quite well known[2]. Indeed, the late Noel Ta'Bois[3] built an ingenious dial-drawing jig from Meccano; and Mills[4] also showed a jig for calibrating dials. Traditionally, two methods have been used to project the simulated sun's position onto the dial plane. One method requires a string to be pulled taut from the nodus to project the desired angles onto the dial face. This requires at least three hands, and is prone to inaccuracy. An alternative uses a long sliding rod, thus limiting the scale of the dial by the length of the rod, and this method is also inaccurate if the rod flexes.

I first saw the idea of replacing the string with the beam from a portable laser in an article by Terwilliger[5,6] in the NASS Compendium. In Terwilliger's superior device, the laser was mounted on a modified transit, giving the required two perpendicular directions of movement. Erich Pollähne[6] also sells a similar but purpose-built instrument called the "Terrax-Laser". The disadvantage of Terwilliger's device for my purposes (besides the fact that I had not got a transit) was that it probably weighs over a kilogram and needs mounting on a secure tripod. Whilst this was no problem for the large dials occupying a whole garden that it was intended for, it was not suitable for my purposes. I needed something that would fit onto the thin gnomon of a dial which had dimensions of a couple of feet at most. Hence a compact instrument was required with the lightest weight possible so that the gnomon would not flex and degrade the accuracy.

Looking at the traditional string-type trigon shown by Rohr convinced me that something very simple could do the job of plotting the declination lines on any arbitrary dial surface. Figures 1 and 2 show the basic design that I came up with. It is made of 1/16" perspex sheet - a material whose virtues I have extolled before[7], with the only disadvantage that it is difficult to photograph! The sheet was stiffened by narrow ribs of the same material to ensure stability.

I already had a laser in the form of a laser pointer used for pointing at features on slides. These are readily available; or alternatively, alignment lasers can be purchased from outlets such as Maplins for around £40. Apart from the laser, the whole instrument cost me less than £5. My pointer is powered by two AA-sized batteries and these occupy about two-thirds of its length. In order to keep the instrument as compact as possible (and hence usable on small dials) I chose to mount the laser outside the gnomon, rather than between the gnomon and the dial face. Since the laser beam must pass accurately through the nodus point on the gnomon, this arrangement requires the use of either a transparent gnomon (impractical) or a temporary short stub gnomon.

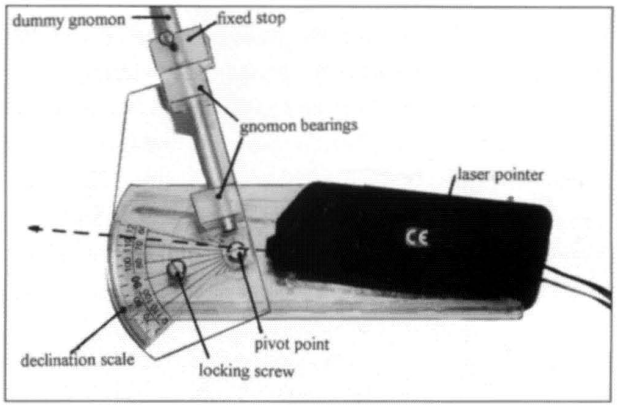


Fig. 1. The basic lightweight trigon, showing its components.

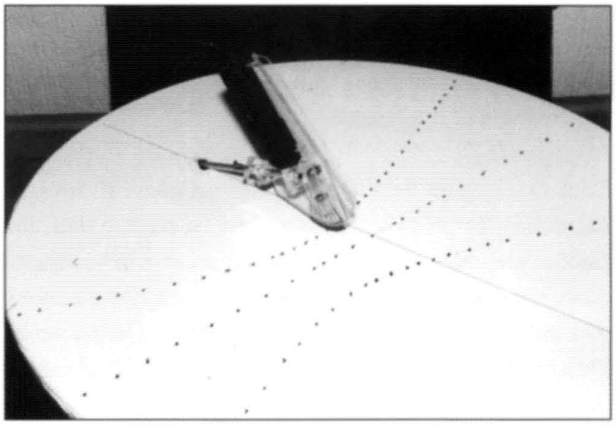


Fig. 2. The lightweight trigon in action on the satellite dish dial, defining the declination lines.

This can be seen in Fig.1. where the 1/4" diameter stainless steel stub gnomon forms a fixed shaft about which the trigon is free to rotate. The bearings are a pair of perspex blocks set to match the position of the laser beam. A fixed collar on the gnomon determines the position of the nodus (after allowing for the spacing of the bearings).

The laser can also swivel in the plane containing the

gnomon using a simple bolt as a pivot between the two principal sections of the instrument. The pivot point is set in line with the nodus point. The calibration on this declination scale (+/-23.5°) is provided by a piece cut from a school protractor. If the instrument is to be used to delineate the hour-lines rather than the declination lines, the laser is left free to rotate around this point and the instrument is locked onto the gnomon at the appropriate hour angle, as shown by an auxiliary equatorial dial made from another, circular protractor (Fig.3).

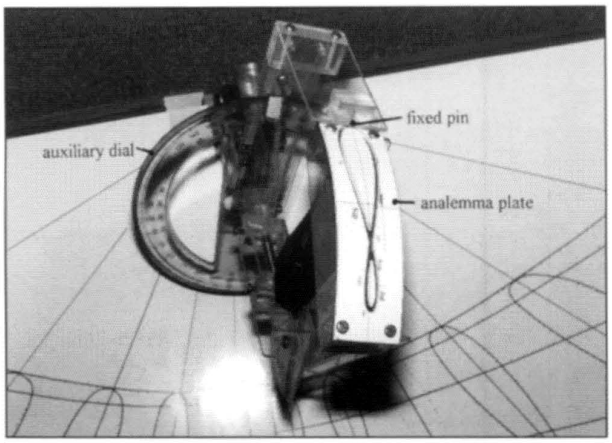


Fig. 3. The extended instrument, with auxiliary dial and analemma plate.

After manufacture, the instrument was carefully aligned for parallelism and squareness on a large sheet of graph paper with an appropriate laser target standing on it. When used as a pointer, my laser has a spot diameter of around 4mm. This is fine for room-sized dials, but for smaller ones I stopped the beam down by the simple expedient of taping a thin piece of card with a pin-hole in front of the beam aperture. The resulting 0.5mm spot, although dimmer, is still perfectly visible on a white surface at two or three feet, and its centre can be accurately located.

The weight of the basic trigon is 118g (4 1/4 oz). This can be further reduced to 88g by removing the batteries from the laser and powering it via two thin wires from an external source. The low weight ensures minimal deflection of the temporary gnomon, as long as care is taken when adjusting the trigon.

Watching the laser describe the hyperbolic declination lines over a declining, reclining dial surface is fascinating, and has converted me to the delights of mechanical dialling. I wondered if it would be possible to draw other key lines on a dial by similar mechanical means. One item of dial furniture sometimes seen, but time-consuming to calculate and draw, is the analemma. This is most often seen on the noon line, but can be plotted on any hour line. The analemma is simply the graph of the sun's declination plotted against the Equation of Time, with the day number being the variable parameter which drives the curve around the familiar "figure eight". The declination is already one of the axes of the trigon. The EoT, varying from -l6mins to +14mins, can equally be expressed as an hour angle rotation around the gnomon, at the rate of 15 degrees per hour. Thus all that is needed for the laser to trace out analemmas is to link the two axes of the trigon via an appropriate mechanical cam or link. As far as I know, this capability has not been described before.

The above principle is incorporated in the expanded instrument seen in Figs 3 and 4.

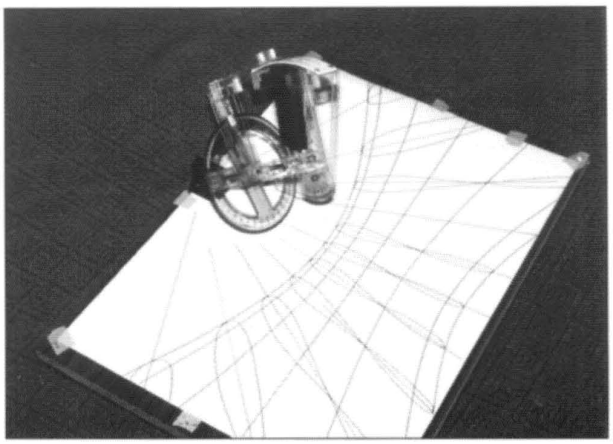
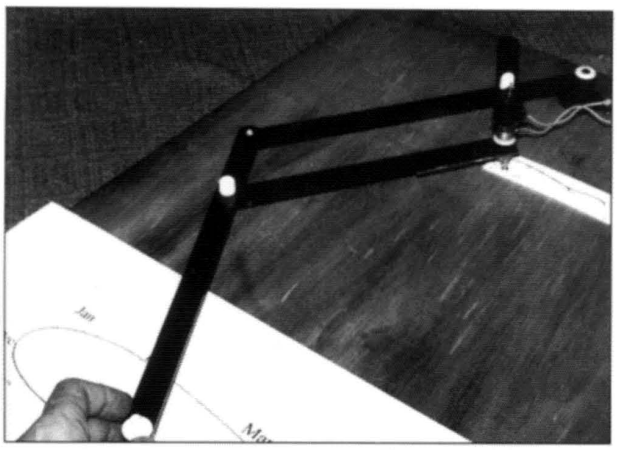


Fig. 4. The full instrument in use defining the 2 o'clock analemma

The analemma is engraved into a curved plate attached behind the laser. In theory, this plate should be a part of the surface of a sphere centred on the nodus. Because the angular range of the EoT is small compared to that of the declination, this sphere can be projected onto an enclosing cylinder, with a sprung pin following the engraved analemma to accommodate the small difference.

Building the enhanced instrument involved producing a sufficiently stiff structure, and actually engraving the projected and scaled analemma into a sheet of plastic that could be curved round the supporting cylindrical segment. I considered three ways of achieving this second objective. The first would have been to use a CNC miller - but I didn't have one available. I could have cut the shape freehand with a fretsaw, but since it was only about 100 x 14 mm it would have been difficult to achieve sufficient accuracy. What I actually did was to plot and cut a 4x template in thin card, and then use this with a converted children's Sketch-a-graph™ pantograph working as an engraving machine (Fig. 5). I expect a High St. jeweller, used to engraving trophies, could do something similar.

The beauty of the finished instrument is that it is universal. With the same analemma plate, the laser will trace the analemma about any hour line on any dial surface, even if



5. Engraving an analemma plate using a children's pantograph.

irregular or at an awkward angle, and over a very wide range of sizes. Actually, two analemma plates, one the mirror image of the other, are needed unless the engraving pierces the plate so that it can be reversed (in which case the centres of the figure-eight fall out!). One plate is used for cases where the gnomon is attached to the dial plate at its south end (e.g. on a horizontal dial) and the other, when it is attached at its north end (e.g. a vertical dial). All that is required is a properly set up temporary gnomon with the instrument centered on the planned nodus position. I'm now open to suggestions for employing it!

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1. J. R. Davis, 'Satellites and Sundials', *Bull. BSS,* **11,** 77-80, (1999).

2. R. R. Rohr: *Sundials-History Theory and Practice,* Dover Publications, New York 1996

3. N. C. Ta'Bois, 'Sundial Line Drawing Jig', *Bull. BSS* **92.3** 28-30 (1992).

4. A. A. Mills, 'A Sundial Delineator', *Bull. BSS* **92.2** 22.(1992)

5. R. Terwilliger, 'Mechanical Dialing and a Laser Trigon', *NASS Compendium* 1996 No.2 22-26.

6. For pictures of Terwilliger's and Pollähne's trigons, see: www. shadow.net/~bobt/trigon.trigon.htm

7. J. R. Davis, 'A Test Table for Horizontal Dials', *Bull. BSS.* **98.2** 37-38 (1998)

LASERCUT SUNDIALS FOR WALLS AND WINDOWS

JOHN WARD & MARGARET FOLKARD

A technique has been developed for rapidly cutting out vertical sundials of almost any design from stainless steel sheet. The procedure is as follows:

A vertical sundial for a specific location and wall orientation and with any desired date lines for a specified nodus is designed on a computer using MICROSOFT QUICK BASIC 4.5 (QB45). This is a very old program but perfect for this application. Line widths and lengths can be altered, different fonts used and the hour numbers and lines placed in any one of several predetermined layouts. The owner's name, location details, date lines and any relatively short quotation can be included in the vertical sundial design. The QB45 program is typically about 20 pages long, but the calculations are done on a modern computer almost instantaneously.

The QB45 output file is imported into the drawing program MACROMEDIA FREEHAND or ADOBE ILLUSTRATOR, where it is examined on the computer monitor to see if any additions or changes need to be made. Small bridges are located strategically in the design to keep the numbers and quotations attached to the body of the sundial.

Next, we make a printout, purely as a record of the design, before exporting the file from FREEHAND or ILLUSTRATOR as a .DXF file.

This .DXF file is finally imported into the program SIGNMAKER, then read directly by a 3.5 kilowatt, 10.6 micron wavelength carbon dioxide laser cutting machine, made by Laser Lab in Melbourne, Australia. Cutting accuracies are reproducible to ± 0.1 mm and accurate to ± .25 mm over areas of 3500x3500 mm. Using 3 mm type 316 stainless steel, linear cutting speeds between 1000 and 1500 mm/minute can be achieved. 6 mm stainless steel can also be used with a corresponding increase in cutting time.

Figure 2 shows a 500x500 mm stainless steel skeleton type wall dial cut out of 3 mm thick material. The cutting time was about 12 minutes.

Figure 1. Time and date sundial for Christian Brothers College, Adelaide, South Australia, 1200x1200x3 mm stainless steel, powder coated.

Figure 2. Laser cut, stainless steel wall sundial, 500x500x3 mm.

Normally, we place the time correction and most other details on a separate cast bronze plate, made using computer controlled photopolymeric techniques. This plate is conveniently mounted lower down on the wall at eye level.

As an unusual variation, these laser cut skeleton sundials can be tailored to suit the dimensions of any existing window and used to produce a silhouette sundial. The window can be sandblasted or etched to act as a scattering screen. The sundial (complete with gnomon) is placed in contact with the outside of the window. Solar time can be read from inside the room under the sun's direct radiation . Such window sundials can include accurate details that are otherwise difficult to achieve without a high level of artistic skill. You must remember, of course, to create the hour numbers on your silhouette sundial in reverse, otherwise they will read back to front!

The same laser cutting techniques can also be used for accurately creating analemmas, complete with date plates, cardinal points and concrete attachment holes. (Figs.3 & 4)

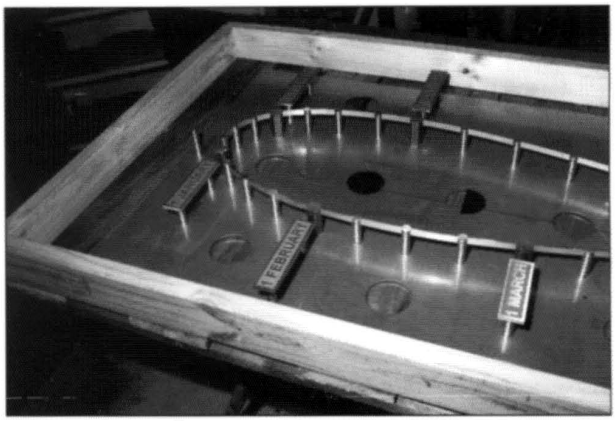

Figure 3. Brass analemma on stainless steel substrate. 2000 mm long, 3 mm thick, laser cut.

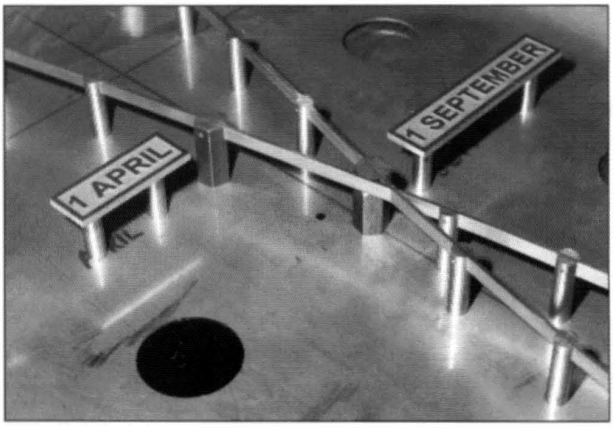

Figure 4. Crossover of analemma lobes, showing mounting detail. All location holes are laser cut.

These monolithic systems in stainless steel and brass can be wholly made in a workshop and delivered to a surveyed site ready for filling in with terrazzo or coloured concrete.

Such systems are ideal for use with analemmatic sundials of human involvement as described in Reference 1.

REFERENCE

1. Margaret Folkard and John Ward: *'Sundials Australia'*, Second Edition, March 1996, page 54.
ISBN 0 646 27581 X

LA MERIDIANA
A MILLENNIUM PROJECT

MARK LENNOX-BOYD

Every Summer my wife & I visit a house owned by her family, an hour from Rome, perched on the top of a hill and drenched in sunlight. Several ideas for new sundials have occurred to me there and in particular during visits of more than 20 years ago I used to gaze at a medieval tower on a nearby hill and wonder how feasible it would be to construct a series of large dials painted on the walls inside it to be read by spots of sunlight projected from small circular openings in the west and east walls and reflected onto the ceiling from a small circular mirror on the sill of a south facing window. Rather than continue with what seemed then like dreaming I decided to do the calculations and have made a working model for a purpose built tower. This was completed in 1985.

The basics are straightforward. Look at Fig. 1. This is the design for the dials of the first model (there has been a subsequent one). The illustration is a little smaller than half the size of the model & shows all 10 dials for the inside walls and ceiling folded flat onto one piece of paper, a cut out of which was glued to the inside of the model. Imagine the central section glued onto the north wall, the west and east walls folded towards you, likewise the floor and ceiling, and the two little bits of south wall folded so that they are parallel with the north wall. Just above the E in the centre of the west wall and the W in the centre of the east wall may just be seen two small circles which are openings in the design through which the sun can project. On a cross bar level with the line above the horizon and in the centre of the north wall is a tiny mirror set in a brass fitting. (The life size mirror will be 20mm dia.). So from dawn through the hours in the middle of the day until sunset light from the openings or the mirror will always fall on one or more of these dials which are calibrated for time at 5 minute intervals, date at approximately one week intervals, zodiac, altitude and azimuth. (Mean figures for longitude, declination and right ascension are also given). The times at which the date lines strike the horizon show the times of sunrise and sunset for the date in question. Time lines are in black with gold for the hours, the date curves are in red, altitude in green, azimuth lines in blue.

An experimental dial followed, shown in Fig.2. It was built in the family house on a wall facing slightly north of east and gives readings for part of the afternoon. The spot of light is projected from a distance of about 350cm. The corrected readings have on occasions been accurate to 10 seconds and the correct date but great accuracy is dependant on the continuous flatness and verticality of the wall as well as the accurate measurement of its declination. The wall was plastered more than 100 years ago. It is remarkably plane and vertical but of course not perfectly so. I have measured its mean declination as 4.93 degrees east of north. I am pleased that corrected dial readings have never been inaccurate by more than 30 seconds. As the distance between the 5 minute lines averages about 10cm. the sun moves across the dial about 3mm in 10 seconds, which shows the high accuracy of the calibration.

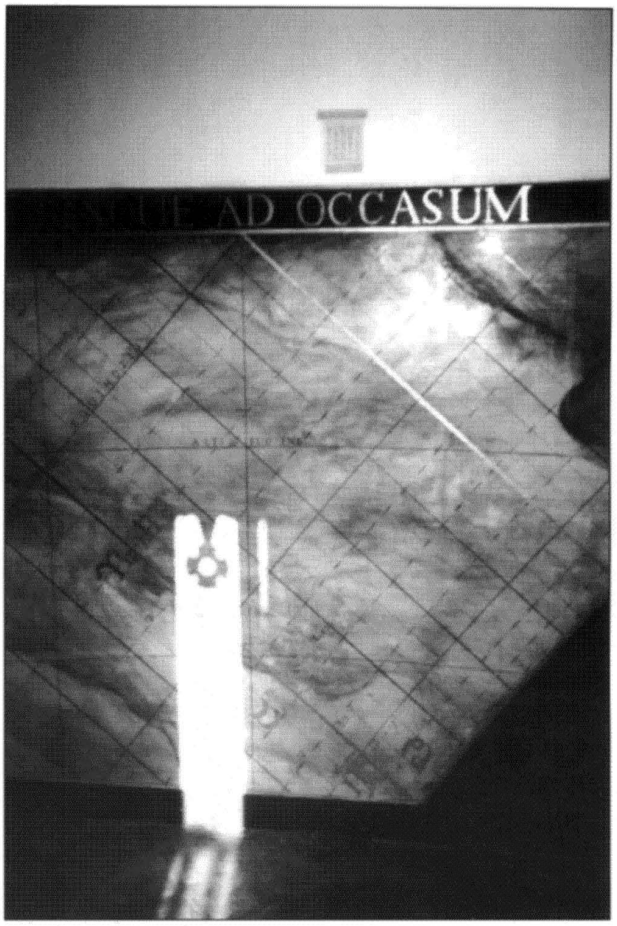

Fig. 2 Experimental dial reading just after 4pm LST

I am now in the course of building the tower on a hill nearby. Work has just started. It will be the stair tower for a small house, a rather large one for such a small building. The property will be called La Meridiana. The pictures of the second model in Figs. 3 and 4 show it as well as it can be photographed. A short flight of steps leads to a half landing on the north side from which rise two half-elliptical

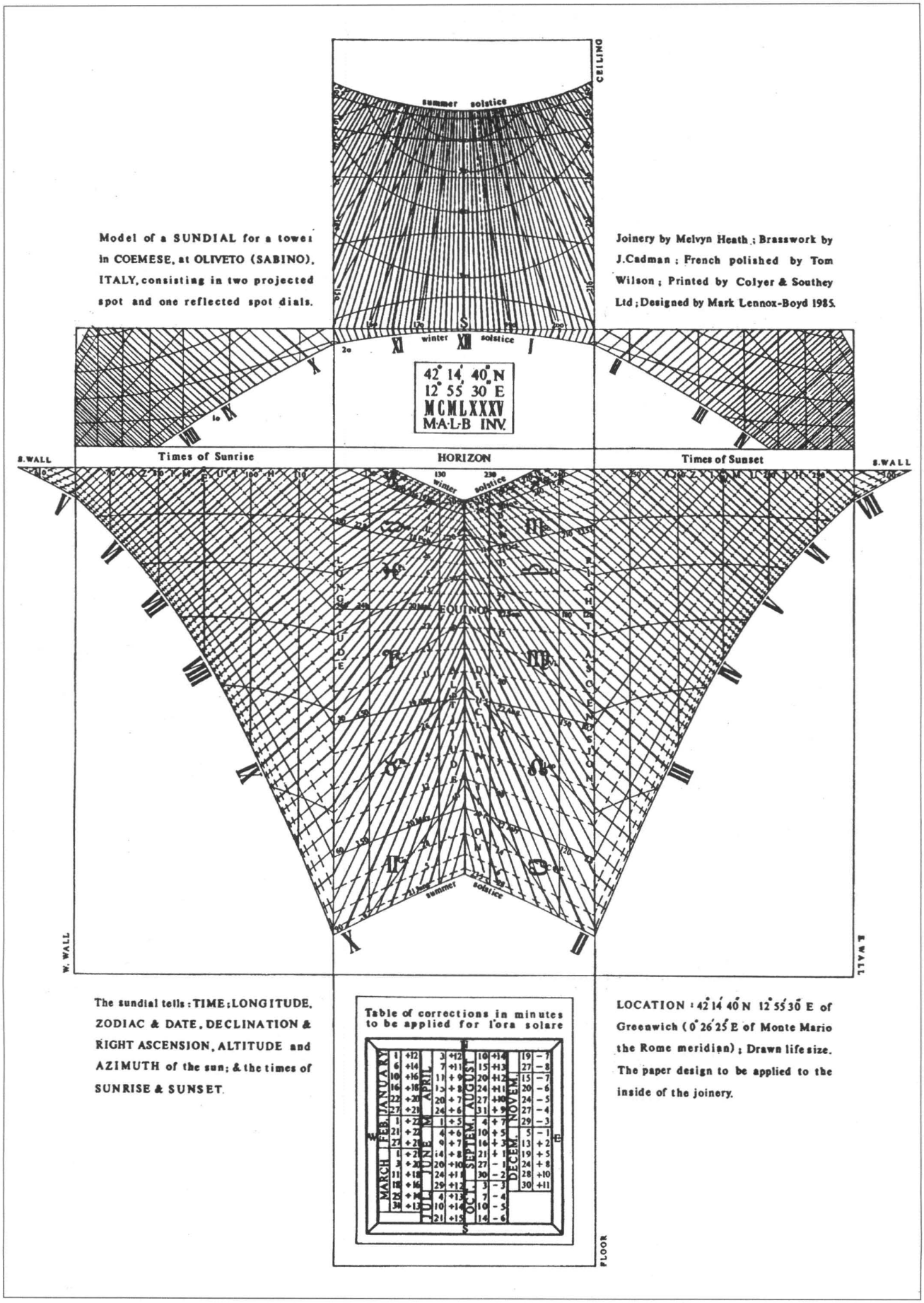

Fig.1 Paper cut out for the faces of the first model, reduced to 45% of original design

Fig.3 External view of the second model from slightly west of south. The five steps leading to the half landing are clearly visible. The brass fitting for the circular mirror is visible on the sill of the semicircular south window. On the west side can be seen a window with a half cone at the centre of which is a circular opening for projecting sunlight.

flights on the west and east sides which are united at the top landing on the south side. This model has 10 more small faces than the earlier one, some of which may just be visible on the treads and faces of three steps each side; so there are 20 faces in all. The cut-out figure of myself gives scale -- the tower will be l0m high, and 3.5m square inside.

From my work on the experimental dial I have devised what I believe are novel methods for the accurate measurement of a wall's declination & distance from the centre of a small a circular opening, the accurate establishment of a horizon and the accurate establishment of a meridian by observation at times other than noon - all

by means of sunlight, tape, spirit level & stopwatch. I have worked on all this slowly. The experimental dial took 4 or so days of my summer visit each year for 7 years to calibrate and paint so I had ample time to think. I also considered using and therefore calculated a reflected spot dial projection onto an elliptical semi-cylinder by means of elliptical integration and Simpson's rule. However I decided not to use this technique on this project because the construction of such a ceiling would be so complicated, and however beautiful would inevitably give less accurate readings than plane surfaces.

All of this, with illustrations and all the calculations and programs and the other problems encountered, I will write about in another article during construction of the dial & as I calibrate and paint it in the early years of the Millennium, should the editor be kind enough to allow me.

August 1999

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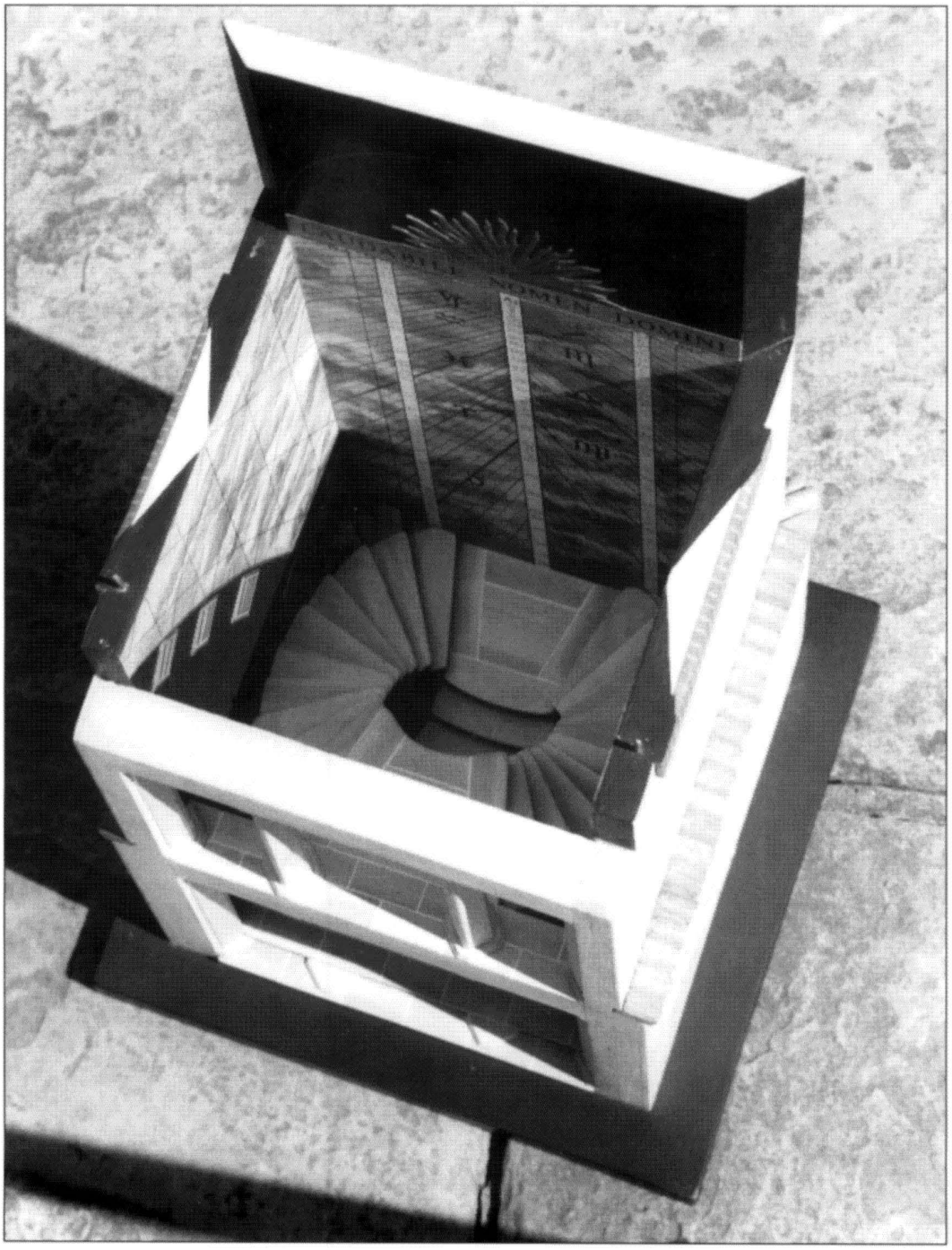
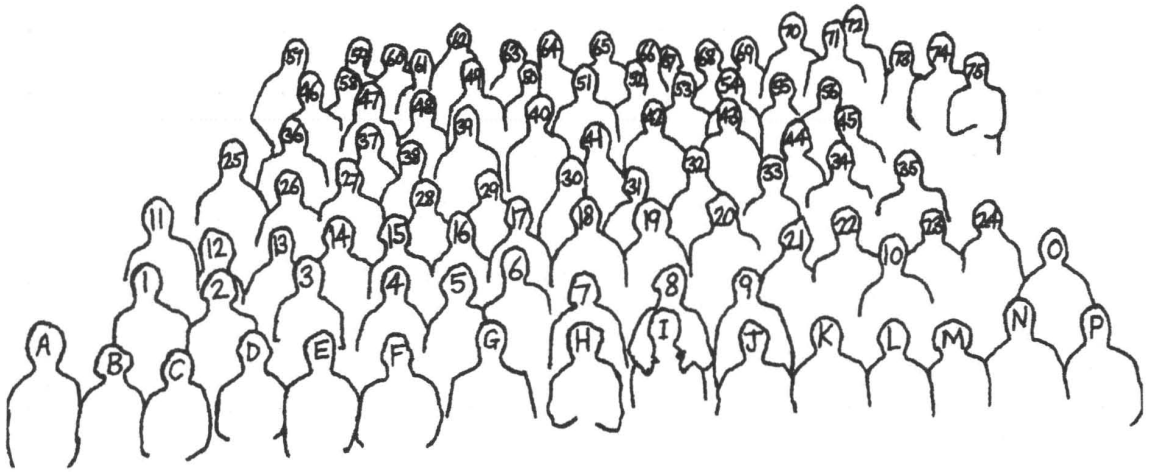


Fig. 4 The inside of the second model. The two half-elliptical flights are visible. Dials are also painted at the ends of the treads of the first three steps up from the half landing and on the faces of two of them.

British Sundial Society

TENTH ANNIVERSARY CONFERENCE at DUNCHURCH LODGE near RUGBY

30th April to 2nd of May 1999



KEY TO THE DELEGATES

Photograph taken on Saturday 1st May 1999 by Robert Sylvester

1 Neville Hoskins, Nottinghamshire
2 Ann Hoskins, Nottinghamshire
3 Dave Pawley, Berkshire
4 Verynan Wootton, Oxon
5 Nancy McVean, Gloucestershire
6 Colin McVean, Gloucestershire
7 Pamela Nicholson, Dorset
8 Doreen Bowyer, Kent
9 Lili Young, Essex
10 Peter Walker, Somerset
11 Martin Jenkins, Devon
12 Janet Jenkins, Devon
13 Margery Lovatt
14 Tony Brooks, West Sussex
15 Sally Hersh, West Sussex
16 Mike Shaw, Merseyside
17 Geoff Parsons, London
18 Silas Higgon, Shropshire
19 Roger Bowling, Cheshire
20 John Lester, West Midlands
21 Glenda Bateman, Berkshire
22 Doug Bateman, Berkshire
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24 Rosemary Kenn, Kent
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27 Aylmer Astbury, Cheshire
28 Mary Isaacs, Berkshire
29 John Isaacs, Berkshire
30 Phillip Wishart, N. Yorkshire
31 S. Edmondson-Jones, N. Yorks.
32 John Bourne, Australia
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34 Bob Adams, Lincolnshire
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57 David Cook, West Yorkshire
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Michael and Diana Lowne, East Sussex; Christopher McKay, Dorset; John Moir, Essex; Andrew and Liz Ogden, Ireland; David Waters, Gloucestershire

NEWS FROM ITALY

We have received a report from the General Secretary of the Sundials Section of the Amateur Astronomical Union of Italy about the Section's 9th National Sundials Meeting
This meeting took place in San Felice del Benaco, Lomardia region, 26th-28th March 1999
A hundred and six members attended the meeting, 30 authors presented papers, and in all 48 papers were presented. The papers were published in full in a 400-page report given to all those present.

The titles (in English) of the papers are listed below. Members of the BSS who are able to read Italian or to obtain a translation may wish for a photocopied offprint of one or more papers. Anybody wanting a photocopy may obtain one by requesting it from the General Secretary of ATTI, (name and address below) at the cost of photocopying and postage:
Signor Enrico Del Favero, Via Lambro 2, 20129 MILANO, Italy

G.Agnelli: The trigon:the re-birth of an instrument from the past - The development of the simulation project for the working of the S.Giuseppe sundial - A comparison of astronomy and astrology: certain considerations
L.Agnes: Solar clocks of the U.Foscolo Lyceum in Paris
C.Allieri: Instruments for measuring wall declination
R.Anselmi: Projection methods in the making of solar dials
M. Arnaldi: Canonical and temporal annotations in the chronicles of solar and lunar eclipses between the 12th and 15th centuries.
F.Azzarita: Shall we turn the dials?
L.Barufffi: Sun clocks: treatise/manual - The Villa Borghese Sundial
M.Catemo: Sun clocks with Italian hours in Upper Latium(Lazio) - The use of Italian hours in the south of Italy.
A.Cintio: Anaclastic or refraction clocks
L.Colombo: The Acaz Sundial
L.Comini: The Sundial Hours of Fruili Venezia Giulia
G.Cornacchiari: The use of the trigon in the construction of sun clocks on a curved church wall.
E.Del Favero: The catalogue of Italian Solar Dials: situations and prospectives.
G.Fantoni: Sun clocks of the past - Nocturnal lunar clocks
G.Ferrari: Interactive sundials with gnomon graduated in hours - Some sundials based on Ptolemaic co-ordinates - Analemmatic rectilinear sundials - Certain formulae for finding the position and length of the pointer in sun clocks needing restoration
G.Ferrari & A.Comi: An ancient solar clock in the form of an astrolabe at Parma
F.Ferro Milone: An instrument for tracing clocks on complex surfaces with indirect or reflected shadow - A rapid method for drawing Italian Hours with French half-hours.
E.Fornasa: The two halves of the sky.
A Gunella: The search for a local meridian with the three point method - The lines of ascendant signs - How many types of unequal hours exist?
N.Lanciano: Astronomic didactic gardens
P.G.Lovotti: Analytic gnomonics in 3D:the vertical solar clock - Solar anthology
C.Lucarini & M.Catamo: And for a bell tower...the sun!
E.Marianeschi: The meridian Line of Piazza Montecitooorio in Rome - A spherical cavity sun clock with refraction variants
R.Mosello: One hundred and eighty dials of the Val d'Ossola
G.Paltrinieri: The Orosolic: a curious gnomonic find in the Charterhouse of Galluzzo in Florence
L.Salucci: The sundial of the Cathedral of Fossombrone
G.Tonello: Piedmont Sundials on CD ROM
M.Trobia: The Sundial of Castroreale
M.L.Tuscano: Sundials and Coats of Arms: the Sundial at Caltanisetta
G. Zuccala: Graphical analogic instruments for gnomonic and astronomic use in general for the transformation of co-ordinates - Numerical analogic instruments for the transformation of co-ordinates - Graphical Cartesian tables for the transformation of co-ordinates. - Numerical analogic instruments for the calculation of horizontal and vertical sun clocks.

GUIDELINES FOR CONTRIBUTORS

1. The editor welcomes contributions to the Bulletin on the subject of sundials and gnomonics; and by extension, of sun calendars, sun compasses and sun cannons. Contributions may be articles, photographs, drawings, designs, poems, stories, comments, notes, reports, reviews.

   Articles may vary in length, but the text should not exceed 4500 words, about three-and-a-half pages in the Bulletin. When writing about a fixed dial or mass dial in Britain or Eire, authors are encouraged to ensure that the dial has been, or will be, placed in the Register of Sundials (See inside back cover for address of Registrar.) If you are uncertain about the recording, please insert a note in italics at the end of the article to give the dial's approximate location: for example, *The sundial described in paragraph 3 is in Derbyshire, Taddington village, Lat. 53°14' Long. 1°46'*

2. Format: The preferred format for text is typescript, single-spaced or double-spaced, A4 paper; or on disc, 'microsoft word' or 'ASCII', with one printout.

3. Figures: For photographs, black and white prints as large as possible up to A5 size; colour prints are also acceptable if they show sufficient contrast. Slides and transparencies are also acceptable. Drawings and diagrams should be in clear black lines on white paper.

4. Each figure illustrating an article should carry on the back the author's name and title of the article (in abbreviated form); also a number, indicating its relative position in sequence in the text: (Fig 1, Fig.2. ..etc)

5. Captions for the figures should be written on a separate sheet, in numerical order. They should be sufficiently informative to allow the reader to understand the Figure without reference to the text.

6. Notes are best avoided: it should be possible in a short article to incorporate into the text all the background information which the reader needs, to understand the article. If notes are used, they may be referred to, in the text as (Note1), (Note 2) in brackets; then listed at the end of the article, after the 'Acknowledgements' and before the 'References

7. Acknowledgements: These should be as brief as is compatible with courtesy.

8. References: Sources are referred to in a text by a superscript number. They are listed in numerical order under the heading 'References' at the end of the article.
   The Bulletin's convention is as follows:
   For books: Author's name; Title of book, in italics; Name of publisher, Place and date of publication.
   For papers and articles: Author's name; Title of article in single quote-marks; Name of journal, in italics (this may be abbreviated); volume number in arabic numerals, underlined or bold; first and last page numbers; date, in brackets.

   Examples:
   A.E. Waugh: *Sundials, their theory and construction.* Dover, New York, 1973.
   D. Colchester: 'A Polarized Light Sundial' *Bull.BSS.* **96.3,** 13-15 (1996)
   A.A. Mills: 'Seasonal Hour Sundials' *Antiquarian Horol.* **19,** 142-170 (1990)
   W.S. Maddux: 'The Meridian on the Shortest Day' *Compendium, Journ. NASS.* 4, 23-27 (1997).

   If you simply wish to give a short list of books associated with the subject of the article, this may be given at the end of the article under the heading 'Bibliography', using the convention as given for 'Books' above.

9. The address of the author will normally be printed at the end of the article, unless the author, when submitting the article, expresses a wish that this should not be done.

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