

# The British Sundial Society

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## BULLETIN

No. 96.2

JUNE 1996



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# HONORARY OFFICIALS OF THE BRITISH SUNDIAL SOCIETY

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Cover Illustration - The mid-seventeenth watch shown contains a sundial (the hinged gnomon is missing), allowing setting of the watch to solar time. The watch dial, with an hour hand only, lies underneath. The movement is signed Denis Martinot A Paris.

## DIALOGUE

### DE ZONNEWIJZERKRING

**Bulletin 96.2** - the first four pages are devoted to the memory of Marinus Hagen and then follows the last article he wrote, - The Little Bear.

At the meeting in Utrecht on 20th January members displayed various instruments and the leap second was discussed. It is hoped that some of the objects shown will be described in further Bulletin articles. The possibility of a library was mentioned and news was given of an exhibition of sundials at Asten in January and February.

At the AGM in March a silence was observed in memory of Marinus Hagen. A proposal for co-operation with the Federation of Bell enthusiasts was declined, but the possibility of working together on isolated projects in the future was borne in mind. New publicity material for the Sundial Society is being prepared and it is hoped for the co-operation of the Planetarium at Franeker and the Bell Museum in Asten in its distribution. Matters for the future were an exhibition and the publication of a list of members.

Two new publications were mentioned, one by the Zee and Federation about a sundial by Paulus Reinman 1604 and the other a book published in Amsterdam in 1859 which could be made available to members by photocopy. Members then displayed various items from their collections.

There follows a note on the phases of the moon taking into account that the sun is many times further away from the earth than the moon is. The matter is followed up in the next article together with further diagrams.

Mean time and the diploidoscope are discussed in the next article with many drawings showing angles of mirrors with notes on the work of several authors about deciding the time of noon.

A sundial has been made which can be used as a bird bath or a dish to hold crumbs to attract the birds to the garden. The dial designed by the Chairman of BSS for the two hundredth birthday of the Hydrographic Service is illustrated. A few notes on accuracy of measurements are then given and comments on information obtained through computers belonging to sundial enthusiasts. There follows some discussion on the Shepherd's dial with some mathematics.

Two full page illustrations and a description are given of the dial at Telgte, near Münster, of 1610. This was formerly a centre of pilgrimage, and the dial shows the Virgin pierced by a sword which forms the gnomon. One illustration has the original Latin inscriptions which were replaced in 1935 by the German ones shown on the other illustration.

There follow comments on the Venetian ship dial in connection with a lecture by Professor David A. King and

some more notes on fixed dials in the Netherlands together with a review of current literature. The Bulletin concludes with notes on the proposed excursion to Rupelmonde to be made with the Belgian Sundial Society on 22nd June 1996.

E.J. TYLER

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### ZONNETIJDINGEN

This is the bulletin of the new Belgian Society - 1996 - 01, a nicely produced journal of A4 format in thin card covers. The front cover shows a vertical sundial dated 1989 which has a 24-hour numeration. The first article deals with the Equation of Time, with tabulated values in whole minutes, and how to arrive at times at a locality in accordance with the time system in use and longitude. It quite surprised the reviewer that Belgium covers from 02° 32' to 6° 24', almost 4° or almost 16 minutes.

Next an article on sundials by the great French horologist Julien Le Roy. The two illustrated are both portable horizontal dials of great beauty. At first glance the reviewer was reminded of Anthony Turner's article in *Antiquarian Horology* in the late 1980's.

Under the title of "Sundial of St. Joseph's College in Beringen", a modern vertical sundial of 1993 is described. It has declination lines and the signs of the Zodiac to indicate the entry of the sun to the appropriate house.

A book review J. De Graeve deals with the work produced by one of our fellow members R.J. Vinck - *On the Principles of the Directional and Analemmatic Sundial - A Computational Approach*, published 1995. The cost of the book is 950 Belgian Francs (about £20), and having seen the manuscript, this seems a quite reasonable price.

Restoration of a sundial in a Belfort Tower is the theme of the the next article, accompanied by an excellent view of the Town Hall of Aalst but in which the sundial is hard to see; followed by a feature in similar format to "Dialogue". A list of dialling journals and references is given without giving details of the contents, and in a panel is an announcement for four meetings in Flanders by P. Oyen is included. With a page of news about other dialling societies in other countries, Bulletin 1996 - 1, comes to an end.

Membership cost 1050 BEF (about £22) to Account Number 068-2214580-97 of the Zonnewijzerkring Vlaanderen vzw, B-9150 Rupelmonde. It is not known at present how many Bulletins will be issued per annum. The Bulletin is in the Dutch language without English summaries.

An English summary was included, found after the review was written! More haste, less speed.

## NEWBURY-IN-ESSEX

MARGARET STANIER

A precedent for successful one-day meetings of BSS members has been ably set by David Pawley at Newbury. A similar meeting was held on 18th May, 1996 at the village of Great Saling, between Great Dunmow and Braintree, at a delightful venue - the Coach House. Under the careful organization of John Moir and Desmond Quinn, 35 members and friends from the south-east met for six happy hours of discussion, talks, and 'play with our toys'.

The green baize covered tables around three sides of the large square raftered-roofed Coach House were fully filled with member's displays, slides, diagrams, publications, photos, models and treasurers. Soon all members were deep in sundial talk, discussion - even argument; and new arrivals were shown around, to be quickly absorbed in the discussions and model viewing. All too soon, David Young, who presided over the morning session, had us seated to face the screen for the morning 'Talks'.

After formally welcoming the group, David went on to give three reasons why there were so few 'good' sundials recorded for Essex - shortage of long-lasting materials, proximity to London and seaports where transport requires exact timekeeping, and too few locally resident dial recorders. He then proceeded to show a part of his enormous collection of Essex Dials, old and new, with certainly no need to apologise for their paucity! He rounded off his talk by a few pictures taken at the recent BSS meeting at West Dean College, including a view of the prize-winning wall dial designed and made by Sally Hersh.

Next came an entertaining talk and slide show by Maurice Kenn, who was more successful than David had been in taming the recalcitrant remote control slide-changer. He took us through pictures of his home-made dials designed for sunny window sills, made from plastic jars, bottles and coffee pots, and cunningly adjustable for London or Sydney. He then took us on a rapid tour of the dials around Sydney, mainly modern handsome modern types, but one, surprisingly, dated 1843, not in its original position.

We proceeded to lunch, the Coach House had prepared a good cold buffet meal and taking our plates, we sat at the round tables at the back of the 'hall', enjoying with our food, more dial-talk and reminiscences.

For the afternoon session, our Chairman Chris Daniel presided, he had arrived just as David Young was leaving to conduct a Historical Society Tour (of guess what) Essex Sundials. The BSS Chairman welcomed the members and

expressed the joy we all felt at seeing those members who had not previously attended a BSS meeting before. We hope to see these new friends at meetings in the future.

The first afternoon talk was delivered by Ray Ashley, in which he described the 'Sundial Trail' set up in the building and grounds of the Horniman Museum in Forest Hill, South London. Ray had been involved in the making of some of the dials and showed slides of the processes of construction. He and the delineator John Moir were particularly pleased when their computations for the ceiling dial, using a light spot from a mirror on the sill of a south facing window, reflected on to the sloping roof of the Centre for Understanding the Environment, produced a perfectly straight line for the Equinoctial Declination.

Finally John Ingram told us about the Mass Dial Group's plans for a weekend meeting in Somerset. A list of about 160 mass dials in Somerset was produced by a Dominican monk The Very Reverend Dom Ethelbert Horne in 1900 when he lived in a monastery (Downside Abbey) in Street; and participants in the week-end meeting (June 28-30) are to be asked to set out as search parties in different directions to see how many of these dials are still to be found, and to put those extant on to recording forms.

We all then set out on a short walk (half a mile) westwards under the guidance of Desmond Quinn, to look at an armillary sphere on the front lawn of a house owned by Mr. Hugh Johnson (a wine and gardening expert). Chris Daniel expressed everyone's thoughts by saying "I thought we were to look at a sundial. It's just a GARDEN ORNAMENT! And then we all enjoyed pulling it to pieces and demolishing it (metaphorically). A slight drizzle cleared and after a brief look at a nearby church we returned to the Coach House for tea and one final look at the delightful exhibits. We always wonder at, and rejoice in, the ingenuity and inventiveness of our fellow-members. Besides Maurice Kenn's domestic containers there were John Moir's lavatory fittings, and this reporter's fancy was taken by David Young's perspex sun-compass, and also by a charming sundial fitted with a burning glass above, arranged to fire a tiny canon at noon.

As we dispersed, we said a warm and hearty Thank You to John Moir and Desmond Quinn for organising an enjoyable informal and successful meeting in a pleasant spot. Many thanks also to our hard-working Secretary and Chairman, who always "make the party go".

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The Editor invites submission of articles for publication which enhance the prestige of the BSS Bulletin. After some seven years of publication, the vast amount of dialling material disseminated has rather depleted that held by the Editor. Articles are being sought for publication in Bulletin 97.1 and beyond.

Contributions can be of any length, but if long will have to be published in instalments. Two to three thousand words length and three or four illustrations per thousand words is about right. If you want advice on a thesis, send an

abstract of about a hundred words to give the Editor some idea of its scope.

Manuscripts are preferably typed double-line spaced, references at the end of the article, with superscript numerals in the text. Captions to be listed on a separate page. See any major article in the BSS Bulletin for the house style used. Authors are reminded they are solely responsible for accuracy of their statements. In matters of decision, the Editor's word is final, as is normal in the publications field.

## DUNPHAIL: THE MAKING OF A SUNDIAL

ANNE SOMERVILLE

The sundial at Dunphail House, Morayshire, in the Grampian region of Scotland, is a twentieth century multiple dial of the obelisk type. It was sculpted in 1990 and then cast in bronze by Gerald Olgivie-Laing, for whom

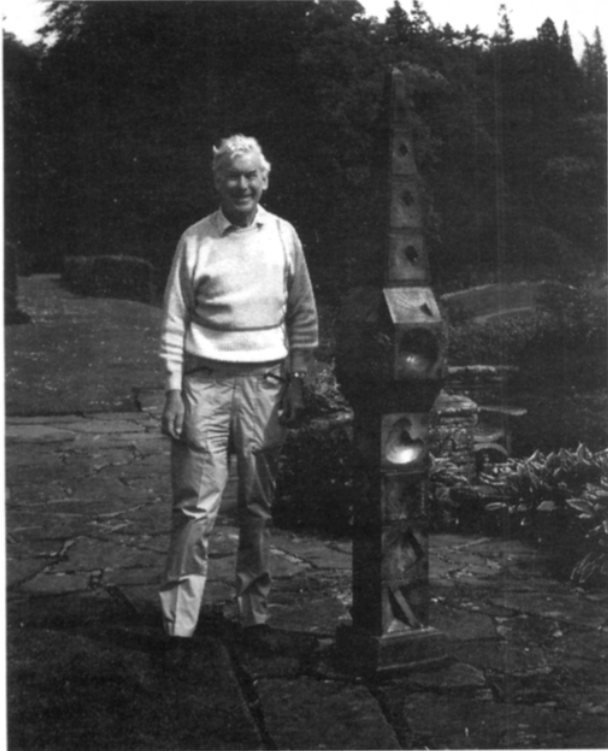


Figure 1: Andrew standing by the Dunphail Sundial

Andrew Somerville acted as sundial consultant and who delineated all the 35 faces present (figure 1).

In September 1989 Andrew received a letter from Gerald Olgivie-Laing of Kinkell Castle, Ross & Cromarty, asking for advice. He had been commissioned to make a sundial to be given as a farewell present from a grateful work-force to Sir Hector Laing, the retiring chairman of United Biscuits. He is evidently a stickler for time, hence the suggestion of a sundial.

The sculptor wished to use as a model the 17th and early 18th century type described by Thomas Ross in "The Castellated and Domestic Architecture of Scotland", published in 1892. He had become interested in these dials while doing research for the restoration of his home, Kinkell Castle, a task which he carried out more or less with his own hands with meticulous regard for its authenticity. He favoured the obelisk type, as at Kelburn Castle in Ayrshire (figure 2) indicating that it would be cast in bronze, and that he wanted to make it "properly functioning", though he did not really know much about sundials or gnomonics. The obelisk at Kelburn is a well-preserved example of these dials and is dated 1707. They were popular between 1690 and 1730, and although all are not dated, they can be safely consigned to these dates; the only exception is the one at Drummond Castle in Perthshire (figure 3) which carries the date 1630. It was made for the second Earl of Perth by John Mylne, master-mason to King Charles I; he also made the elaborate dial at Holyrood Palace, Edinburgh, as well as the one at Stobhall, owned by our Patron, the present Earl of Perth.



Figure 2: Kelburn Castle obelisk sundial

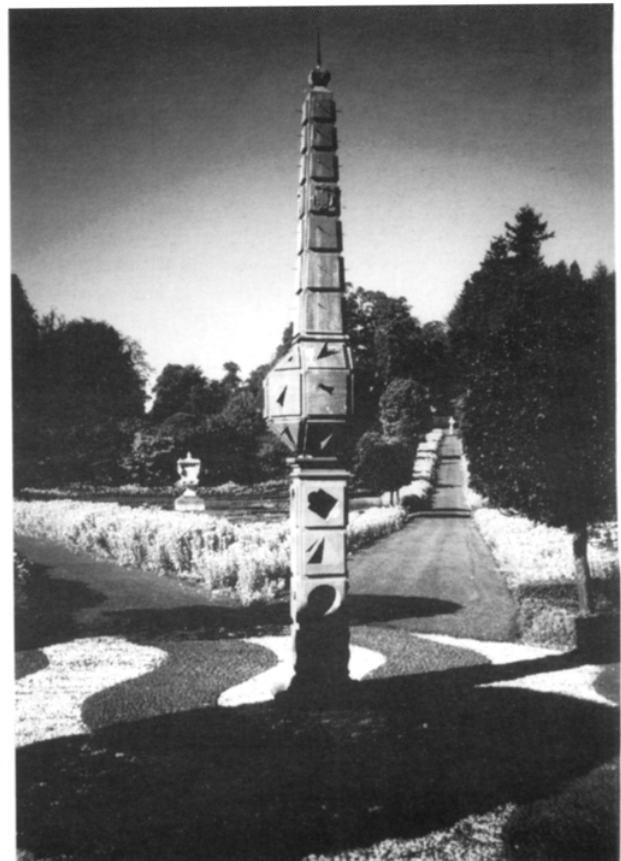


Figure 3: Drummond Castle obelisk sundial



Figure 4: Kinkell Castle



Figure 5: Kinkell Castle, Studio and Foundry

During copious correspondence and telephone conversations, the design of the numerous dial faces was decided upon. The marking out of the flat surfaces presented no problems as they could be engraved direct on to the bronze castings. Andrew provided the engraver with tracings for these, but the hollows had to be marked out on the plaster model before casting, and Gerald suggested Andrew come to Kinkell to help him do this.

It was, therefore, in early March 1990 that we flew to Inverness and came to Kinkell Castle (figure 4), which lies further north on what is known as the "Black Isle" between the Cromarty and Beaully Firths. In figure 5, the studio is the top floor of the building on the right, with the foundry below. He does all his own casting, with the help of some local men whom he has trained.

We should now look at the dial in detail (figure 1). The obelisk type consists of 3 sections: tapering finial, central boss, and 4-sided shaft. The original ones were of course sculptured in stone and the design is unique to Scotland; here we have the first bronze one.

Firstly the finial (figure 6): there are 4 dials on each side

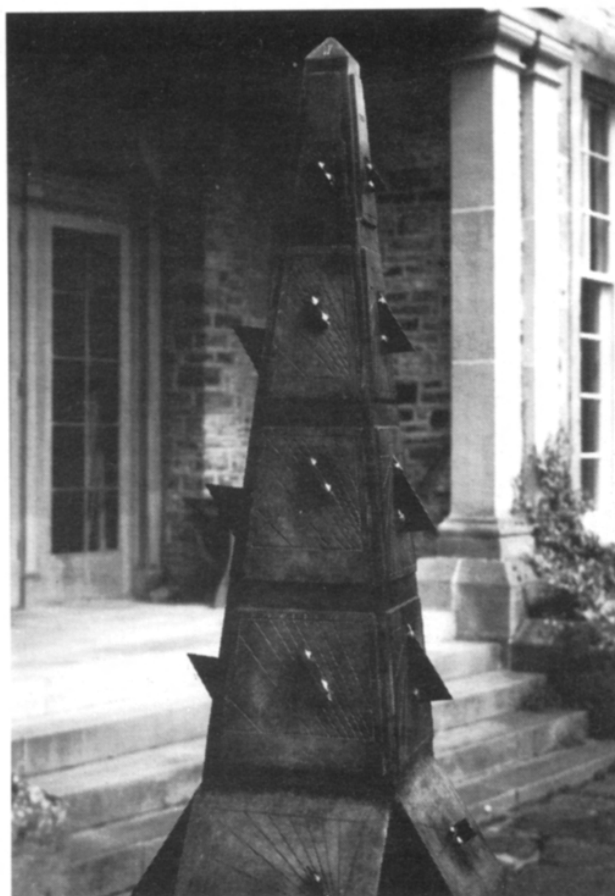


Figure 6: Dunphail Obelisk Finial

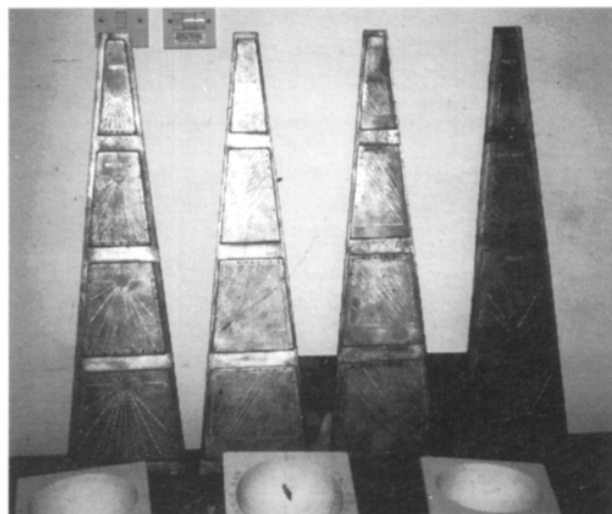


Figure 7: Dunphail Obelisk Finial Panels

reclining 6 degrees from the vertical, but the hour numbers have been adjusted to give the time at Tokyo, Hong Kong, Chicago and New York, all places with United Biscuits connections. Figure 7 shows the 4 panels just returned from the engraver, ready to be welded together and patinated.

Secondly the boss: this is octagonal, with 4 vertical faces at the cardinal points, 4 upper surfaces reclining at the angle of the latitude ( $57\frac{1}{2}^\circ$  N) with cut-out triangles in between, and 4 inclining surfaces and sunken triangles. The vertical faces on the south, east and west have hemispherical hollows, while the north face is flat and carries the dedicatory inscription. The south hollow (figure 8) has a pin gnomon and declination lines, with the signs of the Zodiac engraved outside the hollow. To mark out this dial Andrew used ideas he gleaned from the books of René

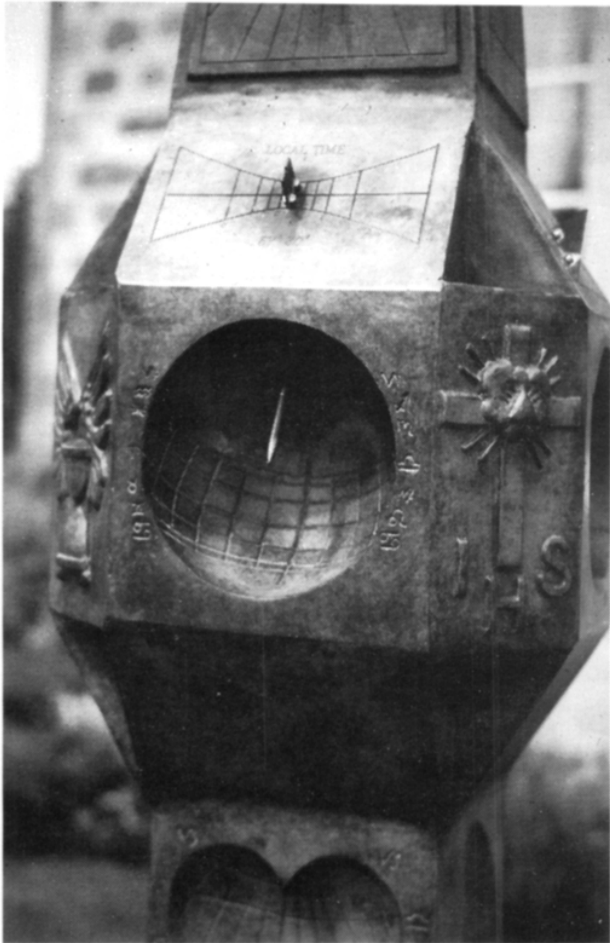


Figure 8: South Concave Dial

Rohr and Heinz Schumacher. Figure 9 shows his device in use, the equipment including a pair of compasses, a drinking straw and a No. 9 knitting needle. In the east and west hollows (figure 10) the shadow is cast by the edge of the hollow, and the position of the notch gives the time and declination. Here, lines are drawn only for the equinox and the solstices for the sake of clarity; the notch is reading outside the solstice line in this photograph, but at this stage the dial had not been finally installed (there was a slight lean on it), and it was hoped that when the dial was properly set up the error here would be corrected. On the 4 alternate vertical faces the sculptor has carved various symbols e.g. an hour-glass, and the badge of the Scots Guards in which Sir Hector had served. The upper surfaces recline at the angle of the latitude and have flat dials; on the south a polar dial (figure 8), with direct reclining dials on

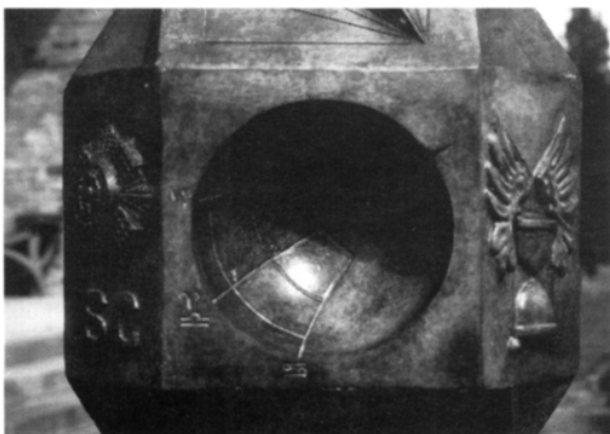


Figure 10: West Concave Dial

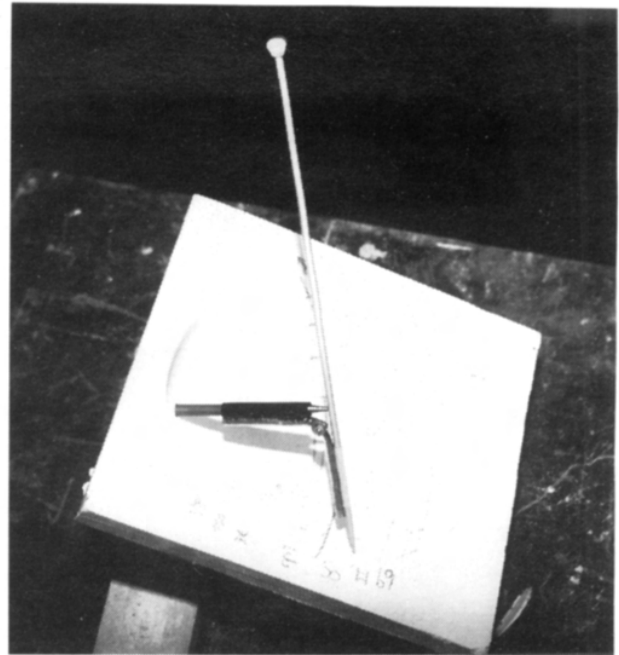


Figure 9: Marking-out Device

east and west; on the north is an Equation of Time correction graph (figure 11) incorporating the longitude correction ( $3\frac{1}{2}^{\circ}$  W), with the dedicatory inscription below. There are no dials on the inclining surfaces.

Thirdly the shaft (figure 1): the shaft has 4 panels on each side, the top one of each carrying a heart-shaped hollow. On the east and west sides the cusp of the heart terminates in a bar at the angle of the latitude so that it acts as the gnomon (figure 12). The remaining panels on these

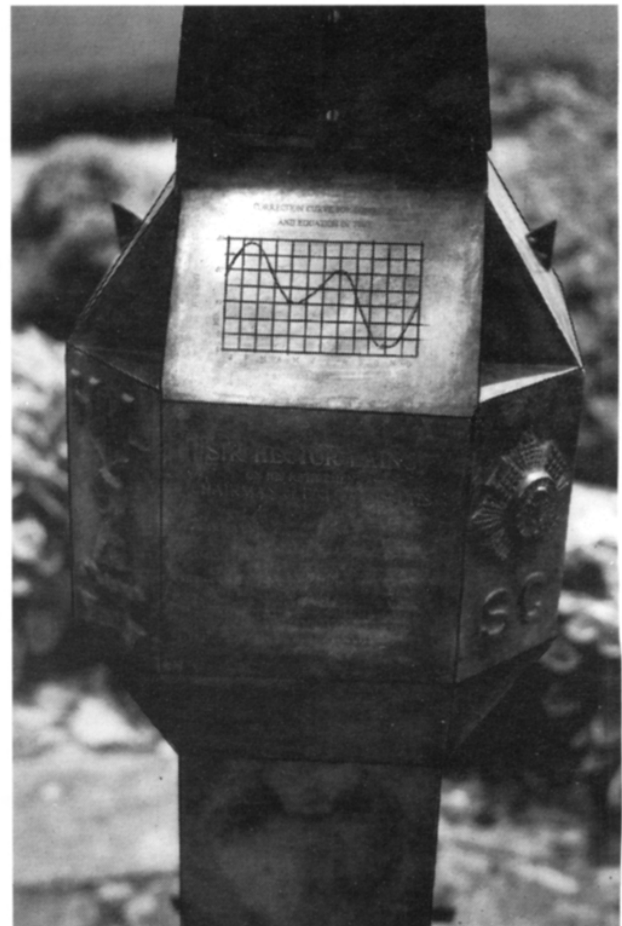


Figure 11: Equation of Time correction graph

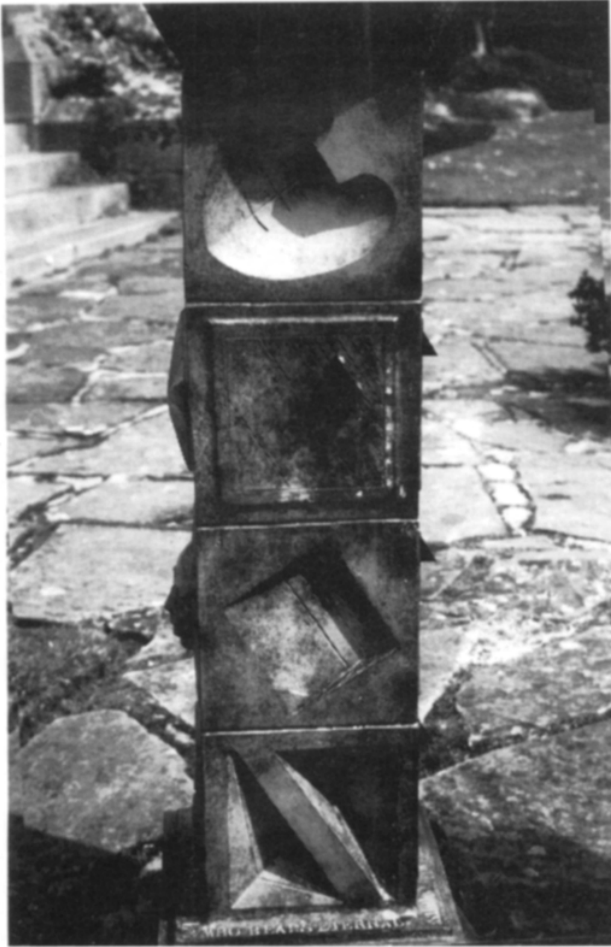


Figure 12: Dunphail West Shaft



Figure 13: Dunphail South Shaft

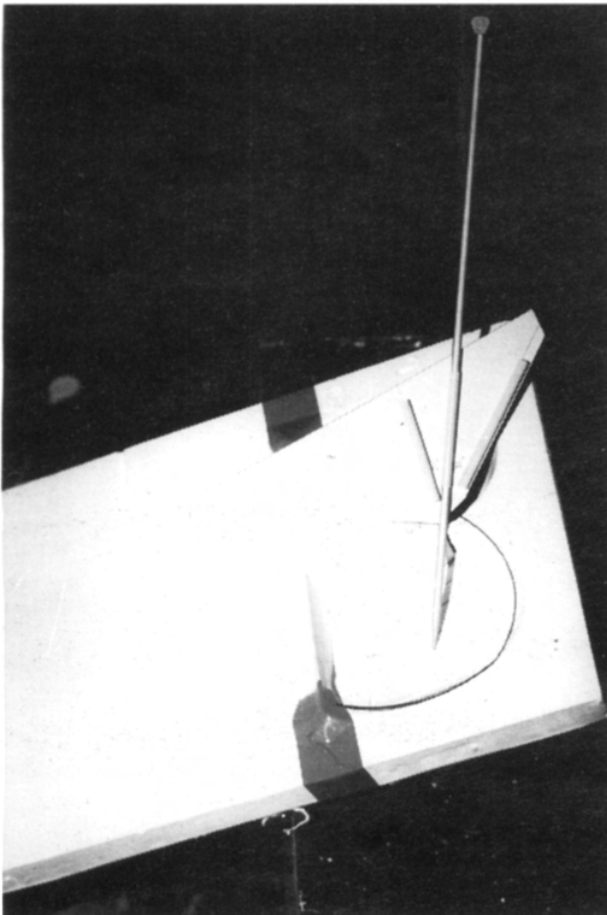


Figure 14: Marking-out Heart Shape

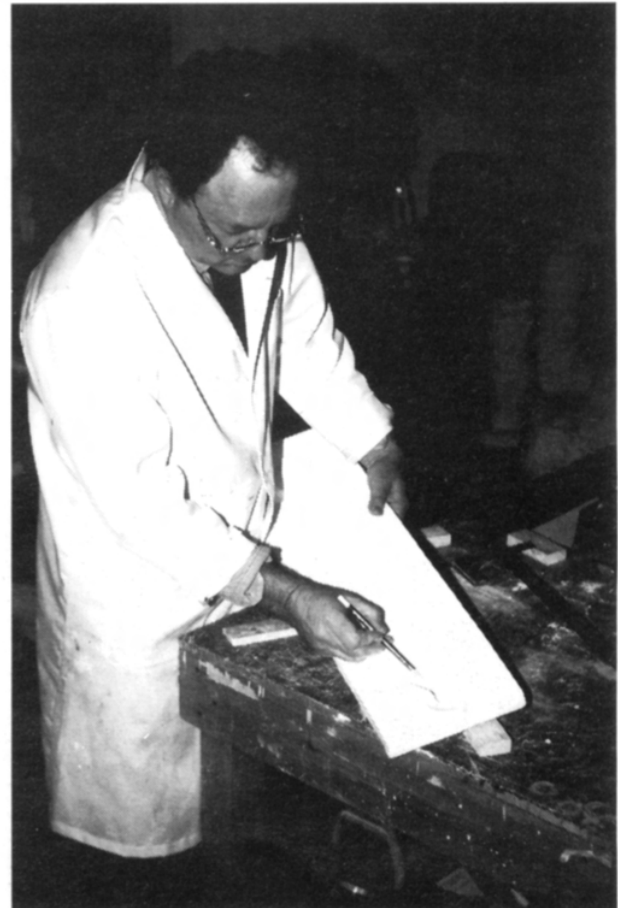


Figure 15: Gerald Ogilvie-Laing



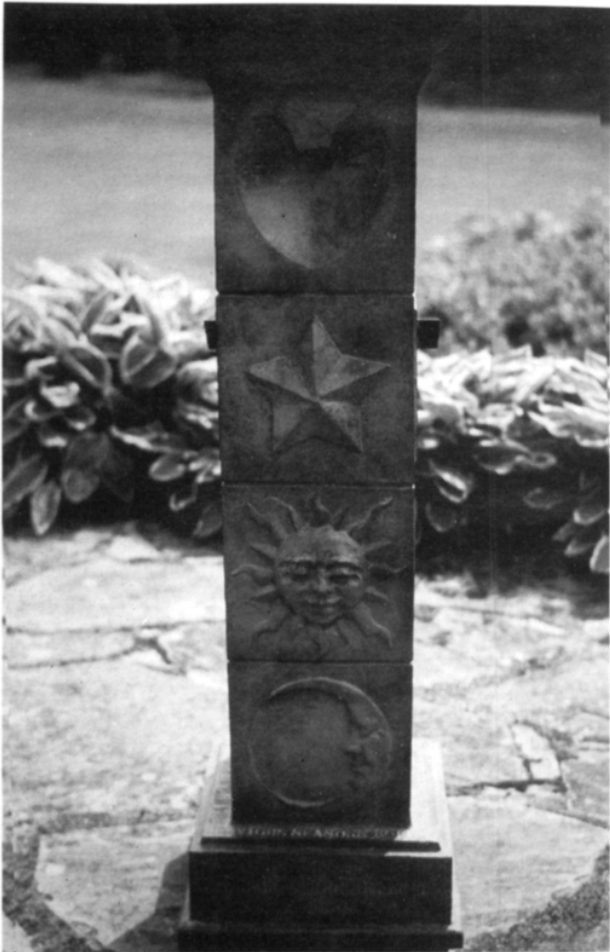


Figure 16: Dunphail North Shaft

sides have conventional vertical dials with, below, hollow dials in the form of a rectangle and double triangle, where the edge of the hollow acts as gnomon. These are fairly simple versions of the typical structures to be found on obelisk dials (see figure 2 and 3). On the south side the cusp of the heart comes to a point (figure 13), and it is the shadow of this point which is used to read the time and declination. The other panels on the south side have dials giving Planetary, Babylonian and Italian hours. A device similar to figure 9 was used to mark out this heart (figure 14). I have to confess that I was not present at the time this work was done at Kinkell Castle; I was walking across the fields with the son of the house, exercising the dog! I hope that the technique will be clear to more knowledgeable diallists. Figure 15 shows Gerald Laing at work. In the



Figure 18: Dunphail House

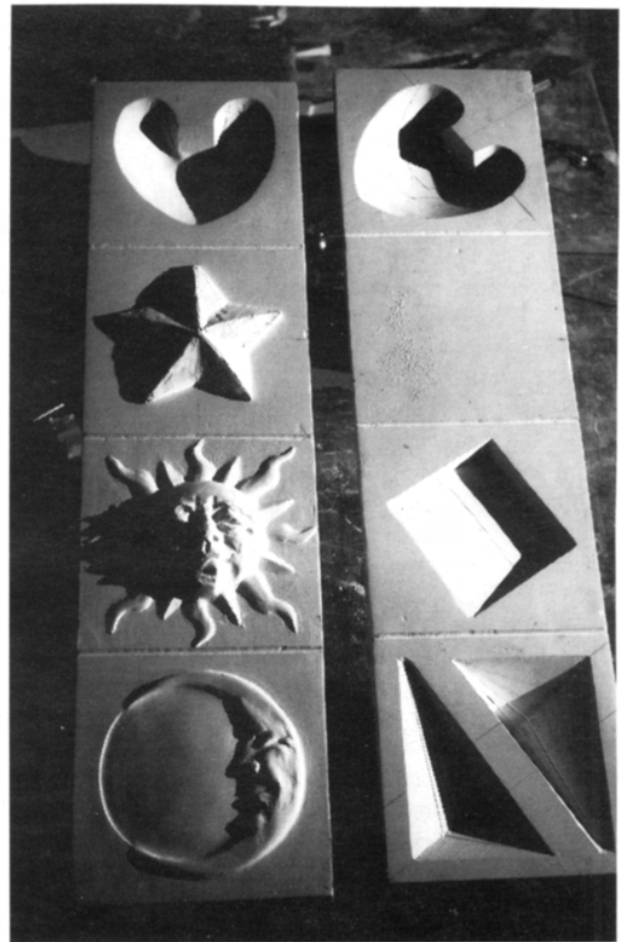


Figure 17: Two Shaft Panels

north heart (figure 16) the bar of the cusp is extended downwards at the angle of the latitude so that its sides cast the shadow. The other 3 panels on this side of the shaft carry the Hermetic symbols of sun, moon and 5-pointed star, symbols which are found on some of the old obelisk dials. Figure 17 shows two of the shaft panels ready for the foundry. The empty panel was for a vertical dial, to be engraved after casting.

We visited Dunphail House (figure 18) with George Higgs at the end of May, only a few weeks after the dial had been presented to Sir Hector. George had originally checked all Andrew's calculations, and it was he who supervised the final fixing of the dial (albeit by telephone) after Andrew's death. Figure 19 shows George talking to the caretakers. Sir Hector was at home when we called,



Figure 19: George Higgs (left)

though only just! - he delayed his departure for London in order to meet Andrew and to thank him for his part in the design of his sundial. He was bubbling with enthusiasm over his present, and showed us the presentation booklet which explained the historical significance of this type of sundial and how to read the time from it, which Andrew had written, and which had been most beautifully and artistically produced. He could have gone on and on but his wife had her eye on the time, urging him to leave, so we were given the freedom of the grounds, from which we saw them waving from their private plane as it passed overhead.

**POSTSCRIPT**

After the above paper was presented to the meeting at the 1995 BSS Conference at Grantley Hall, there was a request from the floor of the house (Frank Evans, seconded by Jim Holland), that the photograph shown here (Figure 20) should be published in the BSS Bulletin, for the special benefit of those who remembered Andrew Somerville's lecture - "The Ancient Sundials of Scotland", at the Oxford meeting in 1990. His excuse for showing the slide was that it demonstrated that these dials, though usually sculptured in stone, could be made from other materials!

George Higgs commented from the floor, "I presume it tells Temporary Hours"!!

The photograph was taken in 1984 when Cheshire experienced an unusually heavy snowfall of the right type, and Andrew worked furiously to make his first obelisk dial before the snow melted - in fact, it keeled over a few minutes later.

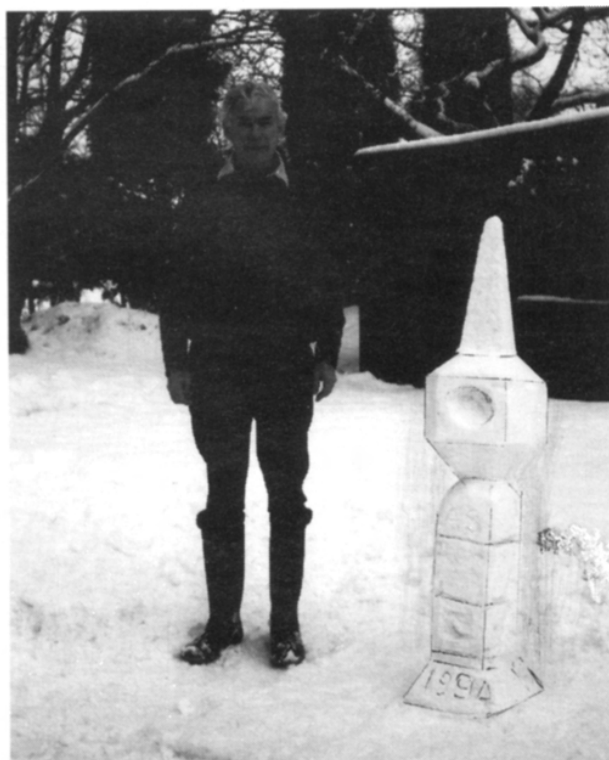


Figure 20: Andrew Somerville and the Snow Obelisk Dial

**CONTINUED FROM PAGE 9  
BICENTENARY OF THE HYDROGRAPHIC OFFICE**

**SETTING UP THE SUNDIAL**

The sundial was set up on its plinth in the early Autumn at its pre-determined site, at the Hydrographic Office at Taunton, where it was formally 'unveiled' on 27 October, 1995, see Figure 2.



FIGURE 2: L to R - RICHARD MOTTRAM (Permanent Under-Secretary, MOD) who "unveiled" the dial; REAR-ADMIRAL NIGEL ESSENHIGH (Hydrographer to the Royal Navy); CHRISTOPHER ST. J.H. DANIEL (Chairman BSS); MARK FRITH (Letter carver); CAPTAIN JOHN GRAY (Master of the Honourable Company of Master Mariners)

# BICENTENARY OF THE HYDROGRAPHIC OFFICE (1795-1995)

CHRISTOPHER ST. J. H. DANIEL

## THE OCCASION

The year 1995 marked the two hundredth anniversary of the foundation of the Hydrographic Office, whose work in the production of meticulously constructed charts, covering the whole world, has contributed so largely to the safe navigation of ships at sea. In parallel with the work to increase the seaworthiness of vessels on the High Seas, this vital work has greatly contributed to the safety of life at sea. To celebrate this event, the Master of the Honourable Company of Master Mariners decided to make a presentation of a specially commissioned sundial to the Hydrographer of the Navy, as a permanent feature at the Hydrographic Office at Taunton in appreciation of their work by all chart users, see Figure 1. He also decided to mark the occasion by holding a dinner for officers of the Hydrographic Service, at which time the sundial would be presented. In this aim, he has been ably supported by other companies of Master Mariners by shipping companies, and by various interested commercial organisations whose names are listed on the plaque that accompanies the sundial at its site at Taunton.

## THE SUNDIAL DESIGN

Historically, the sundial is a scientific instrument, the purpose of which is to determine the time from the apparent motion of the sun. This is achieved by observing the shadow of the fiducial edge (the 'style') of a *gnomon*, or of a *nodus*, which may be a point, or an aperture through which the sun's rays may be projected, on to a graduated *dial-plate*, by which the time may be determined. The sundial presented to the Hydrographer of the Navy is unusual and, in certain respects, unique. It was designed, as the last of a 'trilogy' of sundials, by Christopher St. J. H. Daniel, F.S.A., sundial design consultant, a former P. & O. officer, later on the staff of the National Maritime Museum,

and Deputy Master of the Honourable Company of Master Mariners in 1989-1990. This instrument is a 3-ft (905mm) diameter circular horizontal sundial, made of black Welsh slate (Wincilate), 42mm thick and weighing some 1 3/4cwt. The gnomon takes the form of a vertical spike, the shadow of the tip of which - the *nodus* - indicates Local Apparent (Solar) Time. The other 'parent' instruments of this Arabic style 'trilogy' are smaller and comprise a rectangular green slate dial and an oval 'pink' slate dial, designed by Christopher Daniel for his two daughters.

In this case, corrections tables are provided around the south rim of the sundial to allow Greenwich Mean Time, or British Summer Time to be deducted from the reading obtained at Taunton. Of particular interest is the fact that the latitude and longitude of the sundial's site position have been corrected to WGS 84 to the nearest second. This must be the first occasion on which a sundial has been calculated by this system, as opposed to that of the Ordnance Survey.

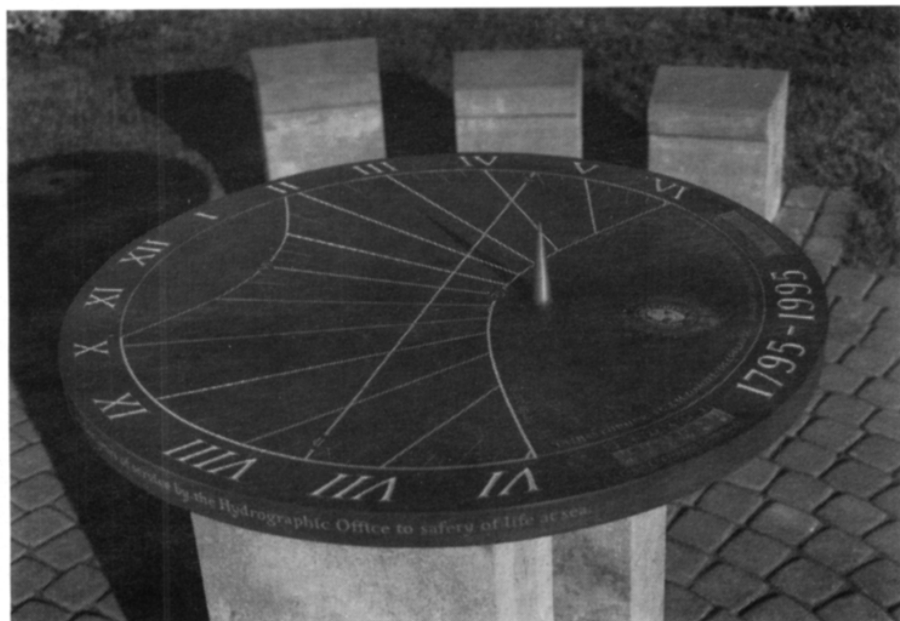
## MAKING THE SUNDIAL

The sundial was cut to shape and supplied by Wincilate Ltd., whose quarries have provided the finest slate in Wales since the time of Elizabeth I. The dial was carved by hand by Mark C. Frith, letter-carver and sculptor of London, in just five and a half weeks, with some 380 incised letters and characters. This includes over 24ft of 3mm lettering! Close inspection will reveal the fine detail, especially the Hydrographic Office badge, which has resulted not only in a scientific instrument, but in a brilliant work of art. The gilding was carried out by Mrs. Sally Bower with complementary skill and finish.

Mark Firth was also responsible for producing the other two sundials in the 'trilogy', all of which track the declination lines of the equinoxes and solstices, the 'furniture' of the sundial.

FIGURE 1:

The Bicentennial Sundial presented by the Master of the Honourable Company of Master Mariners, Captain John M. Gray to the Hydrographer of the Royal Navy, Rear-Admiral Nigel R. Essenhigh.



# AZIMUTH SUNDIALS HORIZONTAL AND VERTICAL

G FANTONI, ITALY

"Azimuth" is a local celestial coordinate, which, for unknown reasons, has been rarely used during the history of sundials. A very modest interest in it is also shown by contemporary diallists.

I am unable to provide a precise reason for this general indifference toward the azimuthal sundials. However, I am convinced that these sundials are excellent, easy to produce and perfectly working instruments. Furthermore, they may also offer substantial advantages compared to their counterparts which use the L.H.A. (hour angle) or the altitude.

The very limited diffusion of the azimuthal sundial, in my opinion, is totally undeserved, and I would like to write a few words in defence of this kind of dials.

The transposition from "azimuth" to "time" can be performed in two entirely different ways:

- a simple, instinctive method, by which the "azimuth" is converted into "time" through mathematics (be it analysis or geometry or trigonometry). This procedure, similar to the one used for other types of sundials, obtains instruments that (in view of the lack of a precise official term) may we call "generic azimuthal dials";
- a second, more sophisticated process, by which the azimuth is drafted on the celestial sphere; the sphere is then projected on a plane on which the sundial appears. We may call this kind of instruments "projective azimuthal dials".

In the practical area past gnomonics presents some good samples of projective azimuthal dials. The type of projection used in this field are only two. In both cases the dial is on the horizon: the stereographic projection, with the point of projection on one of the pole of the celestial sphere; the orthographic projection, with the point of projection to the infinite, on the vertical of the horizon.

To the best of my knowledge, in the past stereographic projection was used only once, by Oughtred, an Englishman. In 1636 he devised the so-called "horizontal astrolabe" (actually this was a sundial, not an astrolabe, as the name may suggest).

A greater popularity was enjoyed by the other projection, the orthographic one (this proves another oddity of human things: in gnomonics the stereographic projection is a much better procedure than the orthographic one!). In this category we can find the very beautiful analemmatic dials produced by Bloud at Dieppe around the years 1660-1670, and the analemmatic garden dials. Actually, in the past, the projective analemmatic dial brought forward a wide activity of study and research, but it did not enjoy a large practical diffusion. Nowadays, however, it seems that the garden model is gaining some popularity among the modern diallists.

In this presentation, nevertheless, I would like to speak in particular about the "generic azimuthal dials". In spite of the fact that they are the most elementary and easiest to build, they have been, by far, the most neglected.

Lets start with an overview of the very simple procedures for their construction.

The first element which deserves our attention is the dial. Since the rotation of the solar shadow is developed on the plane of the horizon, it is fully instinctive to use an

horizontal plane for the azimuth dial. Furthermore, a vertical rectilinear shadow producer must be used as the style. Since the length of the shadow is inconsequential, it follows that the length of the vertical style will also be inconsequential.

Elementary astronomy tells us that at each moment of the day the azimuth of the Sun, i.e. the direction of the shadow of the style, depends on the latitude and the Sun declination, i.e. on the date.

Therefore, once the latitude of the location in which we are placed is identified, we select any given date (that is a certain declination) and assign to this date a trace, i.e. a line of any kind, which is drawn around the style on the horizontal dial (figure 1). Our instinct suggests that this line be drawn as a circle, but this shape is not obligatory.

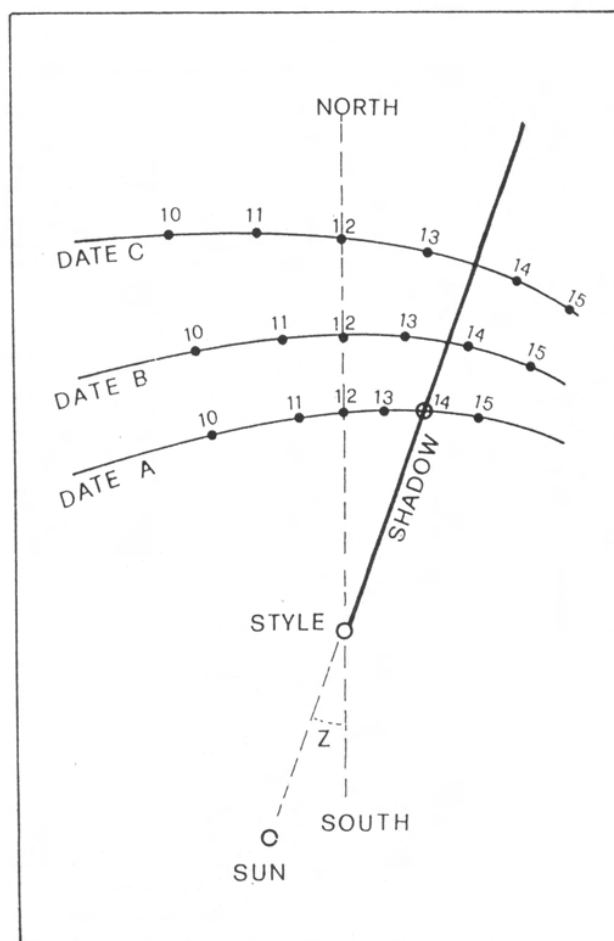


Figure 1

We mark on this line the points where it is crossed by the style shadow at the various hours of the day. Each one of these points will identify the corresponding hour. In this way we have obtained a sundial. This instrument, however, is valid only for the day in which the sun azimuths are those we selected for the construction, within that specific day.

For the other days of the year, we must draw on the dial, with arbitrary settings, other similar daily lines. We identify these new lines with the various day of the year, and we repeat on them the operation of marking the points

of interception of the azimuth lines at the different hours of each day. If we join with a continuous line all the points of the same hour, we will obtain a complete azimuthal sundial. On this instrument a specific calendar, civil or zodiacal, must indicate the day of each of the lines that we have used for the construction.

The time will be read at the point on which the style shadow cuts the line of the day (obviously an interpolation will be done between the calendar lines and between the hour curves).

Figure 2 shows the very simple trigonometric formulas to obtain the azimuth Z of the Sun (from North toward East or West) using latitude L, hour P (from South toward East or West) and declination D.

Figure 3 shows two very simple examples of azimuthal sundials drawn with the method that we have illustrated. The calendar lines on which the hours are marked are drawn like equidistant circles. In one case the declinations are increasing toward the style, in the other they are decreasing. Of course the drawings cease in

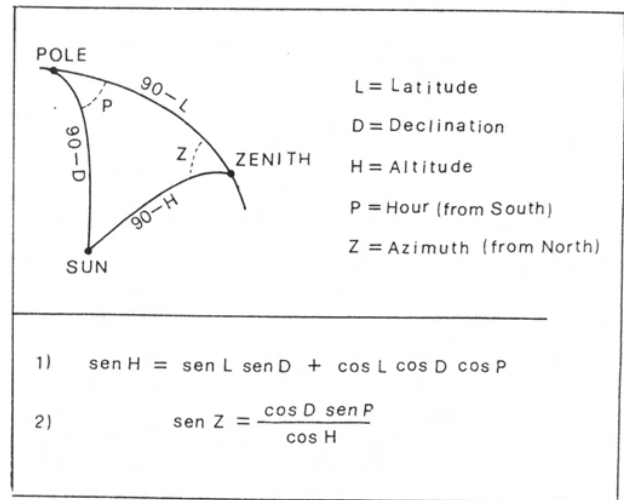


Figure 2

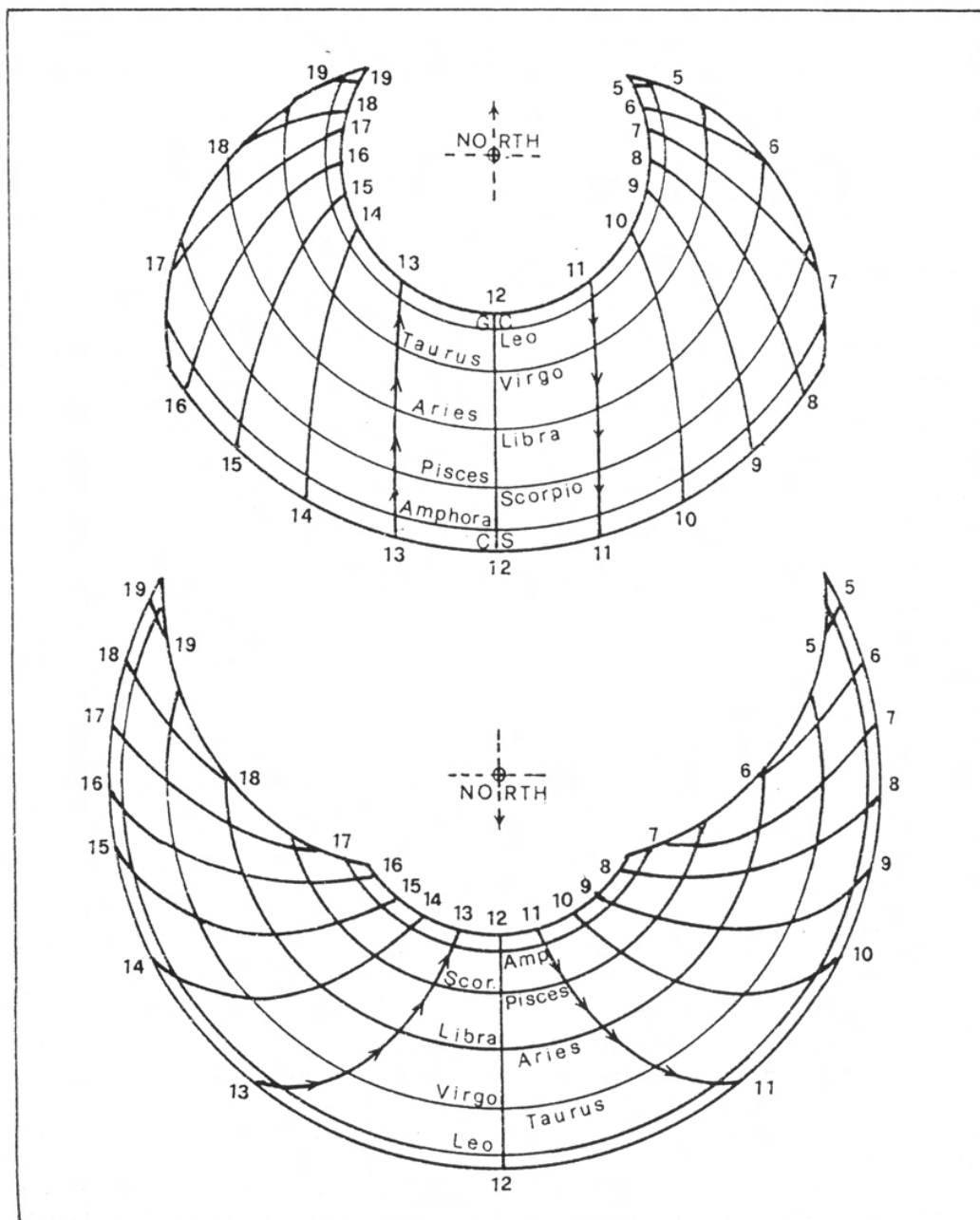


Figure 3

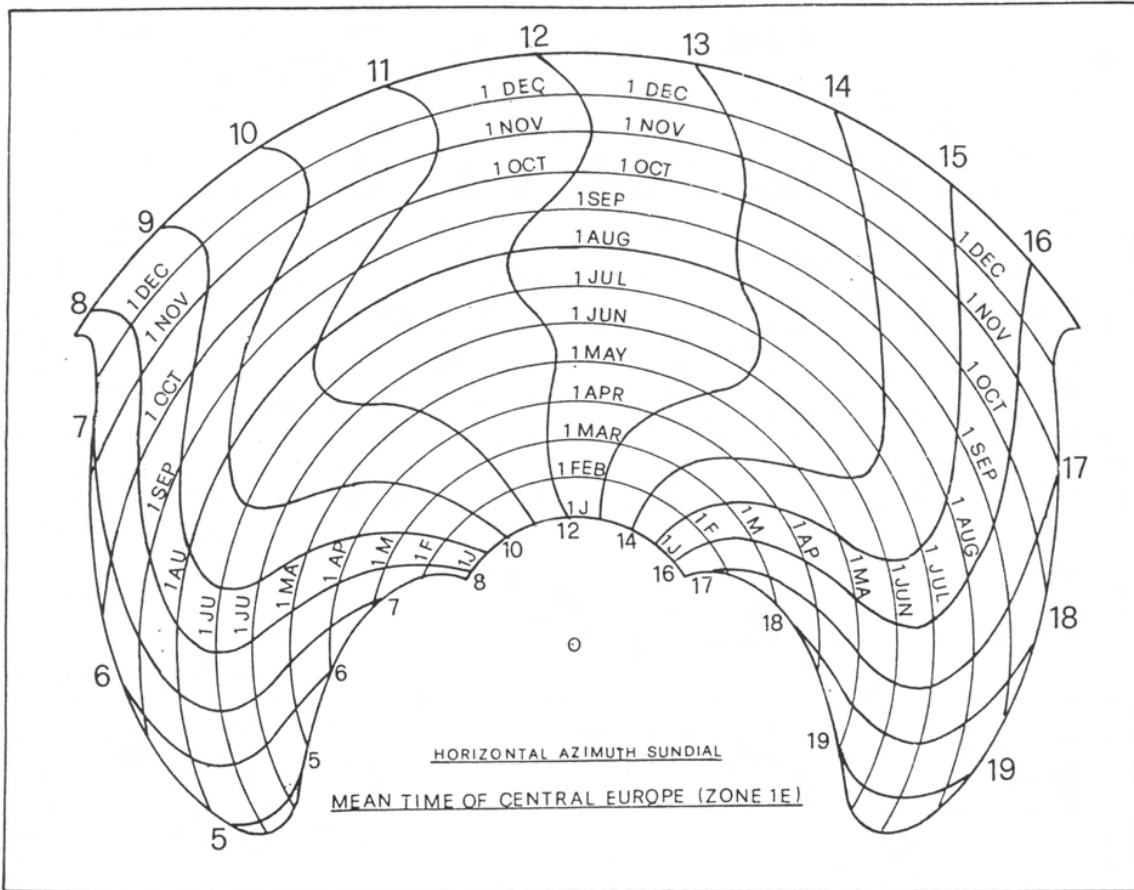


Figure 4

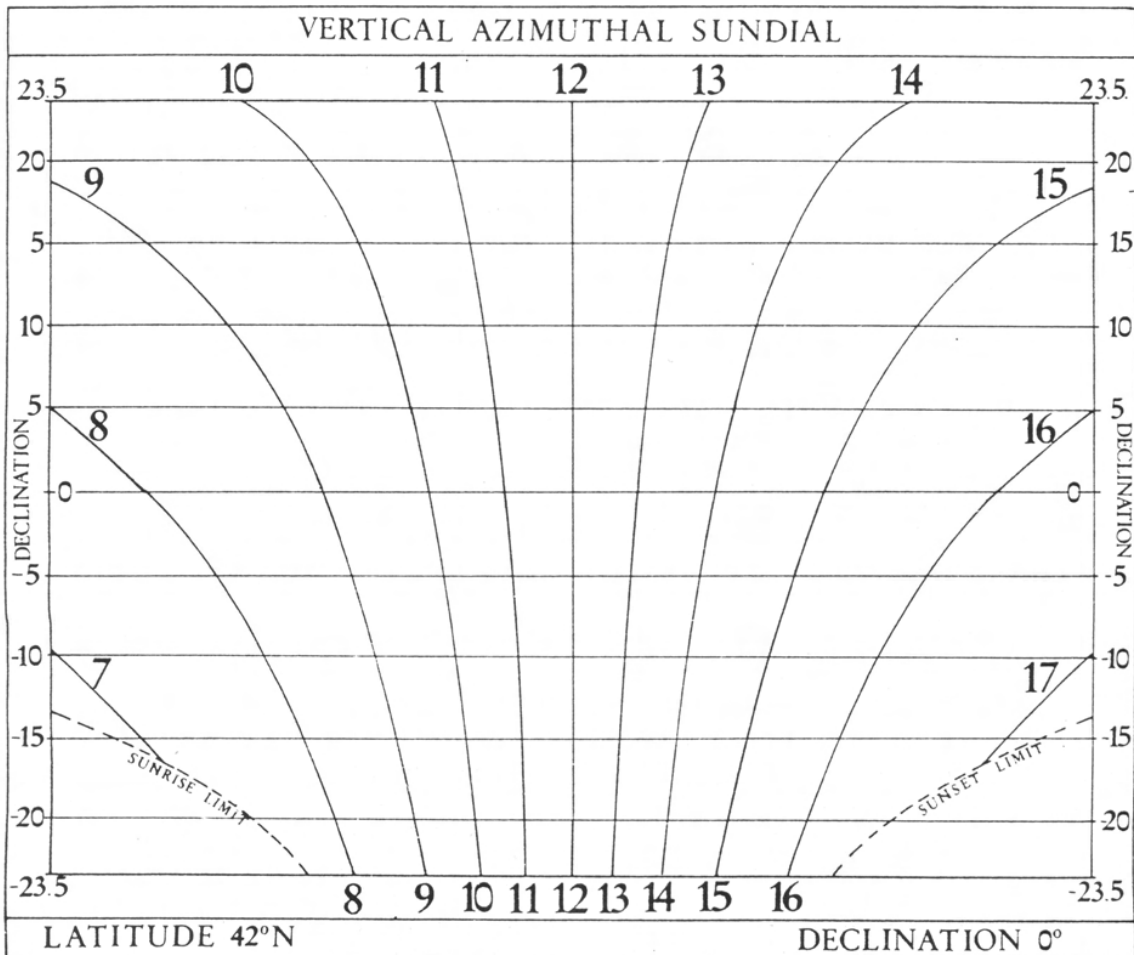


Figure 5

correspondence of the sunrise and sunset.

Another example of horizontal azimuthal sundial is shown in Figure 4. In this case also the element of entrance "date" is expressed over equidistant circular lines. The sun declination has been duplicated, because it proceeds from the first of January to the thirty-first of December. The hour lines appear to be slightly distorted because both the zone-time correction for Rome and the time equation have been inserted into the hours to obtain from the dial the same time shown by a wrist watch in Rome.

Now I would like to underline the remarkable advantages of the azimuthal dial in comparison with other dials using the altitude or the L.H.A. (hour angle).

1. The style is vertical and its length is undetermined. Therefore its installation is quite easy.
2. The shape of the lines for the azimuthal points are totally arbitrary. In our drawing they have been made circular, but they can assume any other form, including a non-geometric one.
3. The distance and the succession of the calendar lines are absolutely arbitrary.
4. The calendar can be easily extended to all the 365 days of the year. In addition, the time equation can be inserted on each hourly line along its entire length, avoiding the necessity of using the 8-shaped analemma.

Honestly we must admit that it would be difficult to find in the whole gnomonic science a sundial that is easier, more arbitrarily drawn, and more adaptable to the wishes of the constructor.

Next, I would like to open a small parenthesis, in order to present another interesting prerogative of the horizontal azimuth sundial (in fact this characteristic is shared by all other horizontal sundials).

We said that we can obtain the time  $P$  with the knowledge of the three elements latitude, declination and North direction (i.e. sun's azimuth). In the same way, if we transfer the hour  $P$  among the known elements, knowing the three elements  $L$ ,  $D$  and  $P$  we can obtain the fourth element, that is the Sun's azimuth  $Z$ , which is the horizontal distance between the Sun and the North. Since the Sun's position (visible by naked eye) is known, the direction of the North can be obtained. In other words, this instrument, designed as a sundial, can also be easily used as a geographic compass.

For example, the same figures 3 and 4 can be used as geographic compasses for locations around  $42^\circ$  latitude. The data will be the date and the hour.

I intend now to take another step, maybe a little risky and unusual, in the field of solar azimuthal dials.

We stated that the plane on which we work with the azimuths is always horizontal, since the azimuth of the Sun develops on the horizon. Therefore, instinctively its use is reported on the horizontal plane.

Now we would like to disregard this "instinct"; in other words we wish to see how the Sun azimuth can be utilized, for sundials, on non-horizontal planes. To avoid exaggeration, we consider only vertical planes, although this variation may be generalized in every other way.

In figure 5 an azimuthal sundial is shown, which is drawn (abominable heresy!) on a vertical plane. The gnomonic declination here is taken at  $0^\circ$ , that is the dial is facing exactly South.

On the dates' scale the Sun declinations are arranged from  $-23.5$  (below) to  $+23.5$  (up) to include practically the first six months of the year, from the winter solstice to

the summer solstice. For the use of the dial, it will be necessary to back track for the other six months.

The calendar lines, rather than being circular (following the usual criterion, which in this case loses every value and significance) have been arbitrarily drawn as horizontal equidistant lines. The North may be set above or below or on any other part of the dial, as the draughtsman prefers. In our figure it was set below.

In this case the style should again be vertical, therefore it must be set parallel to the dial, at a certain distance from it. This distance will then dictate the whole drawing.

The shadow of the style, which appears on the dial as a vertical straight line, during the day moves from left to right: it shows the time where it meets the horizontal line that corresponds to the declination of the day.

The drawing of the hour lines is very simple. The straight line where the vertical plan from the style, perpendicular to the dial, meets the dial is assumed as the "base line". On each calendar straight line the distance  $a$  of the hour line from the base line is (figure 6):

$$a = g \cdot \text{tg} (d - Z)$$

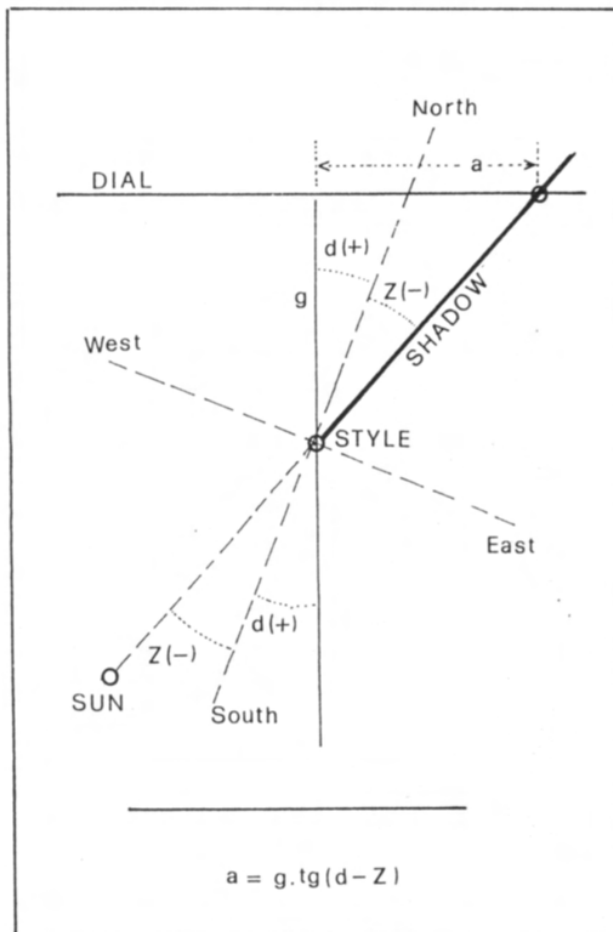


Figure 6

In this formula  $g$  is the distance of the style from the dial,  $d$  is the gnomonic declination of the dial,  $Z$  is the azimuth of the sun. The positive  $a$  must be taken on the right of the base line, the negative on the left. The azimuth  $Z$  should be taken from the South, positive to the East (before noon), negative to the West (after noon).

We also note that the use of the azimuthal vertical dials cancels the extolled advantage of sundials using other

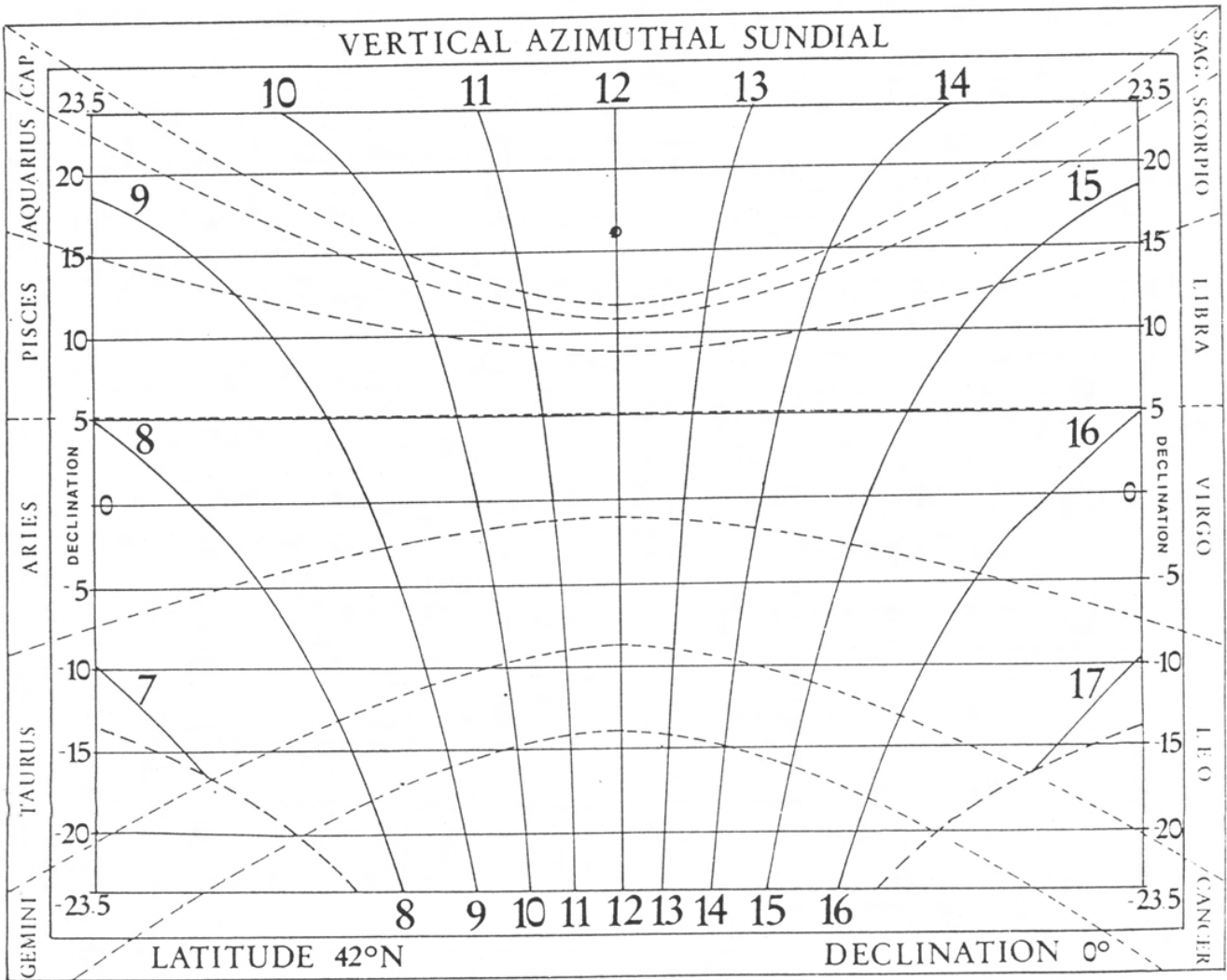


Figure 7

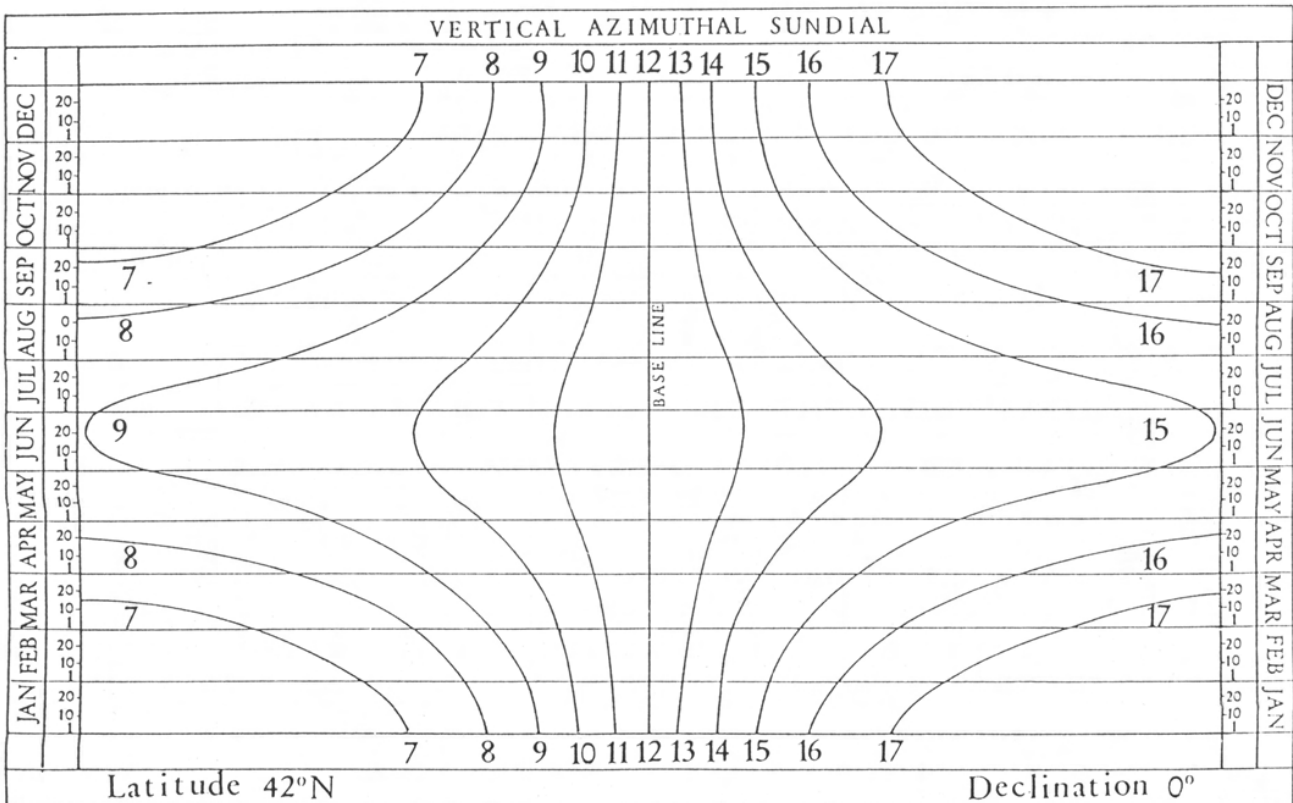


Figure 8



astronomic coordinates (L.H.A. or altitude). In fact someone may say: "I prefer the sundials made with L.H.A. because I can set it vertically, well visible on the walls of buildings, as in the well-known practice!" Voilà, now on the walls of the buildings we can easily set also the azimuthal sundials!

To prevent possible objections, I also note that nothing prevents us to superimpose the zodiacal hyperbolas on a vertical azimuthal dial. This was easily done in figure 7, in which the equatorial straight line is set on the calendar line  $+5^\circ$ . To use the possible zodiacal hyperbolas, the style (always vertical for the hour reading) should bear, as in the general case, a pierced disk at the appropriate altitude. In figure 7 it is indicated by a black point on the meridian line.

At variance with the hour lines tracing in the azimuthal dial (where the setting of the hours is totally arbitrary) the setting of the zodiacal hyperbolas is geometrically compulsory. In the North latitude the declination North must stay down, and all the other declinations must follow a precise geometric succession. I wish to stress that the two drawings superimposed in figure 7 (hour lines and zodiacal hyperbolas) are entirely autonomous and independent, just as the setting of the hour straight lines and the dates hyperbolas in the usual sundials are entirely independent. They are only superimposed on the same dial for the sake of simplicity and use. Therefore no relationship at all may exist between the zodiacal signs of one drawing and the Sun declinations of the other drawing, as in figure 7.

Another example of vertical azimuthal sundial is shown in figure 8.

This one also is drawn on a plane with gnomonic declination  $0^\circ$ , i.e. it is facing South. The construction was again made using the formula giving the distance  $a$  from the base line that we have illustrated before. In this case,

maintaining rectilinear horizontal the calendar lines, we have changed the declination setting into a scale of civil calendar, doubling its excursion from the first of January to the thirty-first of December (as we can do with no problem on an azimuthal sundial). In this way we can cover the entire yearly evolution of the Sun declination.

Also in this case, the aesthetic form of the design is pleasing, although it offers a very unusual appearance for the sundial, and its geometry is not common in the gnomonical tradition. The succession of the calendar lines can be changed and selected at pleasure, modifying in any possible way their setting. Another alternative could be to draw non-straight calendar lines, and so on, selecting any other desired possibility.

Figure 9 shows the same dial of figure 8, set on the gnomonic declination  $30^\circ E$ , that is turned  $30^\circ$  to the East. Also this alternative presents an excellent example of aesthetical geometry. Obviously all the possible alternatives to the dates setting aforementioned are also valid for this variation.

At this point I think I have completed my re-evaluation of the azimuthal sundial, rescuing it from the centennial oblivion where gnomonics had relegated it for no reason or fault of its own. I think I have also presented good evidence of the ease of calculations and drawing of azimuthal dials, and the advantages of this category of sundials, compared to their colleagues using other celestial coordinates.

Furthermore I am very glad to have been able to show how the azimuth sundial may be set not only on the horizontal plane but on any other plane, including the vertical one, thus permitting its use on the walls of buildings.

Last, but not least, the incredible versatility of design of this category of instruments has been clearly demonstrated.

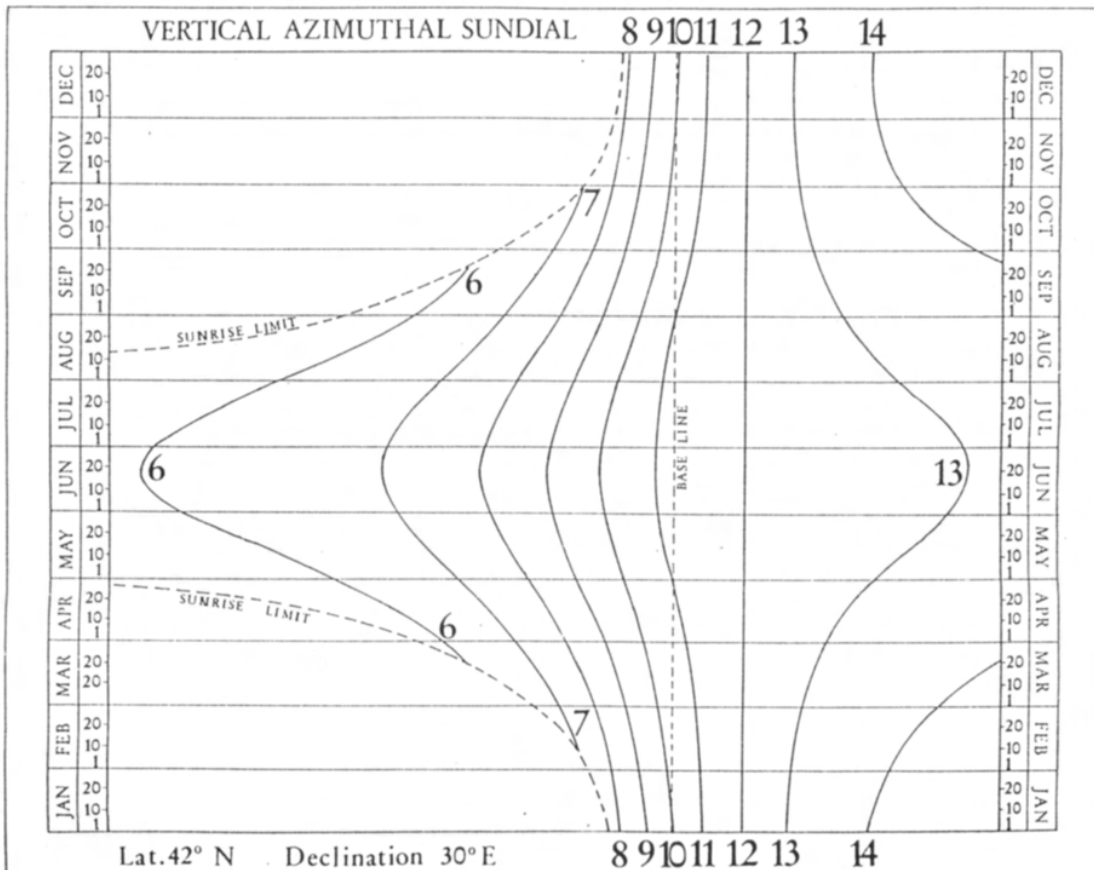


Figure 9

## PORTABLE DIALS - ACCESSORIES

JOHN MOORE

The portable dial would on occasion be made as part of another instrument or decorative object. Gold finger rings have been described that double as ring dials.<sup>1</sup> Astronomical Compendiums, Quadrants and some Nocturnals frequently incorporate a sundial. The portable dial is often found with various additions such as a Perpetual Calendar. Others were provided with various tables, such as those for converting the shadow from the moon's light to solar time, or with a scale showing the Equation of Time. Some dials would incorporate an altitude quadrant enabling it to be used for determining the altitude of a celestial body, a mountain or building.

The dial's storage case is important as protection both when it was first made and even today. Dials still housed in their original cases are usually the best preserved.

For dial maintenance and during manufacture, a lodestone was an important tool for maintaining the proper magnetic strength in its compass needle.

### THE DIAL AS PART OF . . .

The portable dial was generally intended as a time check device for its owner. Due to its small size and difficulty of setting, it was seldom a precise time teller. It was frequently employed for setting the owner's watch at times when solar observation was possible, more likely in Southern Europe than the British Isles. For setting his clocks he would probably use a more accurate horizontal dial set in his garden, which could be read to an accuracy of closer than five minutes as long as he remembered to apply the correction for the Equation of Time.

Occasionally, a dial is found built into a watch<sup>2,3</sup> to provide its own convenient portable time reference. In this case, the sundial is normally housed inside the back of the watch, often behind a pop up cover. If the sundial in the back of the watch incorporated a compass, necessary for the alignment of most types of dial, the watch would no doubt suffer badly from erratic timekeeping due to the magnetic field from its needle. This would be especially troublesome in watches using a steel balance wheel or hairspring.

The sundial has also been seen, quite rarely, built into some early clocks,<sup>4,5</sup> but this is not really a practical application. To use it sensibly, the clock would need to be placed at the correct angle on a window sill or to be taken outside to take the necessary solar reading.

The sundial was an important tool for the surveyor. A set of surveying tools would frequently include both a sundial, a quadrant and a compass. With this tool, direction could easily be found. Such quadrants were also frequently used for setting up vertical dials on walls. A Hollands Circle, also used in surveying, made by C.D. Metz of Amsterdam in the late 17th century includes a sundial in its centre.<sup>6</sup>

Occasionally, a sundial has been incorporated into a measuring rule (figure 1). With the two halves of the rule folded together to form the dial plate, a string gnomon is erected, supported by a vertical arm. For alignment purposes, a small compass is included, sunk into one limb.

Certain drawing instruments, such as dividers are occasionally found with sundial markings on them. Dividers with a horizontal dial and built in compass may be seen in the British Museum (figure 2).<sup>7</sup>

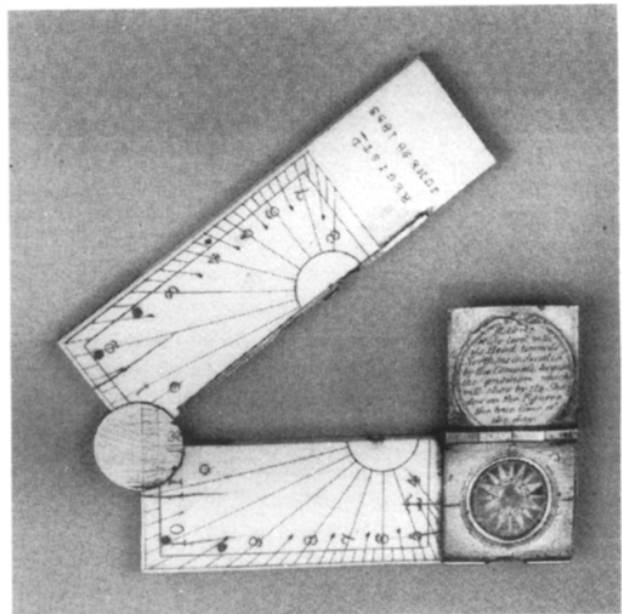


FIGURE 1: Rule incorporating a Sundial



FIGURE 2: Dividers by Christopher Schissler, Augsburg, 1558 in the British Museum

Another unusual dial is known in the shape of a spoon. The hour lines are incised in its bowl, and the gnomon erects from near the tip of the bowl.<sup>8</sup> Although shaped as a spoon, and of a similar size, it is most unlikely that this type of dial was ever used as anything but a novelty sundial. If used as a spoon, its gnomon would certainly cause problems to the user's mouth. It is just one of the odd shapes that dialmakers have used as an exercise to display their dialling prowess.

The Cruciform Dial is a dial built into a crucifix. This is one object where it is debatable whether it is primarily a

dial or a crucifix. In most instances, these dials were finely crafted as religious objects. They were often made from brass, but would then be silvered or gilded. The general design is such that the dial would normally hang round the neck of the owner, as would a regular crucifix, and would sometimes contain a religious relic. The fact that it also doubled as a sundial was an added bonus. The dial shown in figure 3 is particularly small, being only  $1\frac{1}{8}$  inches in height. This form of dial is quite early, and the example shown is thought to be from the 16th century. When used as a sundial, it must be placed on a flat surface, and the crucifix should be raised to the latitude angle, with the top of the cross pointing south. In this raised position, its small compass, which normally nestles inside the hollow crucifix, is then visible. The shadow from each side of the top of the cross is used for the hours from 9am to noon and noon to 3pm, where it falls on the scales on the top of the cross bar. The lower edges of the tips of the horizontal cross bar similarly produce shadows on the two sides of the lower limb for earlier or later hours. Although some cruciform dials were designed for one particular latitude, many were made that were universal, capable of being adjusted to a range of latitudes by setting the angle of the cross against a small calibrated quadrant scale.

#### ACCESSORIES FOR THE DIAL

Lists of towns and their latitudes are common accessories and are found on many types of dial. These lists are more interesting when they include little known towns, or in the case of England, the smaller provincial towns. It is interesting to speculate on the habits of its first owner. Towns like London, Newmarket and Norwich would suggest a gentleman with a country estate in Norfolk.

The equation of time is sometimes found engraved on a



FIGURE 3: Cruciform Dial, gilt brass

portable dial. This is not very common, as the table, even in its abbreviated form, takes up a lot of precious dial space. Where it was found, it was usually in the form of a calendar scale around the dial's periphery, with the corrections inside its diameter in minutes and the captions 'Watch Slower' or 'Watch Faster'. A few dials have been provided with other sub-instruments such as wind vanes, quite common on Nuremburg Diptych dials, or thermometers, usually on the dials of the 19th century. A rather attractive version of the Magnetic Dial, constructed from bone (figures 4 and 5), has a large thermometer around its outside and the equation of time on a piece of paper that is



FIGURE 4: Early 19th century Bone Dial

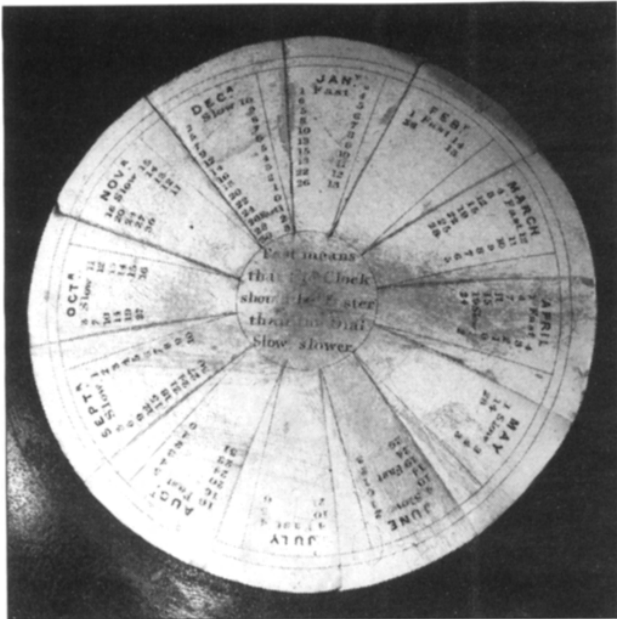


FIGURE 5: Equation of Time in Bone Dial

pasted into its lid. This segmented paper equation of time is often found pasted into the lids of dials of this period. It shows the actual date for each full minute of correction. This dial is early 19th century, and almost certainly English, in spite of its somewhat Oriental appearance. The thermometer is calibrated in degrees Reaumur and degrees Fahrenheit and includes supplementary marks for F = Freezing point, T = Temperate, S.H. = Summer Heat, B.H. = Blood Heat, and F.H. at 112°F as Fever Heat. As well as the sundial, the pivoting dial plate indicates direction with 16 points of the compass shown.

### THE LODESTONE

Most portable dials that are found include a magnetic compass for alignment to magnetic north, unless they are true altitude dials. The compass needle is made from a soft grade of iron that is capable of being magnetised. In most examples found, sufficient residual magnetism remains so that the compass still functions. However, the low grade iron available at the time of their manufacture was not all that good at retaining its full magnetism, and at intervals, it would be desirable to have the magnetic properties of the compass needle replenished. This was usually done by stroking the needle slowly from end to end using a high powered magnet. This magnetic field would align the iron's particles along its length to form a magnet. Unfortunately, strong magnets did not exist at the time and a naturally occurring ore of iron in crystal form known as magnetite was employed for the purpose. A piece of active magnetite would be fitted with two iron poles, and because it is a brittle substance, it would be protected with a non-magnetic brass, or sometimes silver, case. The instrument formed was known as the Lodestone. These are found in a wide range of sizes from around 1 inch in diameter to one foot or more. The larger ones would generally have higher magnetising properties, but if too large would be impossible to stroke against a small compass needle. The needle would need to be stroked against the lodestone. Some are known that are too heavy for one person to lift! (A most impressive large lodestone is to be found in the Museum of the History of Science in Oxford.) The ship's compass was the most important object to require regular

re-magnetising as a strong field in its needle was vital to the safety of all aboard. The captain would therefore frequently carry a lodestone in his cabin for regular 'topping-up' of his compass. He may also have had a compass suspended above his bunk in his cabin, that was read from beneath so that he could keep track of the ship's progress.

The commonest type of lodestone to be found is rectangular with a size of around 3" x 2". Little is known about the lodestones actually used by the early dialmakers. Their lodestone would need to be quite small, or at least have its two poles close together so that it could be used to stroke the rather small compass needles used for these dials, many less than half of one inch in length. One early and particularly small lodestone has been found that was probably used in the production of portable dials (figure 6). This lodestone is only  $\frac{3}{4}$ " in diameter and less than 1" in height. Its poles are only about  $\frac{5}{16}$ " apart, making it ideal for use with the smaller compass needles utilised by portable sundials. Its finely engraved gilt brass case is held together by pins in a similar fashion to the plates of early clocks. Although unsigned or dated it is possibly French or German and was made in the 16th or 17th century. Even after 400 years or more it still retains a reasonable magnetic pull. The more usual lodestone was of the style shown in figure 7. This one is also of miniature size measuring just



FIGURE 6: Early Brass Cased Lodestone



FIGURE 7: 17th century Silver Cased Lodestone

$\frac{3}{4}$ " across, and is again, almost certainly intended for use with small compass needles of the type used in sundials. This lodestone is probably English and somewhat later being made in the late 17th century.

### MAGNETIC DECLINATION

Most dials, when made, would have their compass bowls marked with the current position for magnetic north. This can be an invaluable aid to dating them, figure 8. The early makers were well aware of the annual change in magnetic north and some would allow for later corrections to be made to their compasses. In most dials of the 'Butterfield' type and similar dials with inset compass bowls, the bottom of the compass was made from a separate disc of brass or silver, held in position by light riveting to its outer cylindrical shell. With a little effort, it was and still is possible, to move many of these scales to agree with the current declination figure. However, it is surprising that very few of these dials have actually been changed since their manufacture. The better quality dials, particularly of English origin, would often incorporate a compass declination marker in brass that could be moved inside the compass bowl from a small lever outside (figure 9). In many cases, it was not a simple task, as it required the compass bowl to be removed to do it. This was a good way of losing its fixing screws and was therefore most probably done by the local watch maker, if at all. The movable pointer meant that the dial could be kept up to date by its owner (figure 10). It also aided those who travelled widely, so that they could set the correct local declination figure. Compass declination can be particularly wide, especially as one approaches the north or south poles, and at times, may even completely reverse. This is due to the fact that the magnetic poles of the Earth do not correspond to its rotational axis. The magnetic poles tend to travel around the Earth's axis, moving from east to west, and we believe that it takes around 800 years for them to make a complete 360° revolution. For example, the last time that London had zero declination was around 1660 and the next zero is expected around the year 2030. It therefore follows that a similar 400 year period will probably be required until the next zero is reached around the year 2400 A.D.

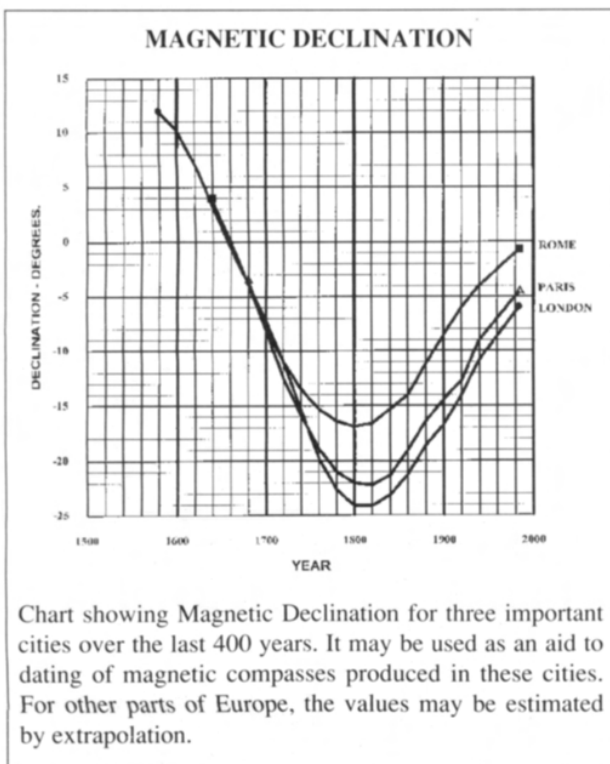


FIGURE 8: Graph of Magnetic Declination



FIGURE 9: Adjustable 'North' marker in the compass bowl of a dial by Thomas Heath, London. Its position may be moved from outside the compass bowl

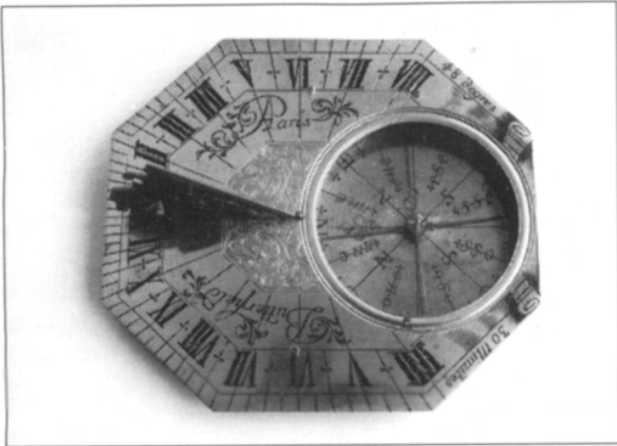


FIGURE 10: Adjustable 'North' pointer, preset in the compass bowl of a brass dial by Butterfield, Paris

### CASES OF PORTABLE DIALS

As has been mentioned throughout this series, the cases found with many dials are in many ways almost as important to the historian as the dials themselves. The case material and method of its construction can tell us much about the dial, its maker and sometimes his customer. The better quality dials generally had fine leather or fishskin cases, sometimes over a wood frame and were usually lined with velvet. Those of slightly less quality would have perhaps only a card case. The dials lucky enough to retain their original cases are usually the best preserved, having been protected by them for much of their lives. The dials were always a good fit into their cases (figure 11). If the dial is not a snug fit, then the dial does not belong and the case was probably one made for another dial.

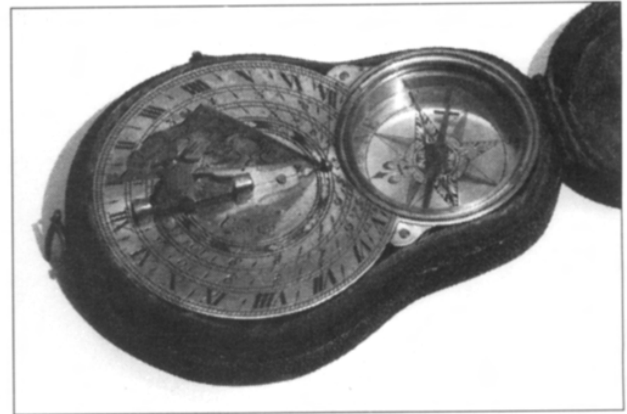


FIGURE 11: Dial by Thomas Heath showing its tight fitting case

Some cases are an important part of the dial, and may contain a list of towns with their latitudes. The cases of some dials by Johann Willebrand and Johann Martin of Augsburg frequently have a silvered brass disc inside the lid with a full list of towns and their latitudes engraved on it. This overcame the problem usually encountered, where there was insufficient space on the dial itself for a complete listing. In some of the Augsburg dial cases there may still be found a printed sheet explaining, on one side, how to use the dial in three languages, and on its reverse, a table of latitude for important European towns.<sup>9</sup> Other pieces of paper are sometimes found inside dial cases. These may relate to the dial being a gift or to add some explanation for its use. These additional pieces of paper are seldom from the time of the dial's manufacture, but even when added as late as the early 20th century they give an interesting insight into the lives of their former owners, and what they

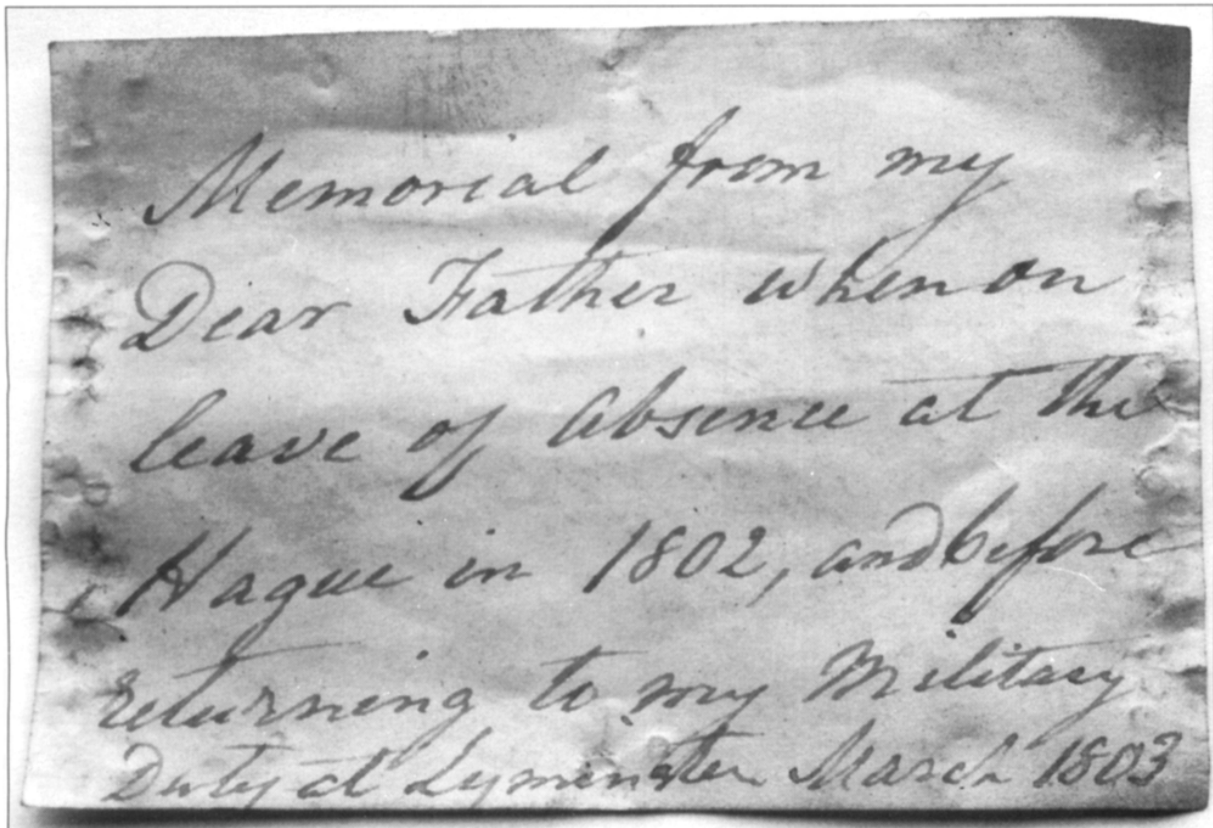


FIGURE 12: Paper from dial by Andreas Vogler of Augsburg. 'Memorial from my Dear Father when on leave of Absence at The Hague in 1802, and before returning to my Military Duty at Lymington March 1803.' On its reverse is written 'For my Sister Catherine's Eldest Son Ch<sup>s</sup>. Esse. F.L. Gabriel Buser.'

thought about their dial (figure 12). The paper may also relate to a collection that once included the dial. It could even refer to its sale by auction. In most cases, these scraps of paper give the dial a 'provenance', making them more highly prized by the collector.

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#### ACKNOWLEDGEMENTS

The author would like to thank Christies, South Kensington for permission to use the picture in Figure 1 and The British Museum for providing the photograph used for Figure 2.

#### CONTINUED FROM PAGE 39 THE CHATHAM SUNDIAL

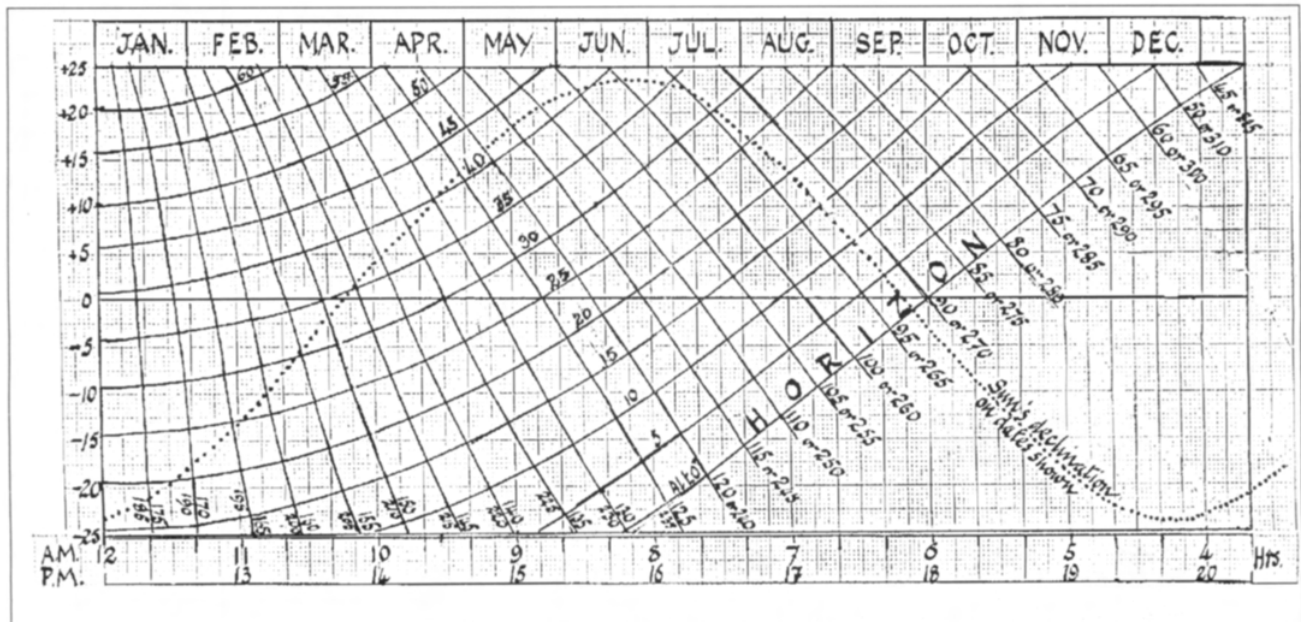


FIGURE 2: A Sun Compass and Sun Clock for Latitude 51°N

1. Read the sun's declination for the date from the dotted curve.
2. Enter this declination on the Y axis.
3. Read the sun's altitude and azimuth from the graticule.
4. Read the Local Sun Time along the X axis.

Note: GMT = Local SUN Time - E + Long West or - Long East. See Equation of Time graph. Atmosphere refraction causes the sun to rise about 5 minutes earlier and to set later than the times for the theoretical sun.

LOCAL SUN TIME (Local Hour Angle of Sun = Sun Time x 15°)

EXAMPLE: On May 1st the sun's declination is 14°, from the dotted graph. Observed alt. of sun 30°. From the graphs the Sun Time is 0805 and its Az. 106° or Sun Time 1555 and Az. 254°. The 14° declination line intersects the horizon curve showing sunrise at 0450, Az. 68°, and sunset at 1910 hrs. Az. 292°.

The example given is for the well known and understood midday times, and altitudes of the Sun, but for the attitudes for other hour lines, the appropriate altitude of the Sun can be calculated by the spherical trigonometrical relation:  $-\sin(\text{alt}) = \sin \delta + \cos \phi \cos \delta \cos \text{HA}$

or more conveniently using the attached nomogram, see Fig. 2, "A Sun Compass and Sun Clock", which may be useful in checking altitudes of the Sun in various conditions of Hour angles and declinations.

## SIMPLE SUNDIALS SEEN ON SAFARI

MAURICE J. KENN

Having already designed and made my own "Translucent Universal Equatorial Sundial".<sup>Ref 1</sup> I was, during a recent trans-world trip, delighted to locate and photograph several other essentially simple and basic equatorial sundials in, respectively, Canada, Australia and Singapore.

Figure 1, for example, shows an elegant equatorial sundial situated near Simcoe Hall on the campus of the University of Toronto, at latitude  $43^{\circ} 39' 37''$  N and longitude  $79^{\circ} 23' 42''$  W. This sundial was funded in 1993 by the Graduates of Applied Science and Engineering of 1943 to celebrate their 50th Anniversary since graduation and co-incidentally to commemorate the Centenary of the Degree of Bachelor of Applied Science at the University of Toronto. The sundial indicates directly both the local sun time and the sun's declination and readily permits, by



FIGURE 1: Toronto



FIGURE 2: Mount Tomah

tabulation, the determination of Canadian Eastern Standard Time.

In New South Wales, Australia, at the Mount Tomah Botanic Gardens in the Blue Mountains, and adjacent to Katoomba (at  $33^{\circ} 42' S$  and  $150^{\circ} 18' E$ ), a very solidly-built equatorial sundial<sup>Ref 2</sup> was funded by the Friends of the Gardens and unveiled in 1992. The curious shape of this sundial, shown in Figure 2, apparently was largely inspired by the characteristic six-sided basaltic columns of the local mountain's geology.

Likewise at Sydney (at  $33^{\circ} 52' S$  and  $151^{\circ} 13' E$ ) in the Botanical Gardens, a large and equally-rugged but basic and sensibly-designed armillary-sphere sundial<sup>Ref 2</sup> has been sited, since 1993, in the herb garden, as shown in Figure 3. Three dimensional and named herbs have appropriately and interestingly been cast into the horizontal ring of this dial, as can be seen in Figure 4.

As before this sundial has also been privately funded, in this instance by the nieces and nephews of N.M.H. Arnott, a keen admirer of the gardens.

Before leaving Sydney three other conventional horizontal sundials deserve special mention. Two of these are at Admiralty House, in Kirribilli. The first and original of these dials has a stone face, dated 1846, and is now preserved under the house verandah, see Figure 5. The second and replacement dial resides in the garden and points Southwards, across the water, towards Farm Cove and the Royal Botanic Gardens, see Figure 6.

More recently an evocative horizontal sundial has been erected below a memorial in the garden of the Allan Border Oval, at Mosman, to commemorate the 1146 local Australians who died not only in the 1939-1945 war years but also in the campaigns extending from 1950 to 1972 in Korea, Malaya, Malay Peninsula, Sabah Sarawak and Vietnam, see Figures 7, 8, and 9.

At Singapore, yet again in the Botanical Gardens, a delightfully-simple equatorial sundial is sited in the "Sundial Garden". Here the gnomon, shown in Figures 10 and 11, is virtually horizontal, Singapore being very close to the Equator, at  $1^{\circ} 17' N$  and  $103^{\circ} 51' E$ . Two other sundials also with virtually-horizontal gnomons, are to be found in the Orchid Gardens, also within the Botanic Gardens at Singapore. These sundials shown in Figures 12 and 13, are of the armillary-sphere type but are somewhat cluttered with virtually redundant members. Sadly, when photographed, the sundial shown in Figure 13 appeared to have been incorrectly oriented.

With the rapid approach of the International Olympic Games in Sydney, and more especially of the Millenium, perhaps other, simple but elegant, and memorable, sundials will materialise. Maybe this article will even help to provide some inspiration and incentive towards achieving this objective.

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FIGURE 3: Sydney



FIGURE 4: Sydney



FIGURE 5: Kirribilli



FIGURE 6: Kirribilli



FIGURE 7: Mosman



FIGURE 8: Mosman



FIGURE 9: Mosman



FIGURE 10: Singapore

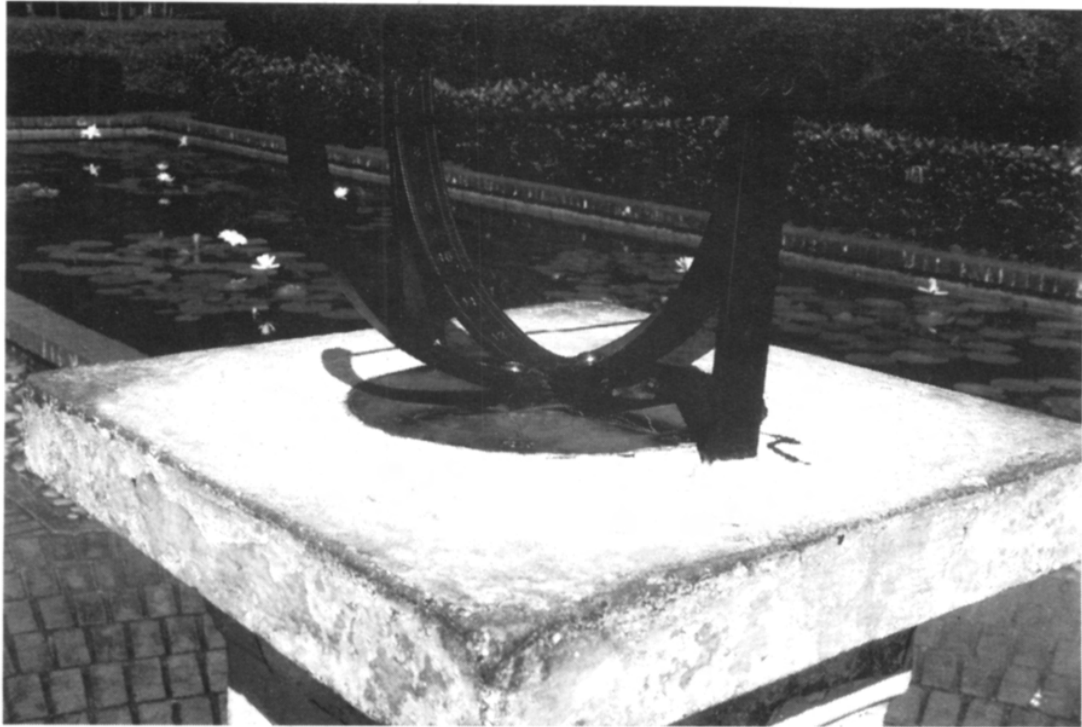


FIGURE 11: Singapore



FIGURE 12: Singapore



FIGURE 13: Singapore

## MERIDIAN LINE AT RAMSGATE

M. R. NORRIS

There are the remains of a solar meridian line at Ramsgate Harbour, Kent.

The instrument was housed on the first floor of what is now the Ramsgate Maritime Museum, see Fig. 1. It was laid down in 1819 by Lieutenant Matthew Curling Friend R.N. - "To provide a means of establishing local apparent time solar time by the observation of the sun's transit".

On the other side of the museum building looking south-east, see Fig. 2, it will be seen that there is a small rectangular window in the filled-in arched recess. A closer view of this glazed aperture is given in Fig. 3. Adjacent to the modern pane of glass are remains of fittings which may have supported a gnomon aperture of some kind.

The museum provides a description, together with a diagram, of the meridian line; this is rather less than convincing, the descriptive text is shown in Fig. 5. As this may be difficult to decipher from the photograph, the text is added to this article as an appendix. The suggested details of the mode of operation in diagrammatic form are given in Fig. 6. (Obviously the person who provided the details knew nothing of the practical details of the operation of a meridian line.)

The opening in the south wall of the building appears to have been cut especially for the purpose and a small pane of glass inserted as shown in Fig. 4. In the centre of this view is what remains of the meridian line, this is now merely a wooden strip because the brass strip was stolen from the museum in 1976, so it is not simple to check if some optical device was mounted to slide along the strip.

If the instrument was ever to be of sufficient accuracy to enable chronometers to be rated by observation of the instant of the sun being on the meridian line, I feel the gnomon aperture must have been placed as far as possible from the plane of the strip, and that any device which could be slid along the meridian line groove would have been a target plate rather than a gnomon.

Perhaps other members of the Society could throw further light on this example, for it would be nice to see the

instrument returned to working order and to find out how accurate it was in practice.

### GREENWICH MEAN TIME

Returning to the north-west side of the building, see Figs. 1 & 7, it will be seen there is an inscription in gilt letters on a black ground below the clock dial. It states "The first Stroke of this Clock at the Hour of 12 indicates Greenwich Mean Time": A smaller panel below the arch states "Ramsgate Mean Time is 5 Min 41 Sec faster than this clock (Solar Mean Time), the significance of the clock showing Greenwich Mean Time being accounted for by the shipping in the harbour and those who wished to check their marine chronometers (not that there would be many of these in use in 1819, and Greenwich was not adopted as the Prime Meridian until 1884).

Looking at F. W. Britten's Watch and Clockmakers' Handbook, Dictionary, and Guide (First Edition 1884 and many editions later but all with the same tables), the difference in mean solar time between Greenwich and Ramsgate is given as 5 Min 40 Sec. Until the invention of the electric telegraph, the difference was not known exactly, and when the time signal was available from Greenwich Observatory via the electrical telegraph, the need for a noon meridian line observation no longer existed.

Not far away, Deal, to the south of Ramsgate, boasted a tower which had a Time Ball released at the exact instant of noon by a signal from Greenwich Observatory when the electrical telegraph line was extended to Deal. This would have been rather more convenient for those who wanted to know the exact time, for it was impossible to know the time to the exact second from the Ramsgate clock except by the sound of the first stroke of its bell, and every 370 yards distant from the clock adds a second's delay to the aural signal reaching the observer's ear, whereas a visual signal is, to all practical purposes, instantaneous.

Without the evidence of the actual brass meridian line,

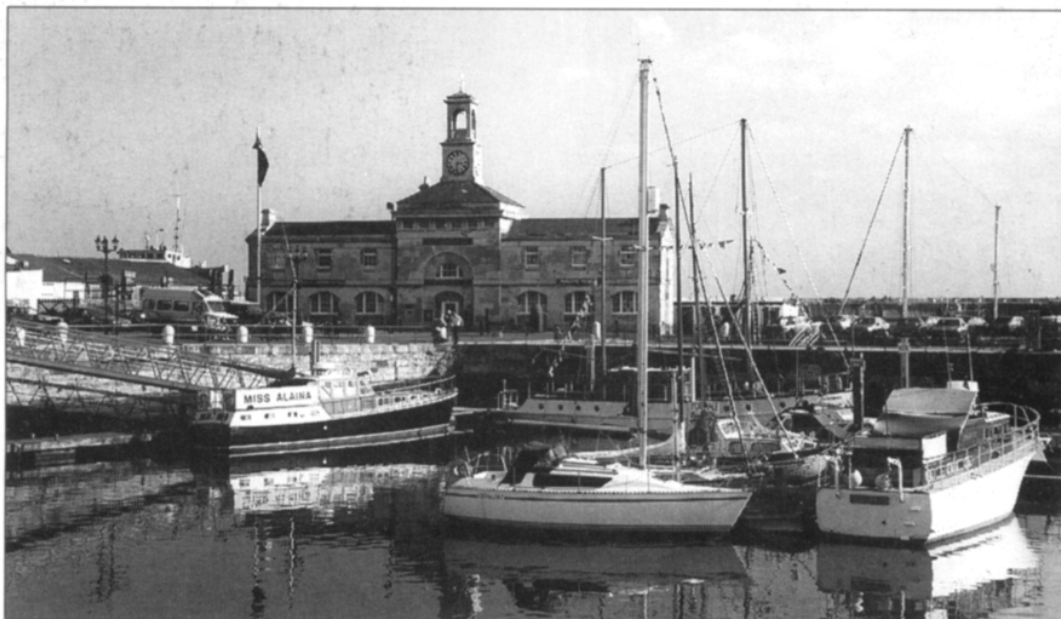


FIGURE 1: Ramsgate Maritime Museum from the north-west.



FIGURE 2: Ramsgate Maritime Museum from the south-east.

it is not known whether this was merely a Noon Line or if it carried additional information, e.g. the solstices and equinoxes. It is likely that it was more complex than a Noon line since considerable effort was necessary to fit the brass strip within the building.

#### OTHER MERIDIAN LINES

Only three meridian lines in Britain are known to the writer, Durham Cathedral, Greenwich, and Ramsgate. Perhaps others are known to members, it would be interesting to hear of these. Noon lines, are of course, the simplest of all; and probably the progenitor of all existing sundials.

There is no mention of Ramsgate's meridian line in Mrs. Gatty, although she does mention that of Durham Cathedral and appends the following description of it:

"In the upper part of one of the unglazed windows of the cloister, about ten feet from the floor, a piece of stone is inserted, in which is a circular aperture, about an inch in diameter, with a thin edge. When the sun is near noon, and thus almost directly opposite to this aperture, the light which streams through the aperture, forms a luminous image which, when the sun is high, as near midsummer, falls upon the pavement, and when the sun is low, as near the winter solstice, falls upon the opposite wall. By observing the time of the first contact of the circular spot of light with the meridian line, and also the time of the last contact, and taking the mean, I have found the instant of apparent noon can be ascertained within a second of time".

The account was written by the Reverend Temple Chevallier some years after the meridian was drawn by Mr. William Lloyd Wharton, of Dryburn, and Mr. Carr of Durham School.



FIGURE 3: The glazed aperture for the Solar Meridian.

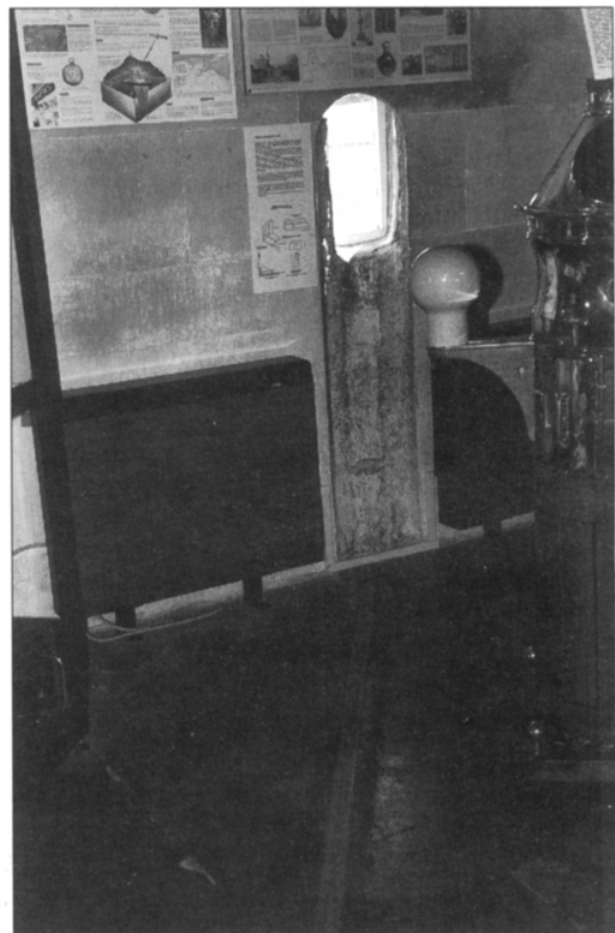


FIGURE 4: The inner view of the glazed aperture, with the meridian line leading away from the base of the wall.

The meridian line at Durham Cathedral has almost decayed away completely in spite of being under the protection of the cloister's roof.

#### APPENDIX

##### Text of Display Panel:

Running north-south across the floor is a meridian, or solar transit line. Originally of brass, it was laid down in 1810 by Lieutenant Matthew Carling Friend R.N. to provide a

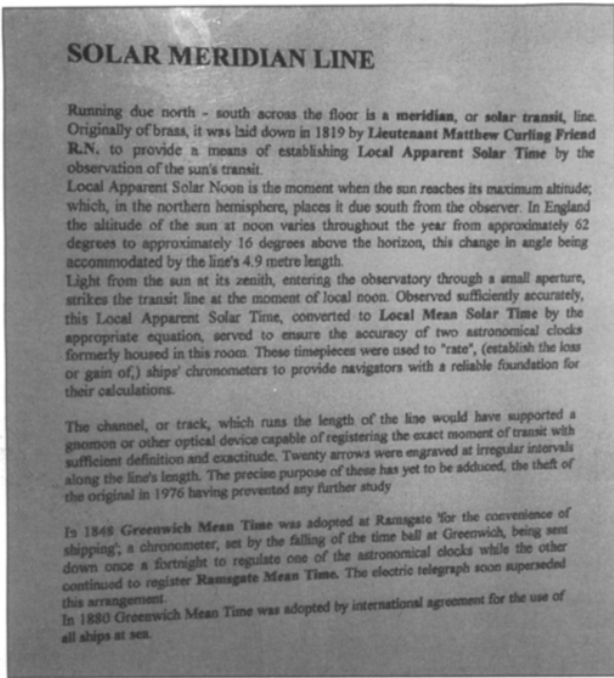


FIGURE 5: The explanatory panel at the side of the wall aperture.

means of establishing **Local Apparent Time** by the observation of the sun's transit.

**Local Apparent Noon** is the moment when the sun reaches its maximum altitude, which, in the northern hemisphere, places it due south from the observer. In England the altitude of the sun at noon varies throughout the year from approximately 62 degrees to approximately 16 degrees above the horizon, this change in angle being accommodated by the line's 4.9 metre length.

Light from the sun at its zenith, entering the observatory through a small aperture, strikes the transit line at the moment of local noon. Observed sufficiently accurately, this **Local Apparent Solar Time**, converted to **Local Mean Solar Time** by the appropriate equation, served to ensure the accuracy of two astronomical clocks formerly housed in this room. These timepieces were used to "rate", (establish the loss or gain of) ships' chronometers to provided navigators with a reliable fabrication for their calculations.

FIGURE 7: The public notice below the clock dial on the north-west face stating that the clock shows **Greenwich Mean Time** and not **local Mean Time**. (This was done at a time when each town and village had its own local time and persisted until the coming of the railways made it necessary to have uniform time over the whole of England, Scotland and Wales.

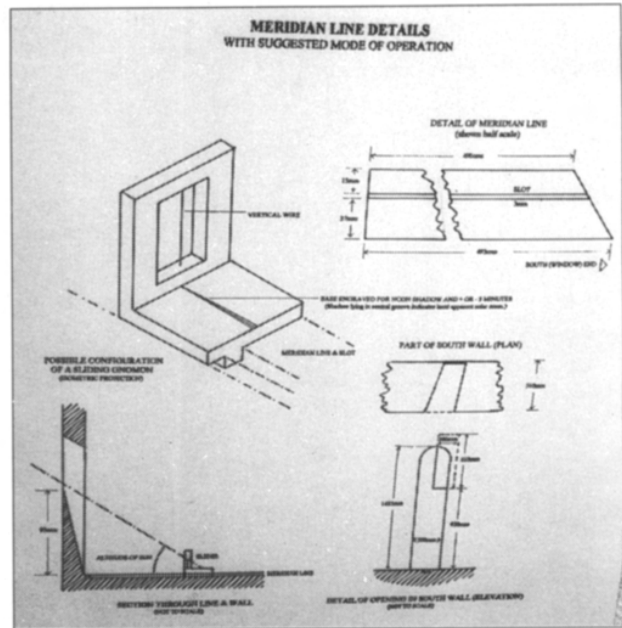
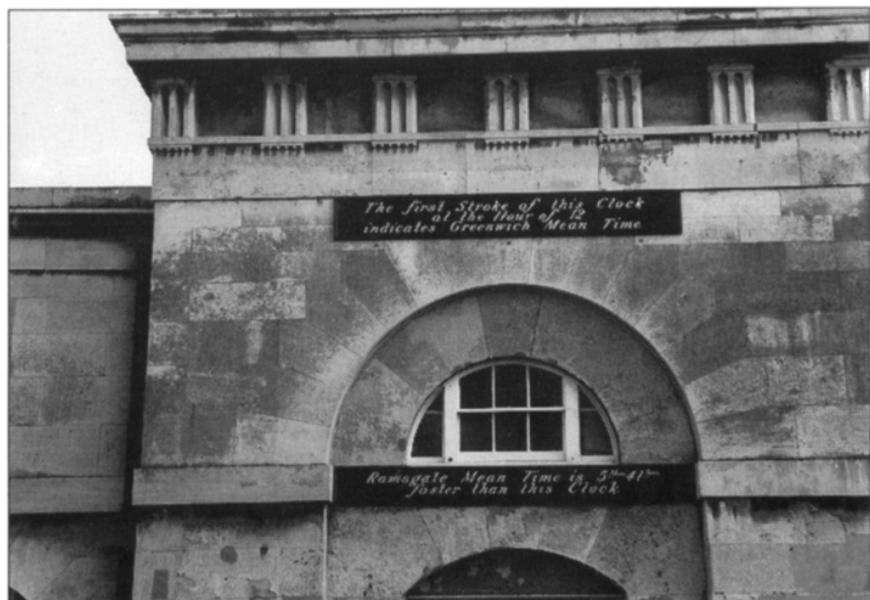


FIGURE 6: The suggested mode of operation in diagrammatic form.

The channel or track, which runs the length of the line, would have supported a gnomon or other optical device capable of registering the exact moment of transit with sufficient definition and exactitude. Twenty arrows were engraved at irregular intervals along the line's length. The precise purpose of these has yet to be adduced, the theft of the original in 1976 having prevented any further study.

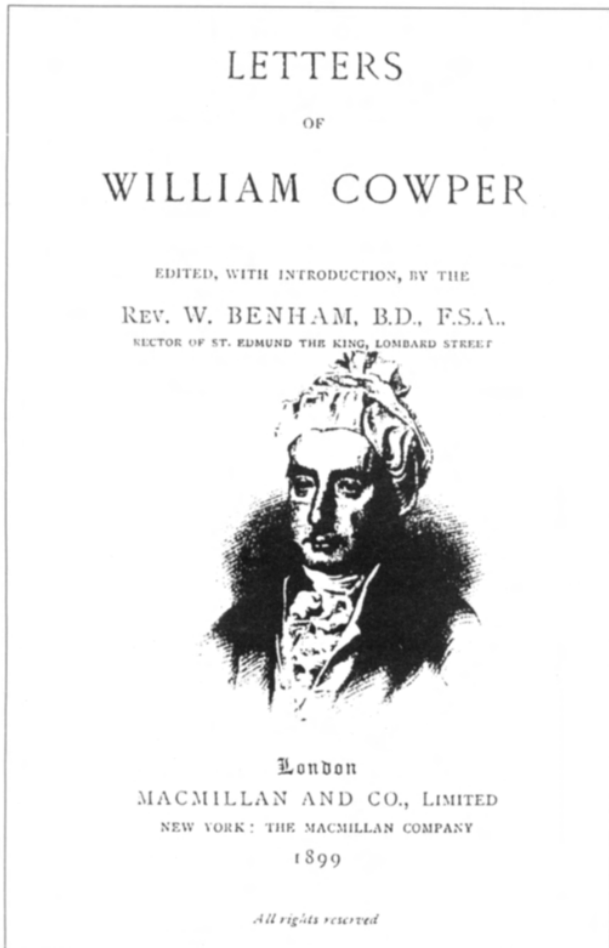
In 1848 **Greenwich Mean Time** was adopted in Ramsgate 'for the convenience of shipping', a chronometer, set by the falling of the Time Ball at Greenwich, being sent down once a fortnight to regulate one of the astronomical clocks while the other continued to show **Ramsgate Mean Time**. The electric telegraph soon superseded this arrangement.

In 1880, [the date was actually 1884] **Greenwich Mean Time** was adopted by international agreement for the use of all ships at sea.

## LOOKING FOR COWPER'S SUNDIAL

FRANK POLLER

The poet Cowper, see figure 1, was given a sundial by his nephew, the Rev. John Johnson, who placed it secretly in the poet's garden in Weston Underwood, Buckinghamshire. Its discovery by the poet was charmingly described in his letter of thanks



WESTON April 11, 1793

'MY DEAREST JOHNNY - To do a kind thing, and in a kind manner, is a double kindness, and no man is more addicted to both than you, or more skilful in contriving them. Your plan to surprise me agreeably succeeded to admiration. It was only the day before yesterday that while we walked after dinner in the orchard, Mrs. Unwin between Sam and me, hearing the hall clock, I observed a great difference between that and ours, and began immediately to lament, as I had often done, that there was not a sundial in all Weston to ascertain the true time for us. My complaint was long, and lasted till, having turned into the grass walk, we reached the new building at the end of it, where we sat awhile and reposed ourselves. In a few minutes we returned by the way we came, when what think you was my astonishment to see what I had not seen before, though I had passed close by it, a smart sundial mounted on a smart pedestal! I assure you it seemed the effect of conjuration. I stopped short and exclaimed "Why, here is a sundial, and upon our ground! How is this? Tell me, Sam, how it came here! Do you know anything about it?" At first I really

thought (that is to say, as soon as I could think at all) that this factum of mine, Sam Roberts, having often heard me deplore the want of one, had given orders for the supply of that want himself, without my knowledge, and was half-pleased and half-offended. But he soon exculpated himself by imputing the fact to you. It was brought up to Weston, it seems, about noon; but Andrews stopped the cart at the blacksmith's, whence he sent to inquire if I was gone for my walk. As it happened I walked not till two o'clock. So there it stood waiting till I should go forth, and was introduced before my return. Fortunately, too, I went out at the church end of the village, and consequently saw nothing of it. How I could possibly pass it without seeing it, when it stood in the walk, I know not, but certain it is that I did. And where I shall fix it now I know as little. It cannot stand between the two gates, the place of your choice, as I understand from Samuel, because the hay-cart must pass that way in the season. But we are now busy in winding the walk all round the orchard, and in doing: so shall doubtless stumble at last upon some open spot that will suit it.

There it shall stand, while I live, a constant monument of your kindness.

Ever yours, W.C.

\* \* \* \* \*

B.S.S. members will be interested in this late 18th century wish to have a sundial in order to know the 'true time', but my purpose is to relate my efforts (sadly unsuccessful so far) to find Cowper's sundial. The stimulus was a note I had come across, a year or two before I joined the B.S.S. in the Berks. Bucks. and Oxon. Archaeological Journal, Vol. 20, No. 1, April 1914 written by W. H. Hallam reporting the dial's existence. It is worth quoting in full as it compresses much information.

'COWPER SUNDIAL. It is not generally known that the sundial of the poet Cowper now marks time in a Berkshire garden. In 1786 the poet went to reside at the Lodge at Weston Underwood, the seat of Sir G. Throckmorton. In 1780 [the date is obviously wrong judging from Cowper's dated letter and the date of his taking up residence at Weston] during one of his periods of melancholia, the poet was specially irritated by the clocks of the house not keeping the right time, and to humour him, his cousin John Johnson - Johnny of Norfolk - sent him a dial, which, on a stone pedestal, the work of Anderson the stone mason and his once drawing master, was placed on the lawn of Weston Underwood Lodge. At the sale of this estate a few years ago by Sir W. Throckmorton, the sundial was cased up and sent to Buckland, see Figure 3, the Berkshire seat of the family. Here the dial remained in the carpenter's shop until the sale of the Buckland estate, when Sir W. Throckmorton presented it to Mrs. Eyston of that village, and it now adorns the garden of their residence "The Cottage", Buckland. - W. Hallam, Lockinge.'

Shortly after joining the B.S.S. I returned to this note. Buckland lies only a few miles from my village. Both were in North Berkshire before the county boundary changes of 1974. I arranged a visit to the Buckland Estate Office. Would anyone remember anything about the Cowper

sundial. Mrs. Evelyn Brighton who has held the office of secretary for many years had no memory of the dial. I was aided in my enquiries by a drawing of the sundial produced in Thomas Wright's 'The Loved Haunts of Cowper', published in 1894. The artist is not known but Elizabeth Knight, the curator of the Cowper and Newton Museum in Olney, conjectures that it may have been produced by Thomas Wright's artist father. Mrs. Brighton introduced me to Mr. Leslie Fryer, an octogenarian who had been a gardener on the estate, starting as a boy of 14. He remembered a sundial pedestal that was cracked and disposed of about ten years ago and thought it was like that illustrated. It had stood in the gardens of Buckland House. However, his manner was sufficiently uncertain to encourage further enquiries.

On the same visit I had arranged to meet Mrs. Wellesley, who still lives on the estate, widow of Richard Wellesley, the last private owner of Buckland House before its very recent sale at present being concluded, but she, too, knew nothing of the dial.

My desire to continue looking was prompted by a communication I had received just prior to my Buckland visit from Mrs. Knight telling me that in the process of clearing out some papers she had found a scrap of paper bearing the words, 'SUNDIAL with RECTOR of BERKHAMPSTED'. As Cowper was born in the old rectory at Berkhamsted, his father being rector there, I arranged a hopeful visit and was just in time to meet Canon Davis, the incumbent, who was in his last week of official duties before moving to Somerset. Despite his crowded last week, he gave me ample time to explain my quest and establish that a sundial standing in the rectory garden (a modern rectory but on the site of the rectory where Cowper was born) was not in fact the one I sought. He ingeniously suggested that the reference I had to the dial and an unknown rector of the place may have been a caption separated from its lost photograph. Cowper devotees had in the past often been photographed in Berkhamsted, in particular by the well, now filled in, which is situated in unmanaged ground on the opposite side of the lane from the rectory. Some of these pilgrims were clergymen, sometimes groups of them. Canon Davis further suggested that the Cowper sundial and rector were no doubt together in the photograph but not necessarily in Berkhamsted. There is still a Cowper Society in Berkhamsted but they have no useful archives and their functions are now mainly musical. Canon Davis declined having his photograph taken alongside the present sundial lest future researchers were further mystified!

Having failed to find the sundial at Berkhamsted, I turned to the last obvious line of enquiry: the Eyston family. By good fortune, the grandson of Mrs. Florence Eyston of "The Cottage", Mr Michael Eyston, lives in my village of East Hanney. Having seen the drawing of the sundial, he clearly remembered seeing it as a boy when he visited his grandmother, though he didn't know of the Cowper connection. He remembered it standing in a small rose garden which was surrounded with clipped box. This would have been in the 1930's. He told me that after her husband's death in 1938 his grandmother left "The Cottage" which she had rented and moved to another rented property called Kews in nearby Frilford. Kews being a smaller house, a sale took place of some of the contents of her Buckland home. No catalogue remains with the firm of auctioneers who conducted this sale nor in County Record

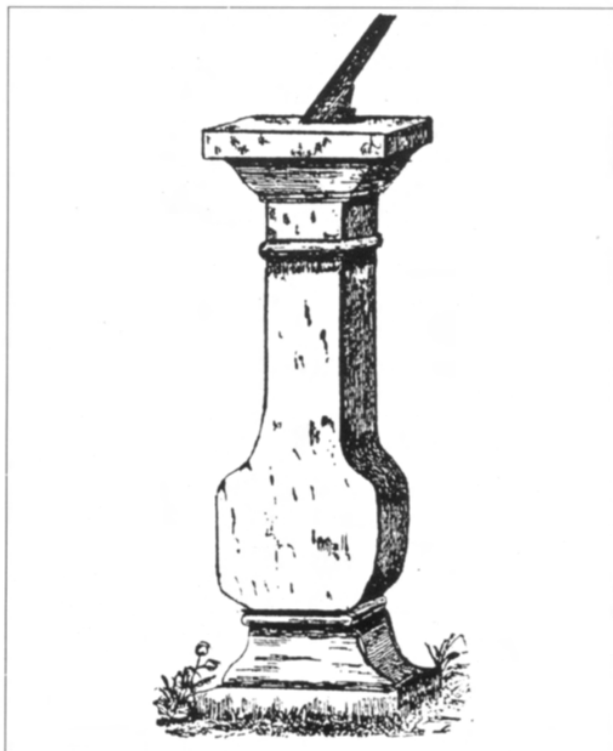
Offices. 'The Cottage' it should be said was an inappropriately modest name for what is now called 'The Dower House'.

Mrs Eyston's ancestral home, however, was Salford Hall, near Evesham which prompted another hopeful visit. Salford Hall was originally built by the monks of Evesham Abbey in the 15th century, coming into the possession of the Turbeville-Eystons in the early 19th century. In 1945, the year Mrs. Eyston died, the Hall was sold to a local farmer who, being only interested in the land, left the Hall to decay, having failed to get permission to demolish it. It was taken over in 1987 by Charter Hotels Limited. Mr. J. Greenhalgh, the Chairman of the governing committee, who supplied me with an outline of the history of the place, informed me that everything of value had been taken by a 'succession of vandals, squatters and gypsies' when Charter Hotels took over. If the sundial ever existed at Salford Hall, it was certainly gone by the time it was made into a hotel.

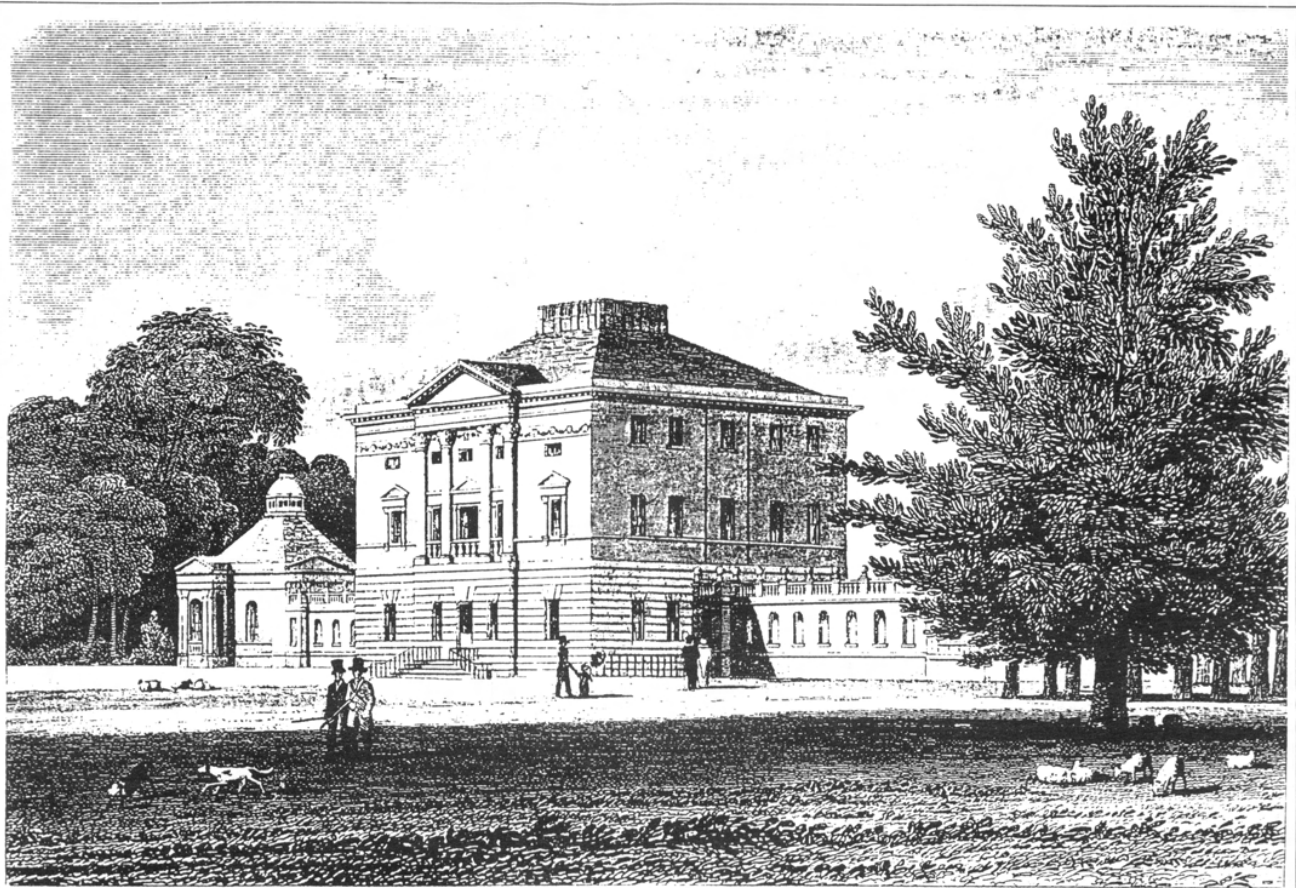
The public house in Abbots Salford, Blossom Valley Inn, was renamed such as its original name, The Eyston Arms, had developed a bad reputation as a gathering place of gypsies. I got this information from the present publican. Older residents still refer to it by its old name and the Eyston element of the old inn sign is now part of the Eyston Cottage sign next door.

To complete what enquiries seemed worth making, I visited East Hendred House near Wantage, home of another branch of the Eyston family. Thomas Eyston, the owner, has a sundial that had been passed to him from a member of his family but this too was not Cowper's. The weather was foul and I was content to view the sundial from one of the many windows. Clearly the pedestal was wrong. The gnomon too was wrong I was assured, a fact I could not verify as a dome was fixed over it preventing theft no doubt but also preventing it ever functioning or even being seen, a curiously desperate measure.

One further possibility was that the sundial had been included in the sale of Buckland House treasures that took place in 1962, but, though more recent than the Kews sale, I have failed so far to find a catalogue.







BUCKLAND HOUSE IN 1822

Despite my lack of success, it seemed worth giving an account of my efforts to date (appropriate too at present as the Cowper and Newton Museum is in the process of having a facsimile copy made of the original). If anyone is likely to come across Johnny Johnson's gift and recognise it for what it is, it is likely to be a member of the B.S.S. The illustration shows its shape to be distinctive. The only inscription reads, 'Walter Gough, No. 21 Middle Row, Holborn, London'. The dial plate itself may, of course, now rest on some other pedestal. If the sundial survives complete or not, the present owner may or may not be

aware of its provenance.

It seems strange that Mrs Eyston's knowledge of the history of the sundial as reported to W. Hallam in 1914 should not have survived within the family. Perhaps it was valued more as a gift than for its history. Mrs. Eyston's grandson informed me that she was a great friend of Sir W. Throckmorton. Perhaps she felt it was appropriate to leave it at Buckland. The old gardener could be right then in thinking it had met its end on the estate but as we know that it had lasted from 1793 to the 1930's, it may still survive.

## CONTINUED FROM PAGE 33 THE SUNDIALS OF THE TALMONT II

Figure 4 is another horizontal dial but one where a slot is used to project a bright line on to the plane of the dial. The part above the dotted line is bent over the dial at the angle of latitude of the place where used, in this case the side supports are for 45°, (Talmont is at Latitude 46°). On the reverse side of the card are the instructions for use:

Hold the card horizontally and turn the slot towards the sun (geographic south). The projection of the luminous trace on the dial gives you the solar hour. To convert to the Legal Hour (Solar Mean Time) you must deduct 1 hour in winter and 2 hours in summer  $\pm 4$  minutes per degree of longitude east or west of Greenwich.

Figure 5 shows a rather more difficult sundial to deal with because the figures in the horizontal band have to be cut out so that light can shine through them. The band is then bent into a semi-circular arc above the base of the dial. Sunlight shines through the perforated figures on to the dial, which is placed horizontally so that the perforated line runs north/south, and the clearest projected figure indicates the solar hour. It would require a very sharp knife and great care to cut the figures out.

Of course, one must bear in mind that these are "fun-dials" rather than sundials. They are brightly coloured, mostly orange, red and green.

# THE SUNDIALS OF TALMONT II

DAVID J. BOULLIN

In the previous issue of the Bulletin (96.1), I reported on my discovery of a sundial shop in Talmont, a small seaside village in Chante-Maritimes, France, a few miles south of Royan (about half-way up the west coast of France in the Bay of Biscay). At the shop there is a pack of five sundial cards on sale, these are actually cutout models produced by Artissime, 32 bis Route de Montilemar, F-26110 NYONS, FRANCE, Tel 75-256-03-94.

**EDITOR:** Dr. Boullin exhibited the cards shown here at the BSS Conference held at Grantley Hall in April 1995. As no details of these were given by him and the writing on the cards will be too small for members to be able to read when printed in the Bulletin, I have added explanations. Any errors which may have been introduced are therefore my responsibility.

Figure 1 is a rather unusual sundial design. On the back of the card is "Mode d'emploi" - method of use. The card has first to be cut around the circumference before carrying out the following instructions:

1. Cut out and bend the triangular style at right angles to the dial. 2. Place the card vertical to the sun. 3. Turn the card (about the bottom edge) to adjust the plane in latitude (morning side or afternoon), using the list of towns shown. Then pivot the card without rolling, until the point of the shadow of the Style indicates approximately (the time) on the date of the day. The card is then in the meridian and indicates North-South. The hour indicated is the solar hour. The card functions from the rising of the sun up to 11h 15 and from 12h 45 to the setting of the sun. Southern hemisphere: inverse before and after noon.

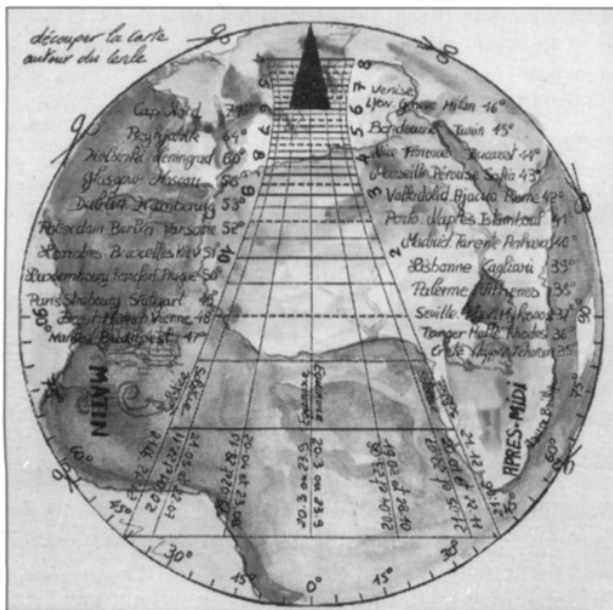


FIGURE 1: Semi-Polar sundial.

In other words the dial plane is inclined parallel to the earth's axis and the 90°-90° line is on the meridian. A sketch on the back of the dial shows the sundial tilted upwards at the style end towards the sun, but this is

incorrect. But if the translated details are correct, then this dial can only indicate for roughly half the day, (the card is printed with "Matin" and "Après-Midi" (Morning and Afternoon). The central horizontal line is the Equinoctial line, the upper and lower lines the Solstices.

After consultation with Mr. Robert Mills, the whole thing dropped into place neatly. The dial shows half a polar dial, but with a pointed gnomon it also indicates the sun's declination. For some reason the hour figures commence at 6 for Noon, it is necessary to add six to the indications to obtain true solar time. Such a dial cannot indicate the rising or setting of the sun because the shadow goes off to infinity. The shadow length cast by the point on the dial =  $x \tan S^\circ$ , where  $x$  = the height of the point above the plane, and  $S$  the angle of the Sun's rays with the gnomon axis. At 90°, the value of the tangent goes to infinity and no useful shadow is cast. So for the beginning and end of the day, about 45 minutes of sunlight cannot be registered at all. The back of the card states up to 11h 15 from the sun's rise, and from 12h 45 to the setting of the sun but this is in connection with the scale on the dial, not mean solar time. See *Sundials* by Frank W. Cousins, pages 128 and 133.

I have examined the catalogue *Cadrans Solaires* by Artissime but this dial is not illustrated, nor does the descriptive text deal with polar dials or this derivative. Perhaps only half of a polar dial was given to allow this to be as large as possible, a full polar dial on such a small diameter (14 cm) would be almost useless. Incidentally the map of the world forms the background, the main dark area is the Atlantic, and is mostly the southern hemisphere.

Any BSS member who wishes to pursue the analysis of this unusual dial, please send a SAE of at least six inches height for a free photocopy.

Figure 2 shows a dial with the well known motto "Carpe Diem" - Seize the (present) moment. It is labelled "Cadrans Solaire Vertical" or Vertical Sundial. The simple instructions are translated here for the benefit of those who cannot understand the French language.

- Bend the card on the dotted line (to close at the rear like a book) after having first cut out the slot FC. The Style - cut on the outline and fold at 180° on the dotted line towards the interior. Insert the style in the slot FC, see the sketch overleaf. This is a meridian sundial which one often finds on the walls of buildings. Orientated to the South, the shadow of the style gives you the Local Solar Hour.

**Note:** there is a little sketch on the rear of the card which shows the dial is kept vertical by the simple means of the folding of the card like a birthday or Christmas card. Of course, for use in England, the angle of the style would have to be adjusted to the local latitude.

Figure 3 shows a more unusual sundial where the dial is horizontal, with one corner turned up to give a point gnomon.

The French text reads: Bend the angle of the card vertically along the dotted line and orient to the south. The shadow of the point of the triangle gives you the solar hour. This design is signed Laure Bailly, as is Fig 1. It gives a good indication in sunlight.



FIGURE 2: Conventional vertical sundial.

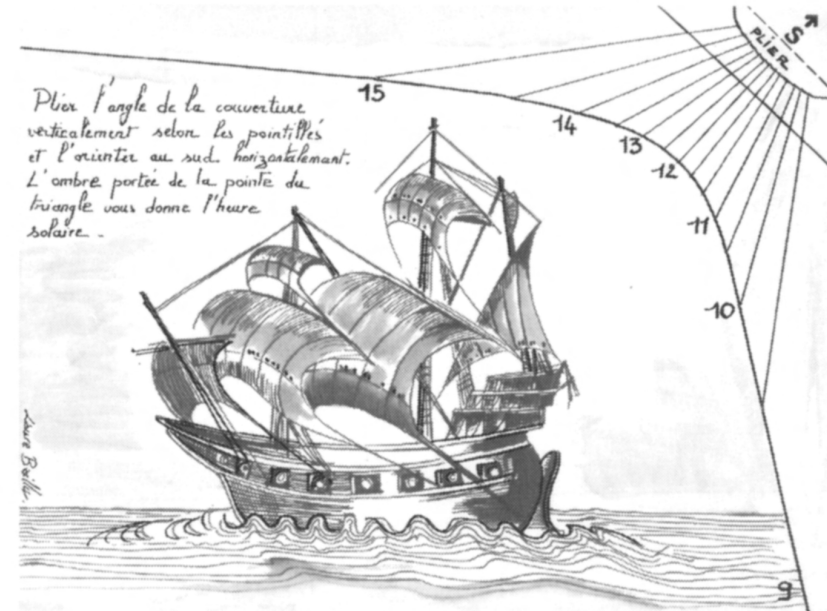


FIGURE 3: Horizontal sundial giving three hour indications either side of noon.

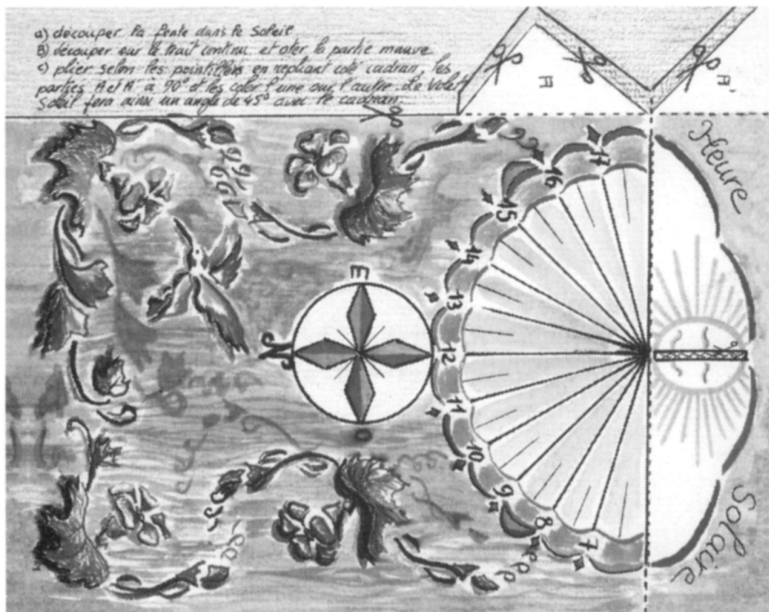


FIGURE 4: Horizontal sundial with slot gnomon.

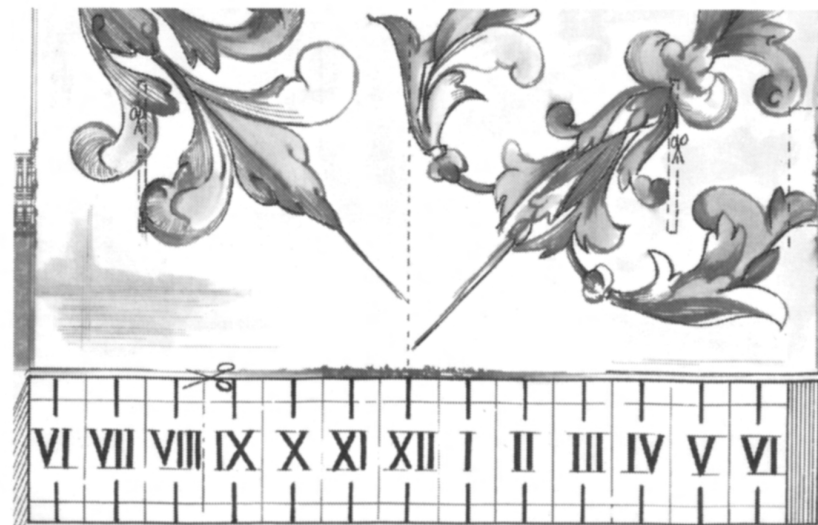


FIGURE 5: Cut-out figures band sundial.

# THE KING'S ENGLAND

J. P. LESTER

Many of our older members will remember *The King's England* series of books containing fascinating details of the British Isles which were edited by Arthur Mee in the 1930's and 1940's. These books are now being reprinted by a company with the trading title of "The King's England Press", Barnsley, South Yorkshire. Amongst the information in these books is the inclusion of such details as the sundials on, or near churches, mansions and country houses.

What is surprising on collating these mentions from the county books is that relatively few of these are actually listed in the BSS Sundial Register. The volumes examined so far cover the Counties of Cheshire, Cumbria, Durham, Gloucestershire, Northumberland, Staffordshire, Warwickshire and Yorkshire, remembering these are the old counties before reorganization. From these volumes the following lists have been prepared, and where the place name is included in The Sundial Register, an asterisk \* is placed against the entry. Of course it does not mean that the sundials mentioned are necessarily the same.

It will be obvious to members that in the period between the original publication and today, not all the dials mentioned will be found today, for example a visit to Beetham, Cumbria; and Broadway, Worcestershire, yielded one mass-dial each: whereas Arthur Mee states there are two. Those BSS members who live in the locality of the places mentioned can make use of the following lists if they wish to verify that the dial mentioned still exists and bring the BSS Sundial Register up to date. It is important to know what has been lost so that members do not waste their time on fruitless visits after consulting out-of-date lists.

## THE AREAS COVERED

CHESHIRE	WARWICKSHIRE
CUMBERLAND	WESTMORLAND
DERBYSHIRE	YORKSHIRE, EAST RIDING &
DURHAM	YORK
GLoucestershire, YORKSHIRE, NORTH RIDING,	
YORKSHIRE, WEST RIDING, STAFFORDSHIRE	

Note that these are the old counties.

### CHESHIRE

*Astbury	"...a sundial on a grand old cross"
*Audlem	"It has a scratched dial on one of its buttresses"
Cheadle	"the 17th century porch where an older stone is scratched with the lines of a sundial"
Crewe Green	School. Sundial with motto 'Use well thy time'
*Dodleston	"An old stone pillar with a sundial in the churchyard"
Eastham	(Churchyard) "There is a sundial on an old cross"
*Grappenhall	"An ancient scratch dial is still on the wall"

Marple	Marple Hall. "an old sundial in the walled garden"
Mobberley	(Church) "...the dial scratched on a buttress"
*Over Peover	"only the 17th century sundial in the churchyard is here to remind us that 'With speedy foot the age goes by' "
Seighton	"Seighton Grange. "...the lavender garden with a sundial which was once a baluster of old Kew Bridge"
*Tarpорley	Churchyard. "Here is an old sundial"
Taxal	Now in Derbyshire. "In its churchyard is a sundial on an old pedestal"

### DERBYSHIRE

Alfreton	"on the steps of a vanished cross a sundial counts the hours"
*Baslow	(Churchyard) "There is an 18th century sundial on an ancient flight of steps"
*Carsington	(Church) "There is a sundial of 1648"
Etwall	(Almshouses) "...and two sundials on the chimney stacks"
*Eyam	"There is an elaborate sundial of 1775 on the wall of the church showing 'the parallel of the sun's declination for the months of the year, the scale of the sun's meridian altitude, points of the compass, and a number of meridians' "
*Foremark	(Church) "There are three sundials on three buttresses"
Grindleford	"where old grey cottages gather round a green with an old sundial"
*Hartington	"The sundial on the porch says, 'So marches the God of day'
Mellor	"Part of the old cross with a sundial ...in a churchyard paved with gravestones"
*Morley	(Churchyard) "The shaft of an old cross is crowned by a sundial"
North Wingfield	"The churchyard has a very old sundial"
*Repton	"The Priory Guest House with an old sundial on the doorway"
Stanton by Dale	"...a tympanum of much interest over the south doorway. In the middle of it is a raised round boss believed to be a crude I sundial of Norman or Saxon days, with lines cut out to mark the hours of 6, 9, noon, 3, and 6; round the boss has been cut at a later time a circle containing a cross outlined in relief"
Taxal	"In its churchyard is a sundial on an old pedestal..."
*Tideswell	"near the picturesque sundial on the ancient steps of the churchyard cross..."
Wirksworth	"Cottage hospital on Greenhill, with gables and dormers and an old sundial on the wall"
<b>DURHAM</b>	
*Bishopton	"Let into the south wall of the nave is a medieval gravestone with a floriated ...

	cross; above it is a painted sundial of 1776 with the latitude marked”
Brancepeth	(Church) “...a sundial on the south west buttress (to mark the hours of service)...”
*Dalton le Dale	“The most remarkable feature of the church is a row of raised numerals set about five feet apart on the north wall, to record the hours from seven in the morning to one in the afternoon. A ray of sunshine once passed through a slit in the roof above the middle of the south wall, to mark the time on this extraordinary sundial”
*Darlington	“In a recess in the <i>north</i> transept is a red stone Norman sundial which was found during restoration work in 1865”
Egglescliffe	“The south porch bearing an elaborately painted wooden sundial of 1779...”
*Escomb	“On the south wall is a worn Saxon sundial, surrounded by a carving of a strange serpent; it is the oldest sundial in England still in its original position”
Hart	“Built into the west wall of the south aisle is an early stone sundial with raised lines”
*Middleton in Teesdale	“By the churchyard gate are the steps of the old cross, now supporting a sundial on a round stone shaft”
*Middleton St.George	Church of St. Lawrence. “... a roughly carved Saxon sundial on a windowsill at the west end” (originally from the old church of St.George)
*Pittington	“Outside the church, let into the south wall, is a Saxon sundial with six carved lines”
*Seaham	(Church porch) “a sundial of 1773 with this inscription: ‘The natural clockwork by the Mighty One, Wound up at first, and ever since has gone. No pin drops out, its wheels and springs hold good. It speaks its Master’s praise, though once it stood. But that was by the order of the Workman’s power And when it stands again it goes no more’ ”
*Staindrop	“To the left of the chancel arch is a Saxon sundial”
*Stanhope	“...a sundial of 1727 on the south aisle wall”
*Tanfield	“...a 700-year-old church with an inscription (under a sundial) stating that it was rebuilt and enlarged in 1749”
*Wickham	“The porch has a sundial dated 1651...”
Witton le Wear	“On the south side of the churchyard is the shaft of an ancient cross, capped by a sundial”

Sundials feature as an index entry in this volume, though it misses the one at Middleton in Teesdale.

#### STAFFORDSHIRE

Blymhill	Dial on stone pillar
Bradley in the Moors	Sundial on the tower
*Castlechurch (Stafford)	17th century sundial engraved in stone

*Checkley	On church wall
Codsall	On pillar and three steps in churchyard (1996 - an empty plinth)
*Kingsley	‘ancient wooden (sic) sundial on tower wall’
Pattingham	Sundial on ornamental pillar in the churchyard
Pattingham	Two mass dials
From Betjeman’s ‘English Parish Churches’	
Eccleshall	Mass clock

#### CUMBERLAND

*Bewcastle	‘part of a sundial’ on cross
*Bootle (Millom)	Sundial in churchyard
*Carlisle	On market cross, 17th century sundial
Gosforth	Sundial in churchyard
Isel	3 sundials on church window
*Lazonby	Sundial on cross-shaft
Matterdale	Font was once a sundial
*Millom	Sundial on cross-shaft
*Wreay	Copy of Bewcastle Cross (see above)

#### WESTMORLAND

*Ambleside, The Knoll	Sundial with motto
*Appleby	Sundials on pillars at each end of main street
Beetham	Sundial on church porch, scratch dial on buttress
*Brougham	Countess’s Pillar - sundials (under Penrith 1136)
*Heversham	17th century sundial in churchyard
Heversham	Sundial on tomb of William Whalley (? two references to the same dial)
Milburn	‘Several scratch dials’ on church wall
Newbiggin	‘medieval sundial on buttress’
*Temple Sowerby	Acorn Bank. Sundial with ‘conversational’ inscription

#### YORKSHIRE, WEST RIDING

*Aberford	Sundial on church porch, 1806
*Adel	Sundial 1628 (sic) in churchyard
Armthorpe	Mass dial
*Bardsey	Sundial in churchyard 1751 (sic)
*Bolton Percy	‘Tudor sundial with four faces in churchyard’
Bolton Percy	Two mass dials, now inside church
Brayton	18th century sundial on churchyard cross
Church Fenton	Sundial in churchyard
Great Mitton	17th century sundial in churchyard
Guiseley	Sundial on church porch
*Hartshead	Sundial, 1611, in churchyard
Hubberholme	Sundial in churchyard
Kirk Sandall	Mass dial inside church and upside down
Leeds	John Harrison Almshouses
*Long Preston	Sundial, 1667, in churchyard
*Low Bentham	Sundial on South aisle wall
Marton in Craven	Sundial, 1714, on tower
Monk Fryston	Scratch dial on South aisle
Monk Fryston	Sundial on church porch
Ripley	Sundial in castle courtyard
*Sedbergh	Sundial, 18th century, on South porch
Sowerby	Combined clock and sundial on tower of

St. Peter's church  
 Swillington Scratch dial  
 \*Thorpe Arch Sundial on church tower  
 Thorpe Salvin Sundial on church porch  
 \*Wakefield (Walton)  
 Walton House. Sundial telling the time in all  
 the capitals of the world  
 Walton (near Wetherby)  
 Scratch dial  
 Woodkirk Sundial on church porch

### YORKSHIRE, EAST RIDING & YORK

\*Aldborough Saxon Sundial  
 Bridlington Town Hall Gardens, 17th century sundial  
 Bridlington Sundial near North pier  
 Bubwith Sundial in churchyard  
 Burnby Two scratch dials  
 Carnaby Mass dial  
 Driffield, Great  
 Mass dial  
 Driffield, Little  
 2 Mass dials  
 Filey St. Oswald's church, mass dial  
 Ganton Mass dials on transept  
 Harswell Scratch dial  
 Hunmanby Mass dial on porch  
 Hutton Cranswick  
 Mass dial  
 Keyingham Mass dial  
 Kilham Sundial on upturned stone coffin in  
 churchyard  
 Kirby Underdale  
 Scratch dial set in vestry wall  
 Londesborough  
 Sundial in tympanum of Norman doorway  
 Londesborough  
 Sundial of 1764 on porch  
 Paull Mass dial  
 Reighton Mass dial on nave wall  
 Seaton Ross 12 foot sundial on cottage  
 Seaton Ross Sundial 1825, over church door  
 Siggleshorne Sundial 1813, on church tower  
 Skipsea "Fine sundial" on South aisle  
 Thorpe Bassett  
 Mass dial  
 Watton "the chancel has traces of scratch dials on a  
 windowsill and by the priest's doorway"  
 Weaverthorpe Saxon sundial in tympanum above Norman  
 doorway. Inscription translated as "Herbert  
 of Winchester built the church in honour of  
 St. Andrew"

### YORKSHIRE, NORTH RIDING

Foston Scratch dial by Norman doorway in porch  
 \*Gillamoor Pillar sundial with three faces near church  
 Great Ayton All Saints Church. Sundial of 1702  
 \*Great Edston Saxon sundial over the South door divided  
 into the eight hours of the Saxon day.  
 Inscription translated as "Time-teller for  
 wayfarers; Lothan made me"  
 Hutton Buscel Sundial on church  
 \*Kirkdale Sundial on church porch  
 Kirkdale Saxon sundial in church porch. (These two  
 dials appear in photographs in the book)

Kirkdale Mass dial on chancel near priest's door  
 Kirkleatham Two sundials on central range of Lord  
 Mayor's Hospital  
 Laithkirk Sundial on church  
 \*Leake Sundial on wall of South aisle  
 Lockton Scratch dial on chancel wall  
 Marske Sundial on church, 1700  
 \*Northallerton Sundial on South transept  
 North Otterington Scratch dial  
 Old Byland "On the east (sic) wall of the tower is a  
 Saxon sundial with an inscription upside  
 down, meaning probably": Huscarl made me  
 for Sumerlethi"  
 Over Silton Mass dial on church buttress  
 \*Pickering Sundial on church porch  
 Redmire Norman mass dial  
 Rokeby On barn near gateway to Mortham Tower,  
 sundial of 1566  
 Sand Hutton Scratch dial on chapel of St. Leonard in St.  
 Mary's churchyard  
 \*Scalby 17th century sundial in churchyard  
 \*Seamer (Nr Scarborough)  
 Sundial on church with motto: "A day may  
 ruin thee; improve this"  
 Sinnington "Two ancient sundials" on church  
 Skelton in Cleveland  
 Fragment of sundial from the old church  
 fixed to windowsill of the porch of the new  
 church. "Believed to be 11th century... The  
 broken dial seems to have divided the day  
 into twelve hours, and the words of the  
 incomplete inscription are said to be Old  
 Norse though the letters are Saxon"  
 Stillington Mass dial beside priest's doorway  
 Welbury Sundial on church porch  
 \*Wensley Sundial on S. porch of church with motto:  
 "As a shadow, such is life"  
 West Rounton "A scratch dial is probably Norman"

### WARWICKSHIRE

Astley "High up in a buttress of the great tower of  
 the church, in striking contrast to the red  
 sandstone of the tower itself is a white stone  
 sculptured in relief with a half circle and  
 several irregular rays. It is a Saxon dial  
 .retained from a Saxon church, no doubt,  
 when Thomas Astley made the church new  
 600 years ago, and kept again when this 16th  
 century church was built"  
 \*Berkswell "The sturdy medieval tower looking down on  
 it all has a sundial bigger than its clock"  
 \*Chesterton "The sundial over the porch has an  
 inscription oddly out of keeping with so quiet  
 a place, for where we wish to stay the sundial  
 says 'See and be gone about your business' "  
 Chilvers Coton  
 Arbury Hall. "The great porch was built by  
 Christopher Wren, above which he put a  
 sundial with the words, 'Life's but a walking  
 shadow' "  
 Clifford Chambers  
 "... the dial roughly scratched over the door,  
 with half a dozen rays to show the villagers  
 the time of mass"

Copston Magna	The ruin of a monument which once supported "a sundial with four faces" is recorded.	*Napton on the Hill	"Over the priest's doorway is a sundial..."
*Coughton	"The spacious 16th century church, in a lovely setting, has a sundial on an ancient cross among the gravestones"	*Newbold on Avon	(South porch) "... an old sundial on the gable"
Cubbington	"In the vicarage garden is a sundial with a motto commenting on the changes of the passing years: 'I mark time; dost thou?'"	*Packwood	(under Solihull in Register) Packwood House. "We counted seven sundials, some framed in moulded bricks and one dated 1667" Church tower "...a mass dial on one of the buttresses"
Curdworth	"Older still must be the three mass dials on the south wall of the nave..."	Quinton	"There is a mass dial near the south door"
*Ettington	(the old church) "On one of the walls, hidden under the ivy, we found a scratch dial with 24 rays"	Studley	Gorcott Hall. "A sundial throws its shadows on the floor of one of the rooms"
Grendon	"...the dial by the priest's doorway for telling the time of mass"	*Temple Balsall	"Its alms houses, school and the fine old house with its twin towers (one with a clock, the other with a sundial) run round three sides of the lawn of a quadrangle"
*Honington Hall	"The quaint octagonal dovecot near the house has a sundial"	Ullenhall	(The old church) "...a sundial on the bellcot"
Ladbroke	"The porch has a sundial which has been marking the hours for 300 years"	Whitchurch	(Church) "A painted sundial marks the hours as we approach; it has been marking them since 1646."
Leamington Hastings	"Its tower has an ancient sundial"	Wixford	"...to tell the time by one of the mass dials still on the walls"
*Loxley	"There is a sundial on the tower saying, 'I die today and live tomorrow'"	Wootton Wawen	(Church) "There is a sundial which was telling the time in Shakespeare's England"
Mancetter	"Strange things we found on this tower ... a sundial to mark the bright hours..."	*Wormleighton	(Gateway) "...and higher up is the stone of an ancient sundial"
Meriden	(Churchyard) "From beside the ancient sundial..."		

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**CONTINUED FROM PAGE 38**  
**BSS ANNUAL CONFERENCE AT GRANTLEY HALL, RIPON**

Margaret joined us a few years ago and was a popular and enthusiastic member until her death Christmas 1994. Wielding his gavel with expert dexterity, sundials, books and other items were speedily dispatched, fetching a welcome total of £343 for Society funds. Our overseas members were particularly vigorous in their bidding and several items were snapped to cries of "Don't let our treasures leave the country!". It was generally agreed that if the Chairman decided to change directions in his career, the role of an auctioneer would be one he would be very suited to. Such was the interest and enjoyment generated by this occasion, it was suggested that an auction should be a regular feature of forthcoming conferences.

On Sunday, Ian Wootton chaired the meetings, starting with Doug Bateman's talk about making a vertical sundial using modern materials. Doug had experimented with perspex, as its durability for signs seemed to offer much as a innovative material for sundials. Two very smart vertical dials were displayed and had been made for shipment to the USA. They were in a blue perspex with cut-out numbers, coated in gold. Practical diallists found this of interest as it explored the use of plastics and the dials produced were clean-cut and distinctive. Anne Somerville then told of the late Dr. Somerville's interest in Scottish monumental sundials and how he had designed a modern version of such a dial for a private customer in Scotland. It was heartwarming to see the pictures of our founder chairman

with an elaborate dial of his own making. One cannot help but think how proud he would have been to see how healthy was the society which he helped to found.

The breaks in lectures gave delegates ample time to converse and to get to know each other. Rogers Turner once again attended with a display of the dialling books which they stock.

The Andrew Somerville Memorial Lecture was given by Professor C. P. Adams of Belfast. We were treated to his investigations into the sundials of Ulster and entertained to learn of the efforts he has gone to, to research their history. The talk was illustrated by an excellent series of slides.

The conference was rounded off by the Annual General Meeting. It was inspiring to see the interest the delegates showed in the way in which their Society was run, with several suggestions being put forward from the floor. The existing Council was re-elected unanimously and we were delighted to welcome Mr. Graham Aldred of Stockport to Council. Bulletin Editor Mr. Charles Aked was presented with a crested China sundial and a dialling treatise, as a token of regard for his excellent work for the Society since its beginning. All in all, this conference continued what has become a tradition of successful conferences, and delegates went their separate ways in the knowledge that friendships had been formed and that the Society was progressing on a straight course.

**B.S.S. ANNUAL CONFERENCE AT GRANTLEY HALL, RIPON**  
**21st to 23rd April 1995**  
**ROBERT B. SYLVESTER**

If anyone dared to question the success of the British Sundial Society, it was only necessary to see the attendance at the annual conference. That our young group can attract over ten per cent of the membership and from far flung places, surely attests to its health and vigour.

Choosing the grace and ambience of a country house again, after the impersonality of modern university buildings, seemed a wise decision and added a certain flavour to the proceedings. Grantley Hall, a well appointed house in its own extensive grounds is set back from the Pately Bridge to Ripon road and proved an excellent venue. Delegates arrived from Friday afternoon onwards, unaware that Council had been there from the day before and had already had two intensive business meetings.

After reception and evening meal in the sumptuously ceilinged dining room, the opening talks began, chaired by Christopher Daniel. John Wall expanded on his paper about diallist John Smith and the Albert Park dial in Middlesborough. His well illustrated talk placed this and adjacent dials in perspective. The Membership Secretary told of the pleasure he had in being able to add faces to the names he encounters so frequently in his duties and if his correspondence is anything to go by, the members are only too human! A few choice anecdotes served to underline this. Roger Bowling's intriguingly entitled talk 'The Lost Continent' outlined his researches into a series of horizontal sundials held aloft by statues of the native peoples of the continents. He researched the whereabouts of this unusual group of sundial supports thoroughly and gave background information about the makers. His failure to locate the missing continent was more than compensated for in his final slide, where he attempted to make good this deficiency by modelling the missing statue himself, clad only in loin cloth. Words cannot convey the impact it had on us all!

A most unusual memorial to commemorate the liberation of the Channel Isles on 9th May 1945 was the topic of Guernsey member David Le Conte. This impressive monument was nearing completion and an obelisk tip casts its shadow once a year on a specific part of a seating area on this momentous occasion. David showed an astronomer's excellent understanding of the sun's apparent motion and most impressively, had designed the monument to function in this manner for a considerable time ahead.

Saturday's meetings, chaired by Anne Somerville, started with new member Peter Lamont's talk about Open Book and Conical sundials. Mr. Lamont showed a thorough grasp of gnomonics and his ability to calculate the shadow movements over a variety of surface shapes. The Sundial Registrar expanded on a previous talk in detailing his work on the National Survey. His impressively bound volumes on display gave members a chance to see the vast amount of material his job entails and he showed how ably he was committing these to the database for the anticipated new edition of the Sundial Register at the end of the year. The original Register contained under 2000 records and the new edition shows a substantial increase on this. It is hoped to make the presentation of the records more user-friendly and to probably introduce illustrations.

Colin Lowndes and Nick Nicholls presented work done on two unusual mass dials in Dorset. These appeared as apparently meaningless scratches at the base of a church window, the jamb of the window acting as gnomon. Mr. Lowndes ability as an astronomer shed light (excuse the pun!) upon them as early time markers. Mr. Nicholls had researched them and surprisingly, it seemed that no attention whatsoever had been paid to them by local history societies. Truly, the BSS's role is called for! After coffee, the continuing enigma of the dial of Ahaz, mentioned in the Bible, was investigated by Allan Mills in one of his usually erudite presentations. The biblical references are unclear but the phenomenon of the sun moving backwards has exercised many minds. The refraction of the shadow by a water filled dial seems to offer some explanation and the characteristics of such a dial were explored.

The lunch break gave ample opportunity for delegates to see the exhibits on display. Members unable to attend had sent material for display. Of those present, once again we delighted in the superb workmanship of Herr Pollahne's precision sundials.

News of the North American Sundial Society was brought to us by Mr. & Mrs. J. Holland from Chicago, who are regular attenders at these functions. We are pleased to have formed such firm links with our cousins overseas and their society, now nearing 200 members, has just held its inaugural meeting at the Smithsonian Institute in Washington DC. Photographs of the event and other memorabilia were on display. Jim Holland brought with him the greetings of that group and took with him, likewise sentiments. Rejoicing in our mutual interest, he told us that we were all just the same .... only the names are different!

Delegates fancying a breath of fresh air could wander in the grounds at Grantley Hall and examine the three sundials there. At the entrance was an intriguingly inscribed Victorian horizontal plate with many of the features of the Albert Park vertical sundial in Middlesborough and a similar one at nearby Castle Howard, a subject ably covered in a paper by Dr. John Wall in a recent Bulletin and during his aforementioned talk. There was an unsigned horizontal dial within the grounds as well as a polyhedral dial, inevitably set up wrongly, perhaps by some eager but unknowledgeable gardener.

All was not sunshine as the storm clouds loomed. It was a great pity that the only really wet spell coincided with the two coach trips. Firstly, both coaches made a quick visit to Otley to see the beautifully inscribed double polar mean time dial in slate and Yorkstone, designed by the Chairman and unveiled in 1993 in memory of a local businessman. Returning to the coaches in pouring rain, we went our separate ways, one group to Fountains Abbey and the other to Newby Hall. Both of these were good dial sites but the weather did dampen the proceedings somewhat.

The Conference dinner is a high spot at any of our meetings. Suitably wine and dined, Chairman Christopher Daniel conducted an auction of the late Noel and Margaret TaBois' sundial items. Noel was a regular contributor to Clocks magazine in the late 1980s and each delegate was presented, upon arrival at the conference, with a reprint of his many articles from the Sundial Page which he started.

Continued on page 37



# THE CHATHAM SUNDIAL

ROBERT H. MILLS

**RESUME:** The vertical declining dial at Chatham by Christopher St. J. H. Daniel is of particular interest, not only because of its historical associations, but also as a fine example of a vertical dial declining at an angle of  $33^{\circ} 45'$  and showing the Zodiacal lines, (often referred to as declination lines but not to be confused with the declining angle) which can give approximate dates.

For a full account of the sundial see BSS Bulletin 96.1, pages 16-18, "The Shadow of Respect" by the BSS Chairman.

The following text contains comments on Vertical Declining Dials. These have been discussed with the designer, who has agreed to their publication in the BSS Bulletin.

## THE CHATHAM SUNDIAL

The Chatham dial, see Fig 1, shows a point on the dial for time of 4.57 pm on October 21st 1805 (4.30 pm Trafalgar local time), commemorating the death of Admiral Horatio Nelson at the sea-battle of Trafalgar against the French navy.

The Sun's Hour angle, or Sun Time is shown by the shadow cast by the tip of the horizontal spike BS. This spike can also be regarded as a small bead fixed fixed at the point S which marks the end point of the usual triangular gnomon PSB, where P is the point at which all the hour lines converge.

The angle SPB ( $\alpha$ ) is  $31^{\circ} 26'$ . The angle  $c$  at which the triangular gnomon has to be placed with regard to the vertical XII (H.A. = 0) hour line is calculated to be  $23^{\circ} 9'$ .

It may help some members to realise that the essential characteristic of the gnomon of a declining sundial SPB is that the line SP should be directed to the celestial pole even though SP is at an angle of  $31^{\circ} 28'$  to the plane of the dial and BE is  $23^{\circ} 93'$  off the meridian.

The angle SPB, ( $\alpha$ ) mentioned above ( $31^{\circ} 26'$  is given by:

$$\sin \alpha = \cos \phi \cos \delta$$

where  $\phi$  is the latitude and  $\theta$  the declining angle  $33^{\circ} 75'$

So we have

$$\sin \alpha = \cos 51^{\circ} 38' \cos 33^{\circ} 75'$$

Giving

$$\alpha = 31^{\circ} 25'$$

For a simple *south-facing* vertical dial the hour angles  $\gamma$  are given by:

$$\tan \gamma = \tan (HA) \cos \phi$$

The relation for a dial declining by  $33^{\circ} 25'$  is modified by shifting the zero hour angle line by an angle  $h$  (EPB), given by:

$$\frac{\sin h}{\cos \phi} = \frac{\sin 23^{\circ} 93'}{\cos 51^{\circ} 3'}$$

As an example apply the preceding to mark the angle for 1 pm (HA -  $15^{\circ}$ )

$$\begin{aligned} \tan \gamma &= \tan (40.5 - 15) \cos 51.3 \cos 33.25 \\ &= 14^{\circ} \text{ to the left of the substyle PB} \end{aligned}$$

Apply to the HA (IV) 60, then

$$\begin{aligned} \tan \gamma &= \tan (40.5 - 60) \cos 51.3 \cos 36.25 \\ &= 10.5^{\circ} \text{ (to the right of the sub style PB)} \end{aligned}$$

The full set of hour lines are:

Sun Time	Hour angle of Sun (h-H)	Shadow Angles
XI	-15	55.5 38
XII	0	40.5 24
I	+15	25.5 14
II	+30	10.5 5.6
III	+45	-4.4 2.3
IV	+60	-20.5 11
V	+75	-34.5 19.7
VI	+90	-49.5 31.34

The Zodiacal lines can be constructed by using the altitude of the Sun at each point of intersection of the sun's declination line and each of the Hour lines, as follows:

For example the four important intersection points on the Hour line XII of the declination lines for  $-23.5^{\circ}$ ,  $-10.5^{\circ}$ ,  $0^{\circ}$ , and  $+23.5^{\circ}$  are determined by their distances from E along the hour line, and are respectively:

ES tan (39-23.5), ES tan (39-10.5), ES tan (39), ES tan (39+23.5); 390 being the altitude at midday during the equinoxes.

Similarly the positions of the intersection points for the other hour lines can be found, and can be checked using a cardboard model, ES is constant only for each hour line as it is the perpendicular distance from S on to the Hour line.

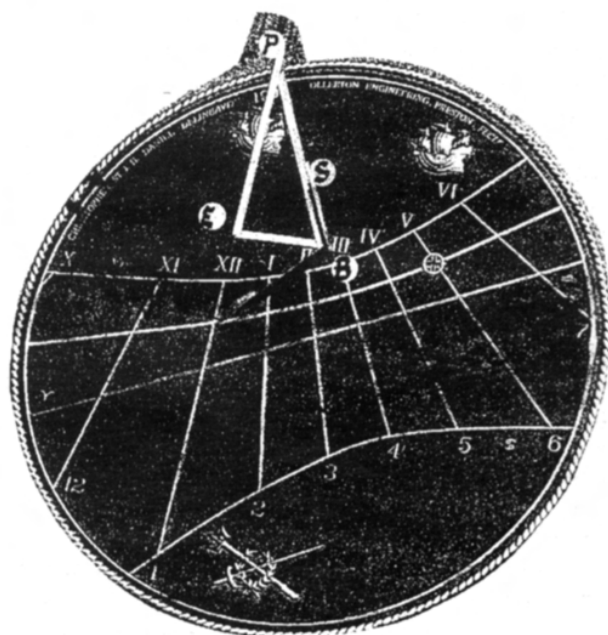


FIGURE 1: The Chatham Sundial

Continued on page 21 . . .

## COMPENDIUM

Volume 2 Number 4, December 1995 issue, contains sixteen main items and shows the increasing maturity of the journal with the passage of time. Like all young societies, there is a great deal to learn when commencing from scratch into an area of which there is little known. The outgoing President Ross McCluney sums up his year in office on page 1, he is leaving the Board of Directors next year (equivalent to the BSS Council), and expresses his gratification at the progress of NASS.



Laurence Jones describes four Waugh dials, two at Mystic Seaport, one at Uconn (University of Connecticut), and the analemma in the hall in Waugh's residence. The Uconn dial is particularly striking and situated in very pleasant surroundings. The article "Famous Sundials of India" by Harold E. Brandmeier is really about the observatories of Jai Singh. Although these have been detailed over and over again, the account is very clear, and there is an interesting comparison with the Augustus' dial in Rome, which occupied five times the area of the Brihat Samrat Yantra in Jaipur. The author seems to have acquired most of the works dealing with these magnificent observatories.

A version of the miracle of Ahaz was taking place when the new equatorial sundial was erected at the University of Colorado. Unfortunately the company which manufactured the huge granite equatorial sundial inadvertently engraved the winter hours in the same sequence as those for summer hours. The sorry tale is told by Carol Chorey, a journalist on the staff of the Daily Camera. As the monumental granite sundial weighs several tons, the original numerals will be cut out and recessed to take tiles of the same rose granite in the correct counterclockwise direction for winter.

The second article dealing with error analysis of the horizontal sundial by Lauroesch and Edinger is given on pages 10 and 11. Alas, the first article contained errors and a corrective set of data is included with the journal.

Under the unlikely title of "Lasers, Tomatoes & Oranges, Navigation Simplified", Allan D. Pratt deals with the concepts of latitude and longitude in determining a position on earth, essential if your sundial is to indicate

local solar time (at least for the majority of sundials).

"From the Tove's Nest" by Fred Sawyer contains a number of items on dialling, and the recent BSS AGM is mentioned. "A Reflected Sundial" is an article by P. O. Taylor and Nancy L. Hendrickson, taken from their republished book *A Beginner's Guide to the Sun*. Next "A Sundial for Maribur" by Robert Adzema describing the making of a large concrete single digit sundial. A cut-out model is included with the journal. Mr. Adzema will be remembered as the author of the book - *The Great Sundial Cutout Book*. The article is in the Design and Construction Forum section.

Quiz No 7 gives the details of a globe-trotting diallist, the reader has to work out the time indicated on his much travelled dial after almost completing his return back home. The penultimate article deals with the proposed logo for NASS, evidently there has been the same problem as the BSS found in selecting a suitable symbol - all the best were grabbed years ago. The one selected is that which the reviewer would have chosen - a vertical dial with an analemma.

Finally an article by Fred Sawyer "Atmospheric Refraction". This is an aspect ignored by diallists because its effects are greatest at dawn and sunset, zero at noon. Since the greatest error through refraction is of the same order as the accuracy to which the best of sundials can be read, there is no point in making allowances for it.

All in all an entertaining journal for the enthusiast.

\* \* \* \* \*

## COMPENDIUM

Volume 3, Number 1 issue for March 1996 is adorned with the new NASS logo. The reviewer would prefer it to be printed more boldly, it looks a trifle spidery as shown. (How easy it is to be a critic as long as you are not asked to do better yourself). A total of 18 main items includes another sparkling selection of topics, commencing with a short poem by Thomas Hardy entitled "The Sundial on a Rainy Day". A small but amusing item is a "Sand Dial" by Woody Sullivan, designed and made on a beach, it had the appropriate motto "Time and Tide wait for no Man. It measured temporary hours only, being washed away by the next tide. This is the first issue of Compendium by Fred Sawyer acting as President as well as being the Editor.

The limits for operation of a sundial are discussed by Harold E. Brandmeier in a five page article with seven half-page diagrams. Four noons by Roderick Wall deals with the various noons, Apparent, Mean, Standard and World. The main time problem now is that posed by the Internet where a few seconds only separate users who are antipodes apart. Just as a small country requires just one time zone, the Internet requires a time system common to all users. "Doing it with style" by William S. Maddox deals with the perennial problem of achieving a true north/south alignment.

The third part of "Error Analysis of the Horizontal Sundial" by Lauroesch and Edinger deals with the first of four sources of error when the foot of the substyle is incorrectly placed.

Woody Allen describes the tracing of a kitchen ceiling

analemma with a reflecting mirror. His method of 160 observations in four years is not for the faint-hearted. Joshua R. Smith, in a short note, deals with Sunweb which is an effort to link sundial indications through the Internet. With all these applications we shall be glued permanently to our computer screens.

In the Design and Construction Forum Robert Terwilliger replies to questions about an analemmatic sundial in the Southern hemisphere, and "what should be the length of a gnomon"? The next item is about computer programs and in particular "Graphica"- a program for converting simple ASCII programs into vector graphic displays. Quiz #8 is taken from Chaucer's *Canterbury Tales* where the traveller is working out the time from his shadow - 4 o'clock with a shadow of about 11ft and his height of 6 ft. On what day of the year did this take place?

Book Notice reviews *Longitude* by Dave Sobel, and *The Stones of Time* by Martin Brennan. *Longitude* has nothing whatever to do with dialling, it is an account of the solving of the problem of longitude by the English genius John Harrison. A little knowledge is a dangerous thing and is amply demonstrated here when the author states the perfect timekeeper devised by Harrison is now known as the chronometer. Tosh and balderdash! Not one marine chronometer was ever based on Harrison's examples, his great triumph was demonstrating that there was a practical solution to time-keeping at sea when even the great Sir Isaac Newton doubted it was possible. The latter book deals with the calendars, sundials and stone chambers of ancient Ireland. The author states the time devices in Ireland predate those in Egypt by thousands of years. Readers must take this assertion *cum grano salis* since Egypt gets more sunshine in a year than Ireland in a decade. It is only the constant day to day study of light and shadow that reveals the recurrent annual theme of the passage of the sun. The trouble in analysing ancient monuments is that one can find what one is looking for by manipulating the tenuous links to one's own end.

Some details of the management of NASS is given on pages 27 & 28, plus details for paying the dues by those who wish to become BSS members. The result of the Logo selection is given, rather more than half of those voting chose the logo shown here. Finally, to round off the issue, the inside back cover has tables of the Equation of Time and Solar Declination for April, May, and June 1996 for the US standard meridian of 75° West.

**CONTINUED FROM PAGE 48  
READERS LETTERS**

**EURODIAL**

The recent debate on the possibility of a change to Continental time, and having a niece living in Holland, prompted me to make what I might term a "Eurodial". I enclose a photograph of it, it is hand engraved on brass. Comments upon it would be welcomed.

DICK SKINNER

This might be known as the "Eurodial".  
Hand engraved on brass by Dick Skinner - 1996.

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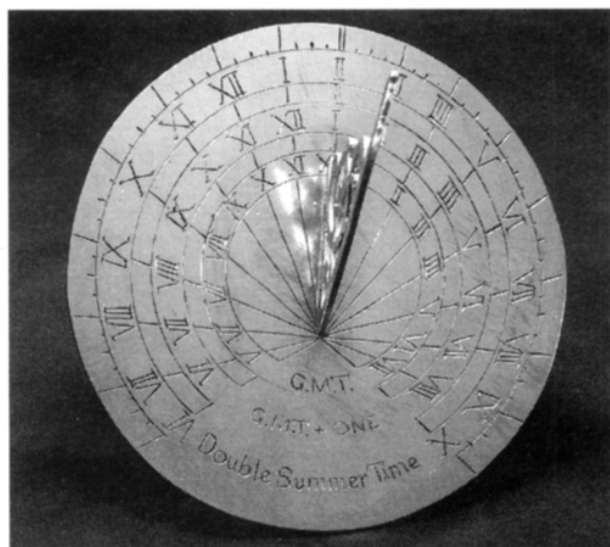
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\* \* \* \* \*

For the benefit of those who wish to become members of NASS, the list of officers is given above. Curiously enough, in the reminder for dues for members, there is no mention of the annual rate. Membership is well worth the cost even if receiving *Compendium* is the only benefit for UK members. The digital form of the journal is highly recommended for it also contains programs which cannot be included in the hard copy version.



# DÜRER'S MELENCHOLIA I: A DIALLIST'S DILEMMA?

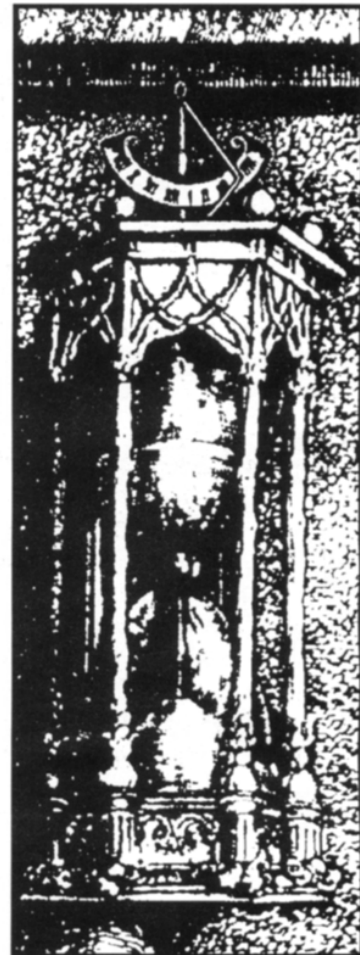
BY PETER I. DRINKWATER

Albrecht Dürer preceded Hans Holbein by more than a decade in presenting an allegorical assemblage of "Instruments of the Arts and Sciences", with figures for "Human Interest". Whilst it is obvious (to many) that Holbein's "Ambassadors" makes more than a passing reference to the Art of Dialling, the connection between Dürer's "Melancholia I" and the making of Sundials is less emphatically perceived. Dürer was a much more 'religious' artist than Holbein: he produced many Engravings and woodcuts illustrating the Passion of Christ, in several of which appears a ladder set up against Christ's Cross in exactly the same pictorial position as the Ladder in "Melancholia I". Familiar too are the hammer and nails and pinchers: all emblems of the Passion. The well known liturgical Hymn "Vexilla Regis" makes direct reference to the Cross as a "balance true" (i.e. "in equilibrium") and here, instead of an actual Cross, we have an actual Balance in equilibrium. I am sure that this reference is intentional. The whole picture is a kind of Intellectual Crucifixion. The figure of Melancholy herself is not an Angel descended to Earth but a Human Being with real earthly concerns (witness the closed purse and chatelaine of keys) who has grown wings (with which, eventually, to soar): unlike most allegorical ladies of the period she does not expose flesh. Even Cupid has been decently dressed and set to his lessons, and the dog of the lower nature lies fast asleep. The plane and saw and template have done their work. The inkwell and attached pen-case cannot yet be made use of. The syringe, to apply the enema traditionally used to purge the humours thought to cause "Melancholy", is hardly a threatening presence. The Book is closed because the information which it gives is inadequate. The Dividers, so useful and so indicative of purpose, lack application. The reason for this stasis, as poignant as the thick darkness which covered the earth at the historical Crucifixion, is the great block of stone which dominates the picture and upon whose most exposed facet can readily be perceived a cadaverous face which shadows Melancholia's own. The Block is a simple Cube which has been complicated by the truncation of two of its opposing points at 45°: upon one of these truncations it stands.

A normally placed Cube has, in addition to the Horizontal plane, four Vertical facets. These may be calibrated (if the Cube is placed "direct") as a set of four Direct Vertical Dials, or (if the Cube is orientated crosswise) as a set of four Vertical Declining Dials. When a Cube is set on one corner, as effectively is the case here, it displays (in addition to the inconsequential Horizontal Plane) all six effective facets. Depending on the orientation of the Cube, and assuming a motional directness, these will be (in traditional Diallists' language): two Direct Reclining Planes: two Declining-reclining Planes; and two Declining-inclining Planes (other nomeclatures are known: these are the earliest and best).

That the incipient Art of Dialling in 1514, when Dürer executed this engraving, was unlikely to be able to cope with these complexities is graphically suggested by the rudimentary character of the time telling equipment actually illustrated. Above Melancholia's wreathed head, surrounding the 'Magic Square' (giving all of the numbers from 1 to 16, so arranged that each row adds up to 34 etc., etc.) which stands in opposition to the perfect Sphere at the

other corner of the picture, is a large Hour Glass, actually running, to tell the passing of the Hours, and a bell upon which to strike them, such as any religious foundation still not possessing a mechanical clock would, at this period, have largely relied upon. But, on top of the backing plate of the Hour glass, and acting as its point of suspension, is an actual Sundial (see Detail Picture), occupying a position quite usually taken (see Dürer's companion piece "The Knight, Death, and the Devil" and several of his other pictures) by a simple twelve hour circle with an hand set pointer to keep track of the constant turnings of the Hour Glass. This little Dial, very easy to overlook, gives the key to the whole composition. It consists of a simple wire Gnomon, which, according to the established perspective of the picture so emphatically stated, must be a right angled triangle with its two subsidiary angles (including the co-latitude, since it is a vertical dial) at 45°: supporting a thin metal arc with its ends scrolled round and marked up with the numbers for the Hours: VIII (for IX), X, XI, XII, I, II, III, and IIII (for IV). There are no Hour Lines or Hour Points, the numbers being placed *in the middle* of the timespan to which they apply, not, as in now the case, at its end. The marked capacity of the Dial is therefore from 8am to 4pm: the minimum rather than the maximum for a south vertical plane, but wholly adequate at all seasons save for that period immediately around the Æquinoxes. Most importantly the Dial establishes that Dialling was certainly in the Artist's mind and that he was thinking specifically of Dialling at Latitude 45°. This is indeed the 'magic'





Latitude where many things which would prove prohibitively difficult at other Latitudes become strikingly simple: it is also the Latitude of Venice, where Dürer had spent two long periods and had begun to make his mark as an Artist; hence the water and islands to the north of the picture. At this Latitude Melancholia's problem is mere nearly within her grasp than she might realize, and it will not be long before she takes up the ruler lying beneath her feet and sets to work. At Latitude  $45^\circ$  the six effective facets of the block, as shewn, can be calibrated as Sundials in one of two simple ways, depending upon the orientation of the Block.

1. Two simple Æquinoctial planes (one North, and one South, facing); and four Polar planes, each with the noon-line deviating by the tangent of  $45^\circ$  (the height of the parallel-bar, or pin, gnomon employed).
2. Two simple Polar planes (one North, one South, facing); and four planes calibrate as for Latitude  $45^\circ$ , with 6 o'clock as their Meridian and hour lines numbered on each facet as appropriate to its situation.

Perhaps some of our readers, having the necessary grasp of the traditional nomenclature which I have employed, would like to try their hands at an exemplification of all or some of these planes.

# THE TORQUETUM

CHARLES K. AKED

In studying "The Ambassadors" painting in the National Gallery (now back after restoration), one is constantly reminded that there is no true point of focal interest. The observer's eyes continually wander over the various features without being truly riveted to any single item. Nevertheless, the instrument which dominates the upper half of the painting is that of the Torquetum. Don't waste your time looking in any dictionary for an explanation, for the word is not included, not even in the large Oxford English Dictionary.

This present article is based upon the article on the Torquetum by the late Henri Michel, the noted Belgian collector of old scientific instruments, in the French magazine *Ciel et Terre* in 1944. In considering this particular instrument, the reader must bear in mind that at the time of its origin and use, many of the mathematical ideas that we take quite for granted today were not known and their concepts lay far into the future.

## ANTIQUITY OF THE TORQUETUM

The date of invention of the Torquetum has not been determined precisely, nor is it known who was responsible for its design. Many astronomical historians connect it with Apianus, because of the excellent description he provides of the instrument in his *Astronomicum Caesarem* published in 1540. Yet long before this, J. Schöner - Regiomontanus (1436-1476) had written about the Torquetum and its use, although his work was unpublished until 1544, long after his death. Many manuscripts of the 14th century explain the construction and use of this instrument, an example is that of Richard of Wallingford, the designer of the most complicated astronomical clock in the world at that time, who cited in 1326 that the Torquetum was one of those

instruments fundamental to measurements in astronomy.

A turgid passage in the first chapter of Regiomontanus has led a number of authors to attribute the invention of the Torquetum to Geber, an Arab astronomer who moved to Seville, Spain about the beginning of the twelfth century. This would seem to be a bad rendering of the Regiomontanus text which describes an instrument similar in nature, but with sensible differences, to those of the Torquetum.

The noted author Robert T. Gunther reported finding a manuscript *Tractatus Torquati Secundum Magistrum Franconem*, which was the work of the Belgian scholar Francon who died in 1083. It is not known if this particular source was ever authenticated.

In the many descriptions of the Torquetum, the engravings in all the known manuscripts are extremely inaccurate the errors being more frequent in the older works, where often the figures only serve to confuse the reader instead of making matters clearer.

The oldest Torquetum ever found was that in a collection which was discovered by J. Hartmann in 1913 and who restored it. The instrument was purchased in 1444 by Cardinal Nicholas de Cuse, and by 1919 it was preserved in the Hospital for the Aged at Cuse, close to Trèves.

## AN ABRIDGED DESCRIPTION OF THE TORQUETUM

With reference to Figure 1, the first plane is horizontal (*Tabula Horizontalis*) and rests on four feet. In practice this would need some means of ensuring it was perfectly level by means of adjusting screws and spirit levels at right angles, or a plumb bob adjusted to a reference point on the

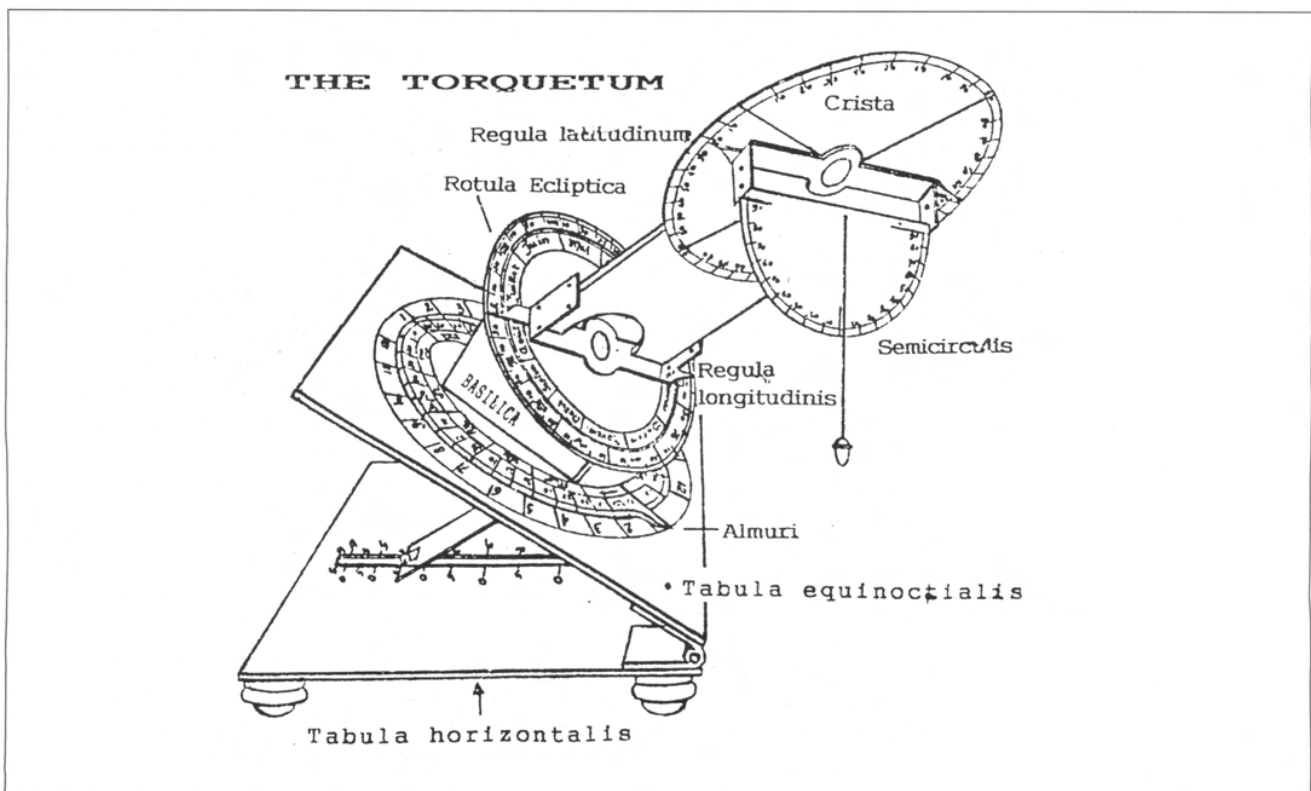


plate. Also in use, as the instrument is so cumbersome and requires manual manipulation in taking observations, it would probably be necessary to screw this down to a firm foundation. A groove bisecting the plate and parallel to one edge is provided and is aligned precisely on the local meridian line.

A second plate, the *Tabula Equinoctialis*, is hinged along one side with the southern edge of the tabula horizontalis and can be adjusted in its angle with the horizontal plate by means of the strut under this plate which serves to indicate the angle by means of the scale engraved along the meridian line. This plate is adjusted to make the complementary angle of the latitude with the horizontal plate, thus making it parallel with the equatorial plane. This plate is furnished with an annulus which is engraved in degrees and hours.

The third plate is much more complex: It pivots around the central axis perpendicular to the second plane and rests on a base called the *Basilica* and is parallel to the ecliptic plane, the required  $23^{\circ} 30'$  angle with the equatorial plane being given by the angle of the top of the *Basilica* which rests on a plate engraved with a zodiacal graduation, an index (*Amari*) is fixed to the origin of this scale, i.e. the zero of Capricorn. Most previous writers have failed to note that this scale is not regularly spaced, it is in effect the projection of the ecliptic on the plane of the equator. Its degrees mark the right ascensions of the various points of the zodiac. Apianus is the only one to make mention of this observation, it seems to have escaped the attention of Schöner and also Bailly, or at least these writers remain quite silent on this point.

On this *Basilica*, which is formed from two trapezoidal supports; rests the ecliptic plane (*Rotula Ecliptica*), the inner annulus of which is engraved with the twelve signs of the Zodiac and their subdivisions. The outer annulus carries a zodiacal calendar, which indicates the day by day progression of the Sun in the course of the year.

The graduations of the *rotula ecliptica* and of the *basilica* are evidently axes based on the diameter Capricorn/Cancer as these two plates are in the same plane of the Colure of the Solstices; and this plane is perpendicular to the intersection of the planes of the plates; Capricorn is towards the summit, with Cancer towards the opening of their angle On an axis and perpendicular to the ecliptic plate is a fourth circular plate: the *Crista*. Integral with this plate and at its foot, a first alidade with sights allows the measurement, on the *rotula ecliptica*, of longitudes. In consequence of this it has the name of *Regula Longitudinis*.

The *Crista* is graduated  $4 \times 90^{\circ}$ , it carries at its centre an axis on which is pivoted a second alidade with sights, named the *Regula Latitudinum* (Latitude Scale).

Finally, to this alidade is suspended a *Semis* or *Semicirculus*; this is a semicircle divided in  $2 \times 90^{\circ}$ , which constitute a level or clinometer. At the extremities of its diameter, marked by  $90^{\circ}$ , two supports suspend the *Semis* by means of two small pivots. The *Semis*, by its own weight, hangs in a vertical plane, and can be used to set the orientation of the alidade. At the centre of the line joining the  $90^{\circ}$ , is attached a plumb bob.

Engraved sometimes on the *Semis* are horary lines, geometric lines of height of the Sun with various hours (unequal or temporary) of the day and the various epochs of the year. But these are merely accessories.

## USE OF THE TORQUETUM

The majority of historians of astronomy have thought that the Torquetum was designed to convert equatorial or horizontal readings into ecliptic coordinates. This loses sight of the state of mathematics known in the 11th century, this applies to astronomical position, and trigonometrical ideas. The Middle Ages were not aware of the elementary formulae of spherical trigonometry, and had confused ideas about plane trigonometry in general. The concept had not yet been arrived at by the astronomers of this period to construct an instrument for these unusual measurements.

In studying these old manuscripts, the application of the Torquetum is to problems of immediate interest, yet these are often found very tenuous.

### Giving some examples to clarify the use of the Torquetum:

Placing the instrument in its working position. It is simple to place the horizontal table with its groove in the direction of the meridian, and incline the equinoctial table parallel with the equatorial plane. It is necessary now to orient the upper stage until the ecliptic table is parallel to the plane of the ecliptic.

It suffices to set the longitude alidade so that it indicates the day of working. It indicates, at the same time, on the horizontal scale, the latitude of the Sun. The alidade remains fixed in this position, the *Basilica* is rotated, with all its upper equipage, until the Sun's rays traverse the two sights of the *Regula Longitudinis*. At this instant, the ecliptic plate is obviously parallel to the plane of the ecliptic. If then the alidade for the latitude is placed on the zero of the *Crista*, it will be parallel to the alidade for the longitude; the plumb line then indicates on the *Semis* the angular height of the Sun above the horizon.

All the upper part thus adjusted, turn the *Basilica* and its equipage until the plumb line indicates zero, that is to say zero height above the horizon. Two positions of the *Basilica* corresponds to this condition: one corresponds to the rising of the Sun, the other to its setting; the angle between these two positions, marked by the *Almuri* on the equinoctial plane, give the diurnal arc and the duration of the day.

The angle travelled by the *Almuri* from the position corresponding with the rising of the sun up to where the Sun's rays cross the two sights, gives the time elapsed up to the moment of the operation, this is to say the hour *Ab-hortu*.

The position of the *Almuri* at noon is easily read, it suffices to convey the degree of altitude of the *Basilica*, which indicates, as already mentioned, the right ascension of the Sun, referred to the zero of the equinoctial table which marks the meridian. The hour of the observation can be deduced in civil or astronomical time, also the time of rising and setting of the sun, by measuring the angle traversed by the *Almuri* between the various positions corresponding to the circumstances.

The instrument may be used with a star as with the Sun, in setting the *Crista* in the same way, the longitude of the star is indicated, and the latitude gives the star latitude

Inversely, if the ecliptic plate is placed in the working position, the longitudes and latitudes of the stars may be deduced. For setting the *Rotula Ecliptica* during the night, it suffices to operate the instrument as set out at the beginning of this explanation, but at the moment of setting

of the Sun in measuring at this moment the longitude of a reference star or that of the Moon, and continuing in the course of the night in orientating the *Basilica* on the basis of this last auxiliary longitude exactly as was done during the day on the basis of the longitude of the Sun.

The other applications of the *Torquetum* have not been discussed here since they are as numerous as those of the

Astrolabe. In substance this instrument constitutes an objective configuration of the elements of the celestial sphere, as does the armillary sphere and the astrolabe. It permits, at the same time, the most facile operations, besides being much easier, and of course, very much cheaper to construct.

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## BOOK REVIEW

**SUNDIALS AUSTRALIA. Margaret Folkard and John Ward. 113 pages, 194 B & W illustrations (one unnumbered). Published by the authors 1996.** Card covers with Astrolux protection. ISBN 0 646 27581 X. Price 20 Australian dollars plus postage. The BSS may be obtaining a bulk supply.

The front cover of this second edition shows an impressive armillary sphere sundial on an equally impressive pedestal, made for a sixtieth Wedding Anniversary. It can only be described as a magnificent piece of work. Of course, sixty years of marriage itself can only be described as monumental.

A review of the first edition may be found on page 50 of Bulletin 95.2 and in the main the second edition is much the same as before except for almost twice the pages, and 2½ times the number of photographs, with an additional section described later. Within the covers is a concise coverage of the vital facts of dialling from its first vague glimpses in the mists of yesterday to the Renaissance of today.

The greatest change in the new edition is the inclusion of Section IX on the blackness and sharpness of shadows, usually ignored in dialling treatises. This is a real contribution to the scientific approach to sundials, clearly outlining the limits for accuracy of reading solar time from a projected shadow - usually totally ignored and yet having greater effect than the small errors of refraction and orientation that the majority of diallists are so concerned about. The majority of diallists make the assumption that the larger the dial, the more accurately it can be read, but this is fallacious. This section also highlights errors made by designers of sundial who have ignored the outlined restrictions. An example of this is the well-known equatorial sundial at Tower Bridge where the use of stainless steel has so many reflections in it that the time indicating shadow is hard to locate. This is confined to between the Spring and Autumnal Equinoxes, for in winter no one, except those journeying on the river, can observe the under scale at all. The reviewer brought about a security alert by stepping over the site boundary chain to see the other side of the dial, and has only glimpsed it from a

distance whilst on a pleasure boat.

There are six pages entitled "Sundial Dictionary" which most of us would term a glossary, whilst Section XII is headed "References" where one normally uses "Bibliography", and here there is no order of any kind in the listing, chronological or author, for example.

The book is a typical desk top publication, and as the authors have placed so much stress on the presentation of shadows, the same techniques should have been applied to the text. The contrast ratio is high but it is well known that the eye takes in a line of 3-4 inches in length in a single glance, but to read across the entire width of an A4 page is much more demanding, especially to home on the start of the next line. A two-column text layout would have been infinitely preferable for ease of reading.

If there is an area untouched, it is that of easing calculations by the use of a programmable scientific calculator or computer. The computer can do all the work in a fraction of a second, so a brief mention of its possibilities is the least that could be included.

As an introduction to the art of dialling for someone without previous knowledge, the book is hard to beat. There is enough information clearly given in the contents to allow anyone to reach an adequate standard to appreciate the majority of simple sundials. It is a competent work by two people who are practitioners of the art and know what they are talking about. It is worthy of a place on the bookshelf of everyone with an interest in dials and dialling. Of course it must be remembered that the book is written for those in the Southern Hemisphere, but it is a bit of fun for northern hemisphereans to stand on their heads occasionally.

This treatise, with a little expansion and some colour illustrations, would make a fine printed book. The material is worthy of better presentation, although it must be said that the quality of the illustrations is both adequate for the purpose and excellent.

For those who wish to buy the book direct, the address is, Sundials Australia, 3 Bedford Street, Kensington Park, SOUTH AUSTRALIA 5068, the added postage by surface mail will be about £2.50.

CHARLES K. AKED



## READERS LETTERS

### NEPTUNE WORKS

Since the publication of my account of a shipyard sundial on Tyneside (Bulletin 93, 3, Oct. 1993) I have gained sight of a copy of the autobiography, completed by family members after his death, of its creator, the shipbuilder John Wigham Richardson. It is a handsome volume, published privately in 1911, three years posthumously, in a limited edition of two hundred and fifty copies, finely printed on handmade paper.

On p.252 the dial referred to in my paper is described without adding to the information I gave, while on the same page a reference to Mr. Richardson's appendix on dial construction in Mrs. Alfred Gatty's "Book of the Sun-Dial" appears. Intriguingly, on the same page there is a description of a second dial at Mr. Richardson's former Neptune Yard at Walker. It reads as follows:

"In the directors' luncheon-room at the Neptune Works is another interesting dial for which he made the calculations and design. A large ground-glass window forms the dial face with the lines and figures etched on it. The gnomon is bolted to the exterior of the glass and its edge is flattened at one point to make a disc through which a hole is drilled. By this means a spot of light appears in the shadow of the gnomon, and when that spot touches the etched curve of equation of time, it is noon at Greenwich. Furthermore, the dial, being translucent, is read from the inside of the room, and has--this advantage, that the shadow travels round the same way as the hands of a clock."

I have never previously heard of this dial but recently I was able to visit the building which formed the former offices of the Neptune Yard. It was no longer in use but was undergoing extensive renovation. There was no trace of the dial nor did I find any news of it. The room which had most probably been the directors' luncheon room referred to was altered and extended some years ago and the original windows were gone. So at present we are left only with the description of the dial and the hope that further information about it will in time turn up.

FRANK EVANS

\* \* \* \* \*

### SUBSCRIBE THE SUNDIAL MAILING LIST

Everyone who can exchange electronic mail with an addressee in the Internet can now subscribe to a mailing list connected with sundials. This kind of electronic mailing list works like an institution which copies a letter sent to it for all members of a list. The electronic link sends all e-mail to the subscribers.

You can ask all kind of questions connected with gnomonics, report about your latest sundial work, announce the release of a new book or whatever. And it's free except for the usual connect costs depending on your local provider for Internet access. If you don't need full online features like WWW, ftp or telnet you can connect to a local electronic mailbox which delivers your mail to a gateway to the Internet. All you need is a computer with a modem and the appropriate terminal software. Help is given in

computer magazines.

The mailing list called sundial has been setup at the University of Cologne. To subscribe just send the following two lines in the body of your mail (no subject needed) to the address [majordomo@rrz.uni-koeln.de](mailto:majordomo@rrz.uni-koeln.de)

subscribe sundial  
end

If you want to unsubscribe you have to send to the same address:

unsubscribe sundial  
end

If you want to send an article or a letter to all other subscribers of the list, please use as the addressee: [sundial@rrz.uni-koeln.de](mailto:sundial@rrz.uni-koeln.de)

Although the mail reflector is situated in Germany the language in the mail is English as this list should be open for everyone in the world.

DANIEL ROTH  
([roth@ph-cip.uni-koeln.de](mailto:roth@ph-cip.uni-koeln.de))

\* \* \* \* \*

### SUNDIALS IN THE WWW

Within the fast growing World Wide Web there is an enlarging number of pages about sundials. For the readers who have access to the WWW it might be interesting to visit the site

<http://www.ph-cip.uni-koeln.de/~roth/slinks.html>

Instead of printing lots of such URLs (uniform resource locator) you simply point your browser to that site and can go further without typing such cryptic addresses. It is a text only page without multimedia stuff to give you a fast access.

DANIEL ROTH

\* \* \* \* \*

### MAGNETIC COMPASS DIAL

At this moment I have got a question about a small portable sundial. It is a dial in a round wooden box with a diameter of 75 mm. It is a magnetic dial, that means, in the middle there is a magnetic disk, on which the dial is drawn, so the dialface is positioned in the north-south direction automatically.

At the outer side of this disk is a 24 hour scale, divided in quarters. On this disk we find the following text:

C. Essex & Co London  
Entered at Stationers Hall  
EVEN MORN NIGHT NOON  
N S E W

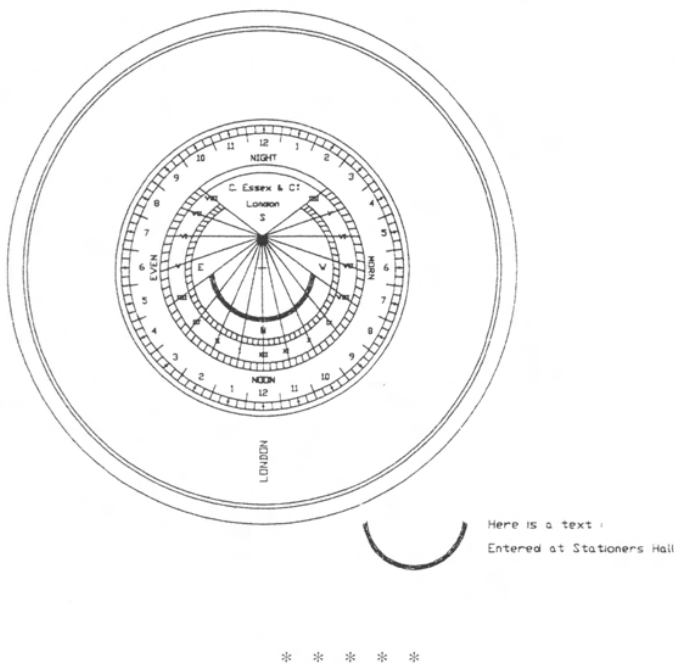
The hourscale is divided in 15 minutes.

On the not movable part of the dial many names of places all around the world are written. The name LONDON is written in capitals, all the other places are written in small figures. I only placed the name LONDON on my drawing. My drawing is no more than an impression of this dial and is drawn at a larger scale.

Do you know about the name Essex and do you know anything more about such a dial? Is it known in which

periode such a dial could be made? I would be pleased if you can tell me more.

FER J. DE VRIES  
Netherlands



**ASTRO COMPASS**

My heart rejoiced when I read Michael Hickman's article "Swords into Ploughshares" (page 52 of the February 1996 issue of the BSS Bulletin) and saw the illustration of his astro-compass. I was, you see, one of those he wrote of who flew the Atlantic during the 1919-45 war.

Trips were necessarily long, the task was to analyse the weather situation out there, to encode information and to transit this to the UK so that forecasts could be made in time to be used by those planning and flying raids over enemy territory. We were, for most of the time, outside the range of beacons and other land-based aids; accuracy was essential, and we relied on astro-navigation.

From time to time I would leave the controls to my second pilot and, after a sandwich and a cup of coffee, I'd put my head and sextant into the astrodome and measure some relevant angles - yes! all those lovely names he mentions and more besides. Then followed a spell with paper and pencil and I would pass the estimate of our position to the Navigator. Only rarely did he agree with it.

It was here that I first came to grips with the relationship between time and longitude. I have since made a somewhat more intimate relationship with John Harrison and his work - clocks and sundials, of course.

But to that astro-compass. I have reason to think that it may be the very one I used all those years ago, and now there it sits on Michael's desk. Bought for twenty-two pounds, indeed. If I am right, and if he will please examine it very carefully, I think he may find that the ever-prudent Air Ministry of the day will have stamped my initials on it. Adjacent to the Crown perhaps?

ARTHUR MORETON

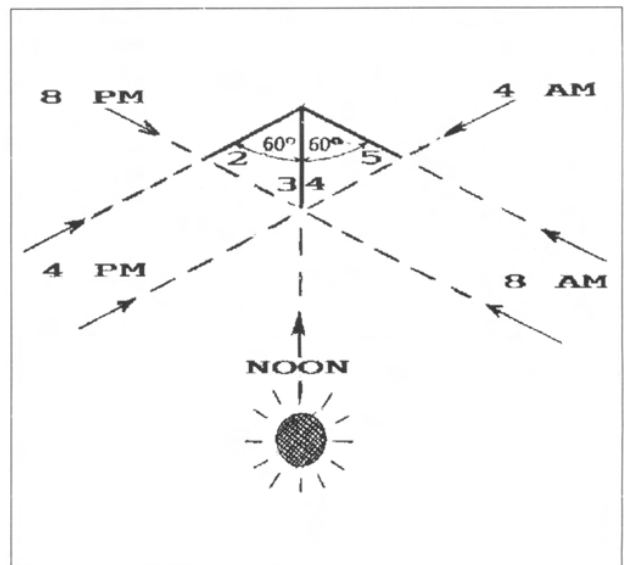
\* \* \* \* \*

**OPEN BOOK DIALS**

I was interested to see Peter Lamont's Open-Book Dials (Bulletin 96/1) especially the polar type in Photo 5. By a different route, I had arrived at a variant of this, in which the central gnomon becomes another two pages of the book. Each of the four pages serves in turn as gnomon or dial. The angle between separated pages is 60+60 degrees and a sixteen hour day is covered, with an almost uniform spacing of the hour lines.

If the pages are notionally numbered from 2-5, then we have:

GMT	DIAL-PAGE	GNOMON-PAGE
4-6 AM	4	5
8-12	2	3/4
12-4 PM	5	3/4
4-8 PM	3	2



JOHN SINGLETON

\* \* \* \* \*

**MAGNETIC COMPASSES**

I refer to the letter from Australian Dialists in Bulletin 96.1 about the difficulty of finding adequate small magnetic compasses for use with pocket/portable dials.

I fear they may have problems in finding what they want: I have been searching for a long time without success. Scout shop offerings seem to be inferior to what I remember prewar.

Marching/map compasses as sold for motorists and orienteers seem the only hope. I found a very nice oil filled compass in the local AA shop recently, drawbacks - price £5.99 and 55mm diameter. However I recall that many of the pocket dials one sees in museums are fitted with quite large magnetic compasses.

The AA example, their catalogue number 22622, manufacturer "Stesco", would not look out of place and is certainly practicable, being nice and steady in use.

Similar, but not satisfactory, compasses can be found in W.H. Smiths.

I have written to inform the Bournes in Moruay.

J. C. SLATER

\* \* \* \* \*

Continued on page 41 . . .

## THOMAS HARDY'S DIAL

R. A. NICHOLLS

The famous writer Thomas Hardy, born in 1840, lived most of his life in Dorset. After his success as a novelist, he built a house at Max Gate, just outside Dorchester, and towards the end of his life he designed and commissioned a vertical dial to be put on the south wall of this house.

Hardy came of Dorset yeoman stock, of which he was very proud, but he became, by his own endeavours "a man of large and varied culture", in the words of the *Dictionary of National Biography*. This culture included music and architecture, which he practised before he became famous as a writer. His training included several years in London, during which he read and studied widely.

He moved into Max Gate in 1885, but the house was frequently altered and extended, and the dial itself was positioned on a small turret erected in the late 1890's. Figure 1 shows Max Gate from the east, with the dial visible on the south face of the turret. This picture is from the sale particulars of the house which was sold by auction after Mrs Hardy's death. The dial is said to have been designed by Hardy to show GMT at Max Gate (longitude  $02^{\circ} 25' W$ ), and was commissioned from local iron founders, Lott and Walne in Fordington, Dorchester, in 1926 or 1927. This firm no longer exists and no written records of the design or commissioning have been found. The dial was not finished and erected until after Hardy's death in 1928. Figure 2 shows the dial, without the gnomon, on the ground in the early 1990s, when it was repaired and repainted. The dates 1885-1928 refer to

Hardy's years at Max Gate. The Latin motto (What of the Night?) is in the tradition of the somewhat mournful thoughts frequently inscribed on sundials. A story exists that when Hardy was taxed with this mournfulness, he replied with a quote from Psalm 30 - "Joy cometh in the morning". The presence of the date is indicative of the resolve of Hardy's (second) wife that after his death, the dial should be finished and erected, and she ensured that the commission was completed, despite doubts raised about the competence of the Dorchester firm engaged on the work.

The wall on which the dial is placed declines  $5^{\circ}$  west of south. Measurement of the angles between hour lines shows that the dial is indeed designed and constructed to show GMT for a dial at that longitude and for the actual wall aspect. The gnomon shadow crosses the hour lines within  $\pm 1$  minute of the time, corrected for the usual equation. This is therefore a well designed - and pleasing - dial, and it is obvious Hardy must have had dialling skill. It is not clear where he obtained this skill. Much of his library exists in a replica of his study in Dorchester Museum, but there are no dialling books - not even Mrs. Gatty. The rest of his substantial library was dispersed by auction after Mrs. Hardy's death, but the catalogue for this auction does not include any books on dialling, except possibly Chambers Encyclopaedia 1905 with an article on dials. Professor M. Millgate, biographer of Hardy, and joint editor of his Collected Letters, points out that his schooling



FIGURE 1

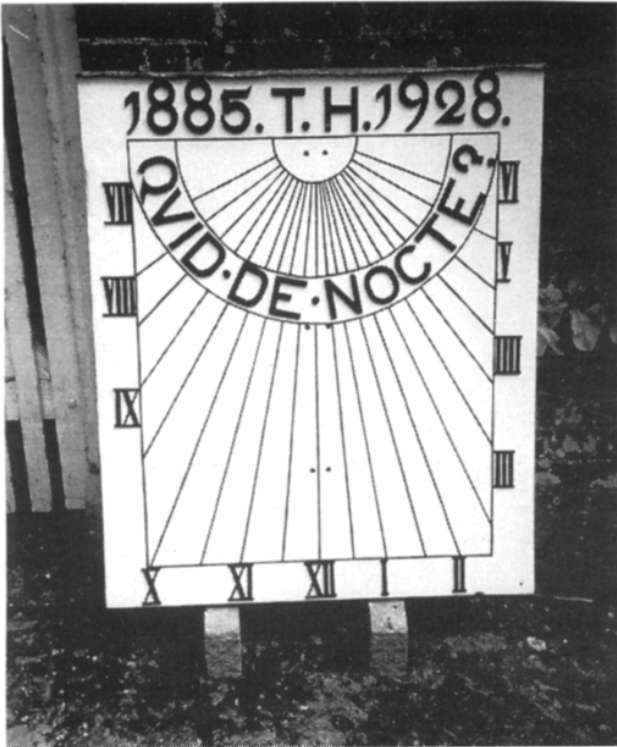


FIGURE 2

and training as an architect would have given him the necessary geometrical and trigonometric skills.<sup>1</sup>

It is indisputable that Hardy had an interest in sundials as such, however. This may have arisen from his work as an ecclesiastical architect and the presence of many dials on churches in the areas of his work.<sup>2</sup> A general interest in astronomy is apparent in the novel *Two on a Tower* published in 1882, but the first definite indication of dialling interest is in the *Wessex Poems* published in 1898. This contained line drawings by Hardy himself, and the first of these is of a dial placed on a tower (Figure 3). The dial is a vertical south, with apparently a solid gnomon. The hour lines are as correctly spaced as is feasible for such a

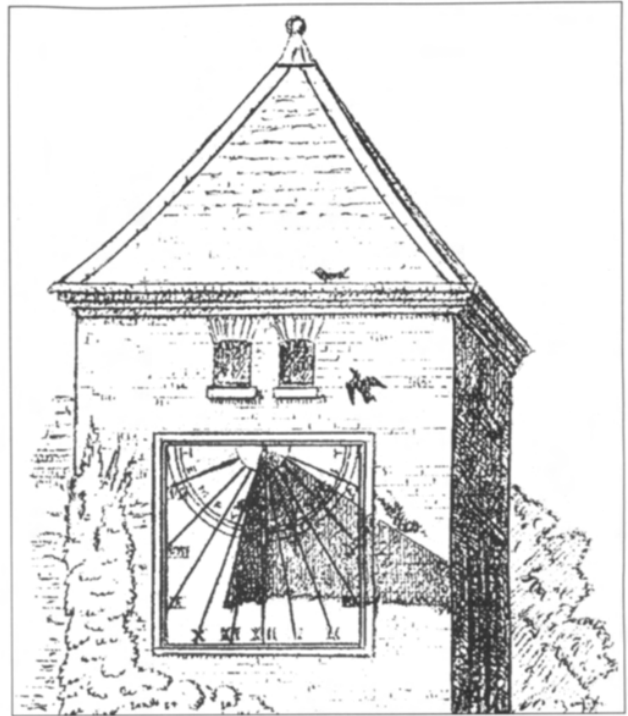


FIGURE 3

small sketch, and the tower is in fact the turret recently erected at Max Gate. The motto on the dial is the hackneyed *Tempus fugit*.

Further evidence is in a short note to Richard Garnett, sent in September 1901. Garnett was Keeper of Printed Books at the British Museum at the time. It is possible that this connection may have given Hardy access to dialling literature. Hardy and Garnett were friends, and corresponded freely. Hardy's letter says (inter alia):<sup>3</sup>

"I have taken note of the address for second hand dials. Many thanks. I think however of putting up an 'erect and direct' one (as the old books used to call them). But I like dials so much that I may get a horizontal one also."

It would be interesting to know that address, and which are the "old books" he had read. Garnett's letters indicate that Mrs. Hardy was also interested in acquiring a dial.

In December 1902, on Christmas Eve, Hardy sent two postcards as Christmas greetings, both showing a vertical south dial with a solid gnomon.<sup>4</sup> One (in English) was to Hardy's sisters (Figure 4) and one (in Latin) to Alfred Pretor, a classical scholar, a friend of the Hardys (Figure 5). The discrimination between recipients in the use of English and Latin seems a sign of the (then) times. Both dials are near enough correctly drawn.

For whatever reason, nothing further is recorded until the 1920s and the actual making of the dial. The manufacture was under the care of Mr. O. C. Vidler, General Manager of Lott and Walne, who supervised the erection of the dial. Mr. Vidler was active long after Hardy's death, and his daughter is still alive and remembers the occasion, which took place in the summer, presumably in 1928. The records of Hardy's life and work kept at Dorchester Museum contain two very interesting photographs taken at the works of Lott and Walne, the buildings of which still exist.

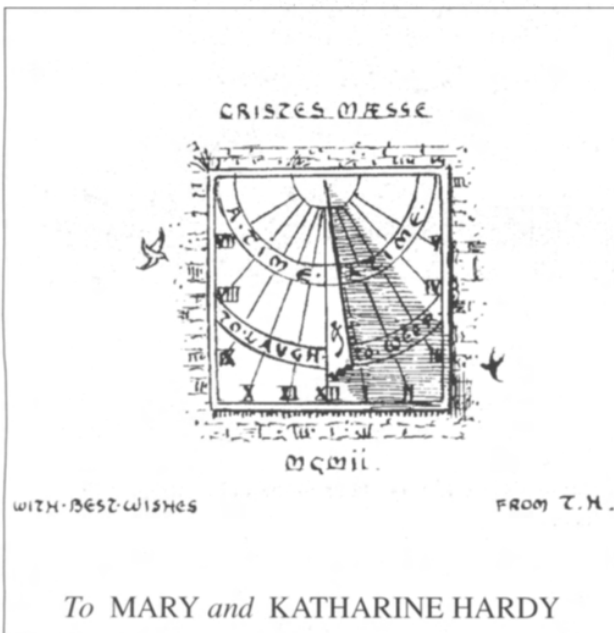


FIGURE 4

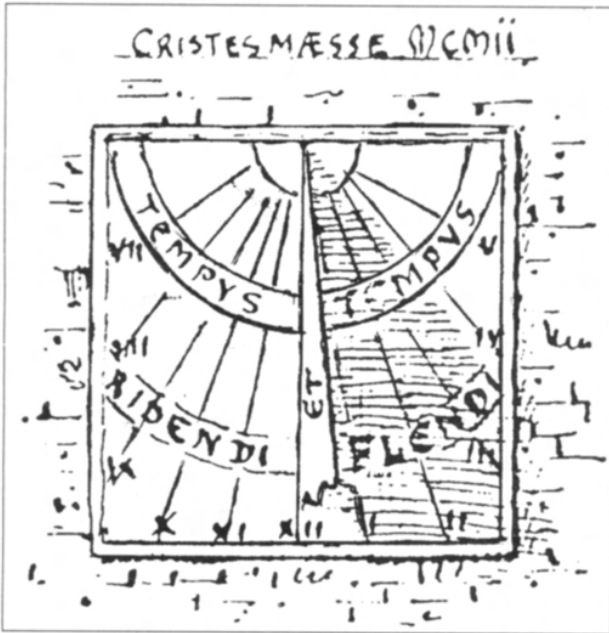


FIGURE 5

Figure 6 shows a dial face apparently without markings, and with a solid gnomon like Hardy's sketches. Figure 7 shows what appears to be the actual dial in front of the same window, presumably just before erection. It is not clear who took these photographs, nor for what purpose. The aspect of the wall at Lott and Walne is not that of Max Gate, so the purpose could not have been to test for accuracy, unless the dial face was specially angled. This is not apparent in the photographs.

Max Gate is now owned by the National Trust, and is open to visitors at set times. The interior remains as it was in Hardy's lifetime, but there are none of his possessions there. The dial is easily viewable and is in excellent condition, see Figure 1.

#### REFERENCES:

1. Professor Michael Millgate. Private communication. 1995.
2. *Fixed dial locations - the Sundial Register*. British Sundial Society, 1995.
3. *The Collected Letters of Thomas Hardy*, ed. Purdy & Millgate. Vol II p. 299. OUP, 1980.
4. *Ibid.* Vol. III pp. 44 and 45. OUP, 1982.

#### ACKNOWLEDGEMENTS:

1. Most of the information concerning Hardy's connection with sundials is based upon the collection of Hardy memorabilia and knowledge of Thomas Hardy's life gained over many years of research and help to Hardy scholars by Mr. and Mrs. T. Jesty, who were tenants of Max Gate from 1971 to 1993. Their help is gratefully acknowledged.

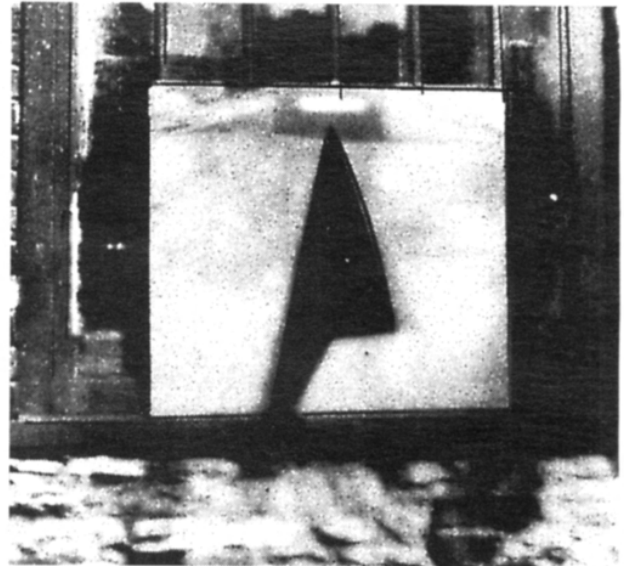


FIGURE 6

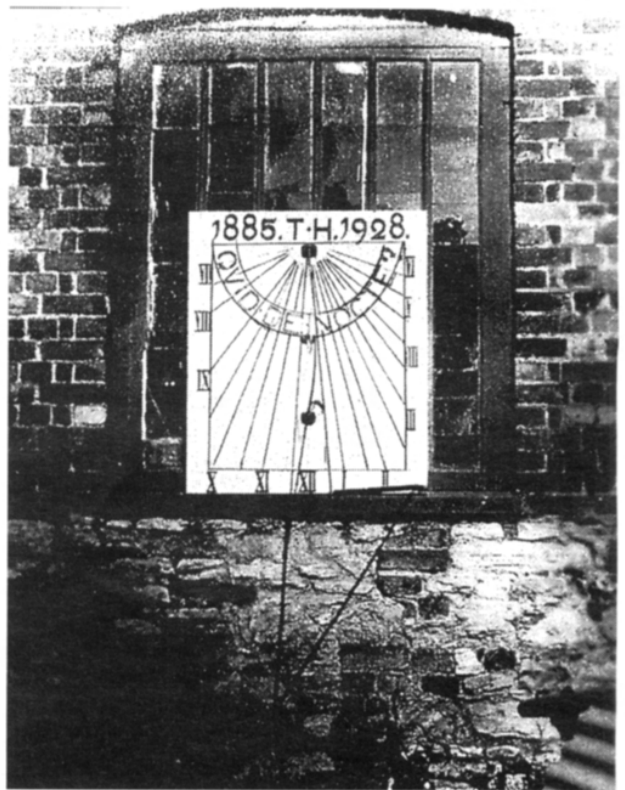


FIGURE 7

2. The information from the *Collected Letters of Thomas Hardy* is included by permission of Oxford University Press.
3. David Young kindly checked the delineation of the dial face.

## GROOMBRIDGE PLACE GARDENS

CHARLES K. AKED

The day broke fine and sunny, just the day apparently to see the opening ceremony of the world's first fountain sundial. It was quite a long journey from West Drayton by car. On passing through Royal Tunbridge Wells, the sight of a particular hotel reminded the writer that it was over twenty years since he had stayed there last, when he acquired his copy of the 1900 edition of Mrs. Gatty in spite of then only having a passing interest in the subject of dialling. It was priced at £15 but a little haggling brought this down to £12 10s when the seller found the writer was interested in horology. The writer has certainly had his money's worth out of the book since.

Groombridge is a little off the beaten track, along the A264 and B211Q westwards from Tunbridge Wells via Langton Green, and lies some distance from the road itself. The house is very old, and the gardens have developed over the centuries. The present owner Mr. Andrew de Candolo has spent lavishly to restore the extensive gardens to their former glory, plus restoration work on the house. The house is not open to visitors but the gardens are popular and open to the public.

In the grounds are several sundials, and the Secretary of the BSS and the writer toured the gardens and the immediate area of the house search of these. It is to be regretted but only one dial of the seven found was correctly orientated, no one was aware of any error. The very large equatorial sundial in the lower garden near the house was not only incorrectly orientated, the gnomon was reversed, with its arrow head pointing into the ground and wrongly angled.

Only the horizontal dial near the front of the house was correctly set in place and it is quite a nice example. Inside the house, where the secretary and his wife, plus the writer were invited after lunch, there are two magnificent window dials, alas set into east facing walls and useless for giving indications of time from the sun. The gnomons are missing, the owner thought that the replacement of these would correct the situation, but it had to be pointed out that although it was only just past noon (on the longest day of the year), no sunlight fell upon the dial. It was obvious these dials had been removed from a south-facing window and just put there for decoration. Much care was taken to secure photographs of these, so the reader can imagine what the writer felt when having expended much time on photographing the dials, to discover some hours later at another dialling site, that there was no film in his camera and the whole day's work was wasted.

But to return to the fountain dial. This took the form of a very large pond with its periphery flush with the surrounding lawn, a perfect trap for catching small children, with a shoal of piranhas awaiting feeding. In the centre of this pond, about ten metres in diameter, played a vertical jet of water, rather less in height than the radius of the pond. Around the stone circumference of the pond were brass figures laid loosely. On finding the "designer" of this "dial", it was discovered that he had no idea of the principles of dialling, nor that it was not possible to construct a dial with a vertical gnomon and fixed numerals on a circular scale. In the event it did not matter at all, the shadow of the "gnomon" never fell on the periphery whilst

the writer potted around the dial pondering on the crass optimism of the unlearned. The furniture of the dial was beautifully made, and greatly admired by the assembled crowd of invitees, not one of whom enquired as to how the sundial was supposed to work, but were more interested in the fish waiting expectantly in the hope of being fed.

It was just before he left the fountain sundial that the Secretary's wife made an observation to the writer and his overlooking of such a decorative feature drew his attention to the need for a stronger pair of spectacles. Perhaps it was this which caused him to be less than observant in using his camera later. Be that as it may, a pleasant day's outing was spoilt by the loss of all the visual information which should have been recorded, a misfortune which had not occurred since 1984, and the reason why there are no illustrations to this text apart from the photograph taken at St. Mary's Church, Harrietsham when the contretemps was discovered and rectified too late to be able to retrace the events of the day. No wonder Shakespeare wrote "where ignorance is bliss, 't'is folly to be wise".

Wait for a suitable sunny day and Groombridge Place Gardens is the ideal spot for a day's outing with the family. Plenty of parking space and enough gardens to last the whole day, with the sundials thrown in for good measure. Permission will be required to photograph the three dials near the house and the stained glass window dials. Make sure you have film in your camera, or like the author, your visit will be largely wasted (from a dialling point of view).



Sundial at St. Mary's Church, Harrietsham. Motto reads "Oh, Send out Thy Light and Thy Fouch". John Drury and John Hogben, Churchwardens, 1853. *Truth*

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