The British Sundial Society

BULLETIN

VOLUME 16 (i) MARCH 2004

Front Cover: *Dial at Culzean Castle [Photo, C. M. North)*

Back Cover: *'Precision Sundial' adjacent to CSIRO Radio Telescope, Parkes, NSW, Australia 33°S 148°E [Photo, M. Kenn]*

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BULLETIN

OF THE BRITISH SUNDIAL SOCIETY

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EDITORIAL

Two of the contributors to this issue are encouraging accuracy, and the awareness of it: Mike Cowham invites us to read shadows with greater precision; and Douglas Bateman tells us of the accuracy limits on our everyday magnetic compasses. For pure aesthetic enjoyment we have a fine series of photographs in 'Dial Dealings'; and another series of photos showing Trinity College Sundials. Then, to raise a rueful smile, comes Tony Wood's 'Sonnenuhr, Achtung!' We hope that all readers will find something to please, and nothing to blame, in the March issue.

THE SOCIETY'S NEW PATRON: THE HON SIR MARK LENNOX-BOYD

From its inception, the British Sundial Society has been fortunate in having had a Patron who has taken a keen interest in the affairs and progress of the Society. Consequently, it has given me great pleasure to announce that the Society now has a new Patron, who is not only a worthy successor to the late Earl of Perth, but one who has long been an active member on the Society, The Hon Sir Mark Lennox-Boyd (membership number 56).

Sir Mark Lennox-Boyd was born in 1943, educated at Eton and Christ Church, Oxford, where he read Oriental Languages. He went on to study at MECAS (the Middle Eastern Centre for Arabic Studies) in the Lebanon, and, later, at the College of Law in London. He was called to the Bar of the Inner temple in 1968 and practiced as a barrister until 1974, when he became a parliamentary candidate. He was elected a Member of Parliament (Conservative) for Morecambe and Lonsdale (later Lunesdale) in 1979 and held this seat for eighteen years until 1997. During this time, he became Parliamentary Private Secretary (PPS) to the Chancellor of the Exchequer, Lord Lawson, (1981-1984); Government Whip (1984-1988); Parliamentary Private Secretary to the Prime Minister, Baroness Thatcher, (1989-1990); and held office as Under Secretary of State at the Foreign & Commonwealth Office (1990-1994).

It is remarkable that, during this busiest of periods, when he was Parliamentary Private Secretary to the Prime Minister, Sir Mark found the time to join the British Sundial Society, being one of the first hundred members. Indeed, the Membership will recall his article that appeared in the October 1992 issue of the *Bulletin,* describing his magnificent Holker Hall 1.5m diameter slate *scaphe* sundial, that he had designed and delineated, which had been unveiled earlier in the year on 5th June 1992, in the presence of His Royal Highness the Duke of Edinburgh.

Sir Mark is a modest man, who has been interested in sundials for over thirty years. Like many others, whilst browsing in a bookshop in 1969, he came across a book on sundials, in this case the work by Frank Cousins, which he bought and read with much enjoyment. Thereafter he began to collect books on the subject, contenting himself with the study of the *Art of Dialling* until such time as he took up designing dials. His first outstanding achievement in this field was the sundial commissioned for Holker Hall by Lord and Lady Cavendish. Since then he has designed numerous other dials, not least his La Meridiane project in Italy, and is currently engaged in writing a book on sundials.

Sir Mark's other interests include architecture, art, design, gardening, geometry and travel. He is married to a successful Italian landscape designer, the Lady Arabella Lennox-Boyd, and has one daughter, Patricia, who like many of the young modern generation, is evidently well advanced in all the latest computer technology!

A Member of the Court of the Worshipful Company of Fishmongers, Sir Mark Lennox-Boyd was Prime Warden of the Company in 1998. He is a Trustee of the Georgian Group. With such a career, and with such remarkable knowledge and experience, Sir Mark is uniquely qualified to be the Patron of the British Sundial Society, and the Membership can be sure that he will fulfil this role with the Society's interests very much at heart.

Christopher St J H Daniel
Chairman

DO WE NEED SHADOW SHARPENERS?

MIKE COWHAM

The sundial in most people's eyes is a non-precision device. Many people do not understand the Equation of Time, Latitude or Longitude errors or even the necessity to keep the gnomon correctly aligned with the Earth's axis. Those of us who study sundials appreciate these and many other facts but are we still able to read our dials with precision? The answer is usually 'No'. One of the main reasons for this is that the shadow is not sharp at the edges. The shadow from a normal triangular gnomon has a region of indecision, more properly the region of the shadow known as its penumbra: Fig. 1. When reading a dial we try to estimate the mid-point of this fuzzy shadow. Quite often we will get it wrong due to the various contrasts of the dial plate, shadow, surface patination, background illumination etc. This penumbra region is due to the finite size of the sun's disc, which subtends an angle of around 0.5° at the surface of the earth. This 0.5° represents an uncertainty of around 2 minutes a far as the reading is concerned: Ref. 1.

This basic physical fact seems to limit our quest for precision. Several people have tried to produce shadow sharpeners with limited success, but the basic problem still remains.

Some quite simple types of gnomon overcome these problems to a great extent. Take for instance the noon mark. This consists of a gnomon that is an annulus where the sun's rays are shining through its central hole onto the noon line. The shadow is therefore the ring around the spot of light. This spot is circular, (or more precisely elliptical),

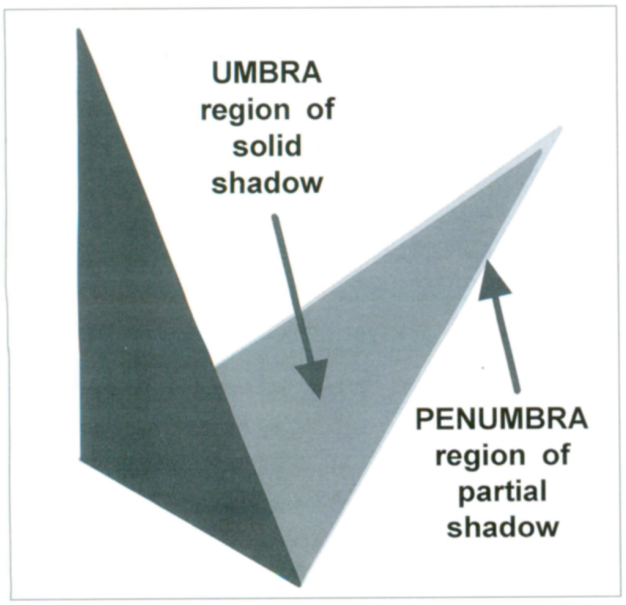

Fig.1. Shadow from a triangular gnomon.

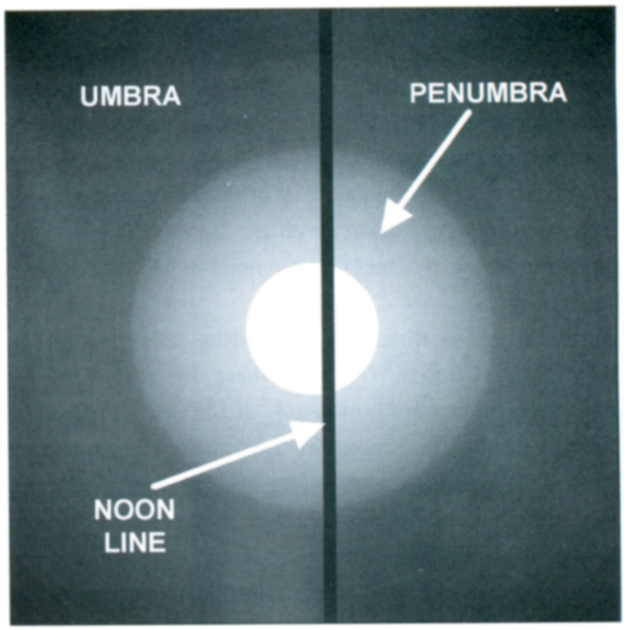

Fig.2. Shadow from a circular aperture.

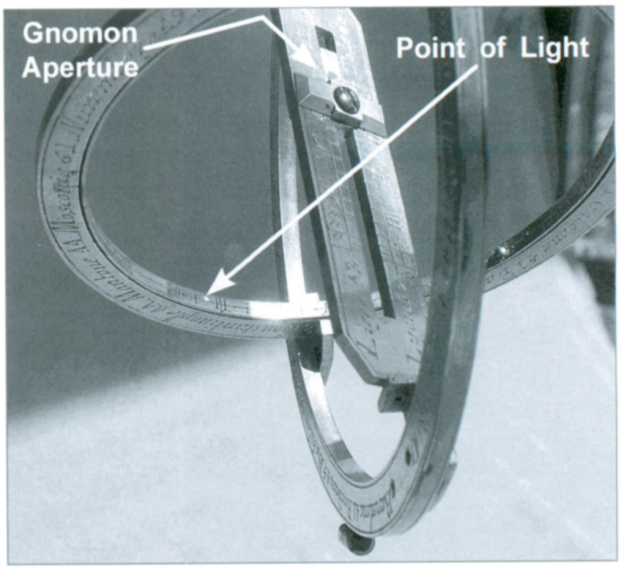

Fig.3. Universal Equinoctial Ring Dial with pinhole gnomon.

and it is relatively easy to estimate its true centre: Fig. 2. There is little indecision as the shadow is symmetrically positioned around the correct point. This type of gnomon has been used on various types of dial, in particular the Universal Equinoctial Ring Dial, which is renowned for its accuracy: Fig. 3. This gnomon may also be employed on many horizontal and vertical dials. Its main problem is that as the sun travels away from noon, (or other prime direction), the light through the aperture becomes restricted due to the fact that it is passing through the circular aperture at an ever increasing angle. Even for an aperture of

virtually no thickness the light will be totally cut off before 6am or after 6pm. In the case of the ring dial, its user constantly turns the gnomon so that the sun's rays can pass directly through the aperture. If necessary, in order to 'sharpen' the spot the gnomon can be rotated slightly to give a narrow elliptical spot of light. Similarly any gnomon aperture could be turned to suit the sun's direction but such an arrangement would be impractical, especially on a large vertical dial.

Another solution to the problem can be presented by a rod gnomon of a finite but constant thickness. Here the sun's light falls on both sides of this rod giving a shadow that is symmetrical around the desired line. As with the aperture type of dial it is relatively easy to estimate the centre point of such a shadow. The diameter of the gnomon is not too critical but should be such that it subtends an angle of at least 0.5° to the dial plate giving regions of both umbra and penumbra. A further advantage will be found with this type of gnomon in that where it is used for a horizontal or south facing vertical dial the rod's origin can be in the dial plate: Fig. 4. In this case, shadows near to the origin will have a clearly defined umbra and further out just a penumbra. This feature should allow the dial to be read with even more precision. To take advantage of this, the dial markings should be arranged to run close to the root of the gnomon. A thin rod gnomon is not as rigid or as vandal proof as the more normal triangular gnomon and may not be suitable for horizontal dials but vertical dials should be relatively safe from damage.

A well-known family of dials that use this principle are portable string gnomon dials. These were some of the earliest pocket dials ever made with examples going back to at least the 16th century. In the case of the diptych dial,

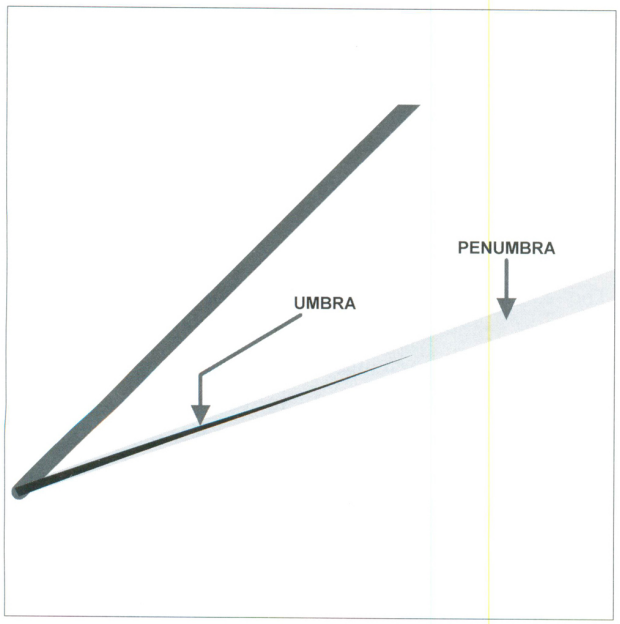

Fig.4. Shadows produced by a thin rod or string gnomon.

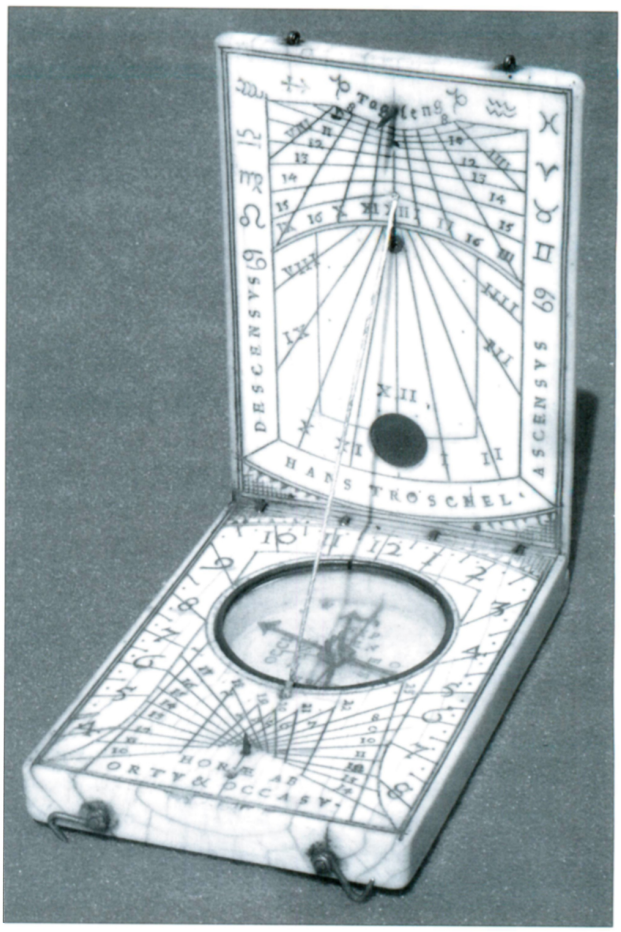

Fig.5. Ivory Diptych Dial by Hans Troschel of Nuremberg, c1610, with string gnomon. Shadow at 11:30.

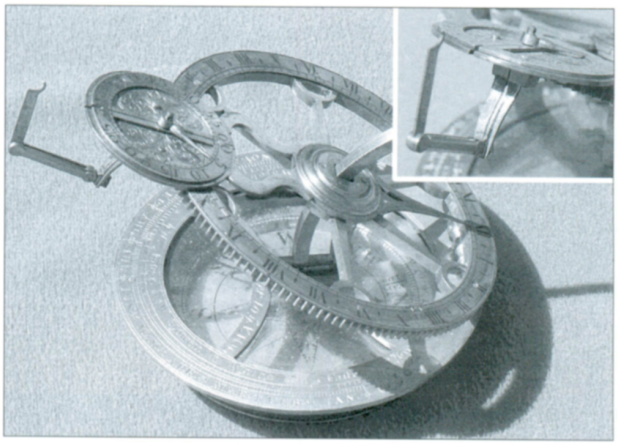

Fig.6. Thin blade gnomon used on Minute Dial by Thomas Wright of London, c1732. Inset: Actual shadow of the gnomon close to the fiducial line.

the gnomon is anchored at both ends and their makers have delineated both horizontal and vertical dials using the same string gnomon: Fig. 5. The armilliary sphere similarly uses a fairly thin gnomon and most of these can be used with reasonable precision by estimating the centre of the shadow line. Many other precision or 'minute dials' use similar principles utilising either a pin hole gnomon, a taut wire gnomon or a thin blade gnomon: Fig. 6.

Having made the case for these thin gnomons and seemingly against the triangular gnomon as fitted to most horizontal dials it would be a pity to see these often wonderful pieces of art disappear. We must retain them for their artistic beauty and perhaps put up with the possible lack of absolute precision. After all, the sundial should be as much a work of art as a time teller.

REFERENCE

1 A.A. Mills: 'Sunlight and Shadows' *Bull.BSS.* **96.1,** 22-27 (1996).

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SUNDIAL WITH A CRICKETING THEME

D A BATEMAN

A few kilometres south of Maidenhead, Berkshire, is the village of Holyport. The village is in the parish of Bray, and the Parish Council decided that their principal millennium project would be the construction of a sundial.

The concept was due to the Chairman of Bray Parish Council, Geoff Hayes. His role did not end there for, as part of a 'hands on' approach, he designed and built the brick plinth and raised square as a gift to the Parish. The bricks are called 'squint' bricks that have a 45° angled face, and

Fig.1. View of Millennium Sundial, on green of Holyport, Berkshire.

Fig.2. The Sundial face.

Fig.3. The Cricketer himself.

were hand made by the Micklemersh Brick and Tile Company Ltd of Romsey. Within the plinth is a time capsule containing items selected by children from schools within the Parish. The bricks that radiate from the plinth are aligned with the points of the compass.

The cricketing theme arose because cricket was played on the green from 1846 to 1963, and the village claims to be amongst the earliest village cricket clubs. In order to have the correct dress for the cricketer on the unusual and charming gnomon, Mr Hayes' son went to Lord's Cricket Ground to research the dress that cricketers would have worn in 1846.

The sundial was designed by Edwin Russell with the cricketer sculpted by his wife Lorne McKean. Joanna Migdal did the engraving of the plate with the equation of time. Brookbrae Ltd were in overall charge of the manufacture, and made the capital from a fine grain white reconstituted stone. The hour lines and numerals are deeply moulded into the capital, and delineated for summer time.

Acknowledgements are due to members John and Gillian Churchill, Maidenhead, who were aware of the dial and suggested this tribute to a very fine dial, and one which is guaranteed to bring a smile.

SUNDIALS AT TRINITY COLLEGE CAMBRIDGE

JOHN DAVIS

INTRODUCTION

Trinity College Cambridge is by no means the oldest of the Cambridge colleges, being founded in 1546 by Henry VIII, but it is the largest and richest. It has a long history of scholarship in mathematics and natural philosophy with its alumni including John Dee (1527-1608), Francis Bacon (1561-1626), the great Isaac Newton, Charles Babbage (1791-1871) and the Astronomer Royal George Airy (1801-95). Thus it is natural that sundials should feature amongst its architecture and work.

AN EARLY DIAL

The earliest known dial at Trinity was painted and gilded in 1672 and was located over the Hall stairs in the Great Court. It is depicted in the Loggan print of 1690 in Cantabrigia Illustrata, mentioned in Willis & Clark[1] and reproduced in Fig 1. It is clearly seen to be an East dial with lines for the solar declination. The dial would have been in place around the time (1661-96) that Newton was Lucasian Professor of Mathematics at the university but there is no evidence that he designed it, even though he is known to have made sundials as a boy[2]. Although the entrance to the stairwell is still present the dial is no longer in there, its place being taken by a carved coat of arms. It is likely that the dial was of painted wood and that the requirement for repeated repainting proved too onerous.

TRINITY OBSERVATORY

After the restoration of the monarchy, Trinity's Master, Richard Bentley, wanted an observatory for the college and, despite Flamsteed's advice that the site was unsuitable, he had it built over the King's Gate, leading into the Great Court. He got some of the necessary finance from the will of Thomas Plume (1630-1704) the vicar of Greenwich and Archdeacon of Rochester. In addition, the money was to maintain a professor of astronomy and experimental philosophy. The first of the Plumian Professors of Astronomy was Roger Cotes (1687-1716) who equipped the Observatory; later, George Darwin (the son of naturalist Charles) was appointed to the post in 1883.

A 1703 manuscript inventory in Trinity's Wren Library (completed 1695) lists thirty of the scientific instruments held for the as-then unbuilt Observatory[3]. Some of the descriptions are rather cryptic and not all of the instruments have been identified but many of them are now on display in the nearby Whipple Museum of the History of Science[14]. Although some were ordered especially for the purpose from the mathematical instrument makers John Rowley and John England, others had already been in the college for around half a century. Of particular interest to diallists, these include a 10" dialling scale and a 9" sector, both by Henry Sutton and dated 1657 and 1660 respectively.

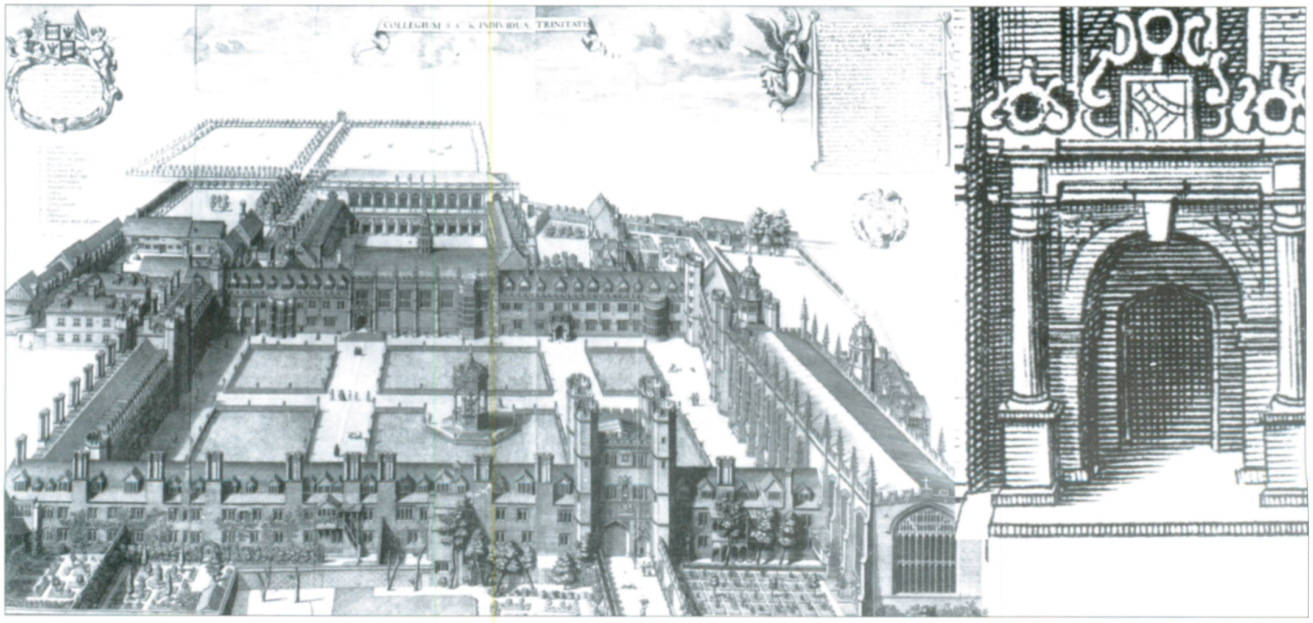

Fig.1. Trinity College, Cambridge, as shown in Loggan's 1690 engraving. The direct east sundial, shown in the inset, is over the arch at the top of the steps, just left of centre. The observatory was built on top of the King's Gate, just to the right of centre of the lower range.

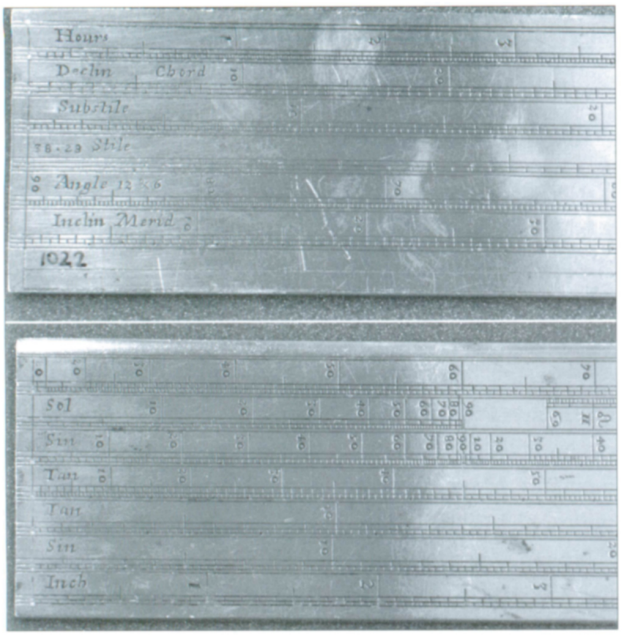

Fig.2. Parts of Henry Sutton's 1657 dialling scales, The back surface (top) shows scales for Hours, Declin Chord, Substile, Style, Angle 12 & 6, and Inclin Merid. A Lat scale is (unseen) on the end of the Hours scale. The front surface (bottom) has scales for Sol, Sin (two ranges), Tan (two ranges), and Inch.

The dialling scale is shown in Fig. 2. It was optimised for use at a latitude of 51° 32', as several of the scales are clearly marked as running to its complement of 38° 28' and hence it was probably intended for London rather than Cambridge. It is unusual in that, in addition to the standard *Latitude* and *Hours* scales, it has other dedicated dialling scales marked, for example, *Stile* and *Substile*. Other instruments which can be matched to the manuscript inventory include a 6" brass plotting scale (incorporating dialling scales) signed *E. Culpepper Londini fecit* and a 13" Gunter's quadrant with a nocturnal on the back signed by Elias Allen and which would have been made before 1650.

One item not made by a professional instrument maker is a 12" diameter horizontal instrument[4], made to Oughtred's design and donated by one John Holland in 1650. John Holland of Gloucestershire was admitted to the College in 1646 and became a Fellow in 1653 but little else is known of him. The instrument is shown in Fig 3 which shows that the standard of the engraving is better than most "amateur" attempts. An inscription reads *"Calorum facies in plano projecta ad latitudinem celeberrima Acadamia Cantabrigiensis* 52° 15'. *Medium non deserit unquam Cæli Phœbus iter radijs tamen omnia lustrat* ∞*"* which may be translated[5] as "The face of the days heat projected on the ground plane for the latitude of the most renowned Cambridge University 52° 15'. Phoebus (= Apollo) never abandons his journey in Midheaven but still throws his light upon all things with his beams". On the obverse, it carries a triple spiral with twelve convolutions marked with values of logarithms, sines and tangents.

A larger (30") horizontal instrument with a 12-sided shape is also in the collection and has a similar, though inferior, engraving style to the Holland one, although it is unfinished and rather inaccurately engraved.

JOHN ENGLAND DIALS

The instruments which John England made for the Observatory in 1703 include a 10" universal equinoctial ring dial, a large sector and an analemmatic dial. John England[6] (w.1703-1718) was apprenticed to Robert Jole (or Chole) who had, in turn, served his apprenticeship under Hilkiah Bedford. His apprenticeship started in 1690 and he was made a freeman of the Stationers' Company in 1702/3. According to Taylor[7], he gained his royal appointment as Instrument Maker to Queen Anne on the advice of

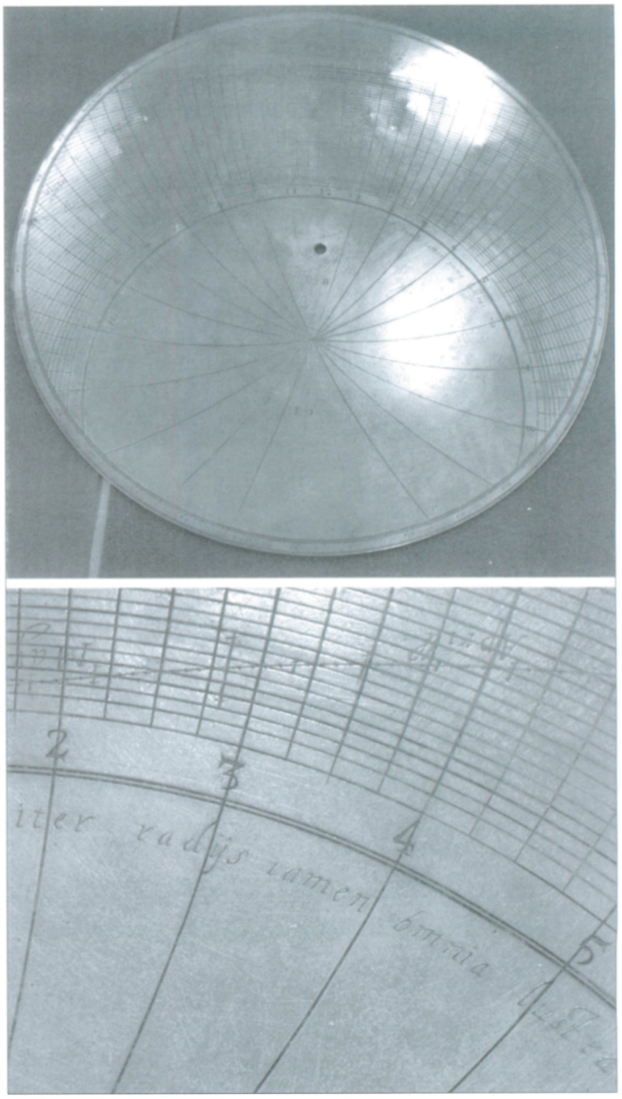

Fig.3. John Holland's 1650 horizontal instrument which lacks its alidade. The close-up shows part of the stereographic grid with the ecliptic for April and May, and part of the inscription.

Christopher Wren and Isaac Newton: it seems likely that they could also have been responsible for him winning the commission to produce the Trinity instruments. He worked from Charing Cross in London and a 12" diameter double horizontal dial bearing his signature was shown at the BSS Newbury meeting[8] in 2002. That dial is on a copper plate and the engraving is not to the same standard as the Trinity instruments, leading to the belief that it is an early piece. The form of the signature on it is in the same style as that on the sector he made for Trinity, illustrated in Fig. 4, although the signatures on his other Trinity instruments are in a more formal script. The sector has arms 480mm (18") long and it includes, amongst its many trigonometrical and geometrical scales, lines for *Latitude* and *Hours*, so that it would have been capable of delineating dials to a high level of accuracy.

The "analemmatic dial" which England made for Trinity is actually an elliptical dial paired with an ordinary horizontal dial on the same 342 x 212 mm brass plate, to the design most commonly associated with Thomas Tuttell and which he described in Joseph Moxon's *Mathematicks made Easie, or a Mathematical Dictionary*, published in 1700. It is shown in Fig. 5. As well as the signature and the date, it carries the inscription in England's hand "COLLEG. TRINIT. CANTAB" which is also carried by the other instruments. Of particular interest is the extra data provided by the scales along the slider of the moveable vertical gnomon on the elliptical dial. In addition to the date, running solstice-to-solstice, it gives the Sun's place in the zodiac, the Sun's declination, and the times of sunrise and sunset throughout the year. A clever spring mechanism allows both gnomons to lie flat when the instrument is not in use although, unlike Tuttell's versions, the plate does not fold in the middle.

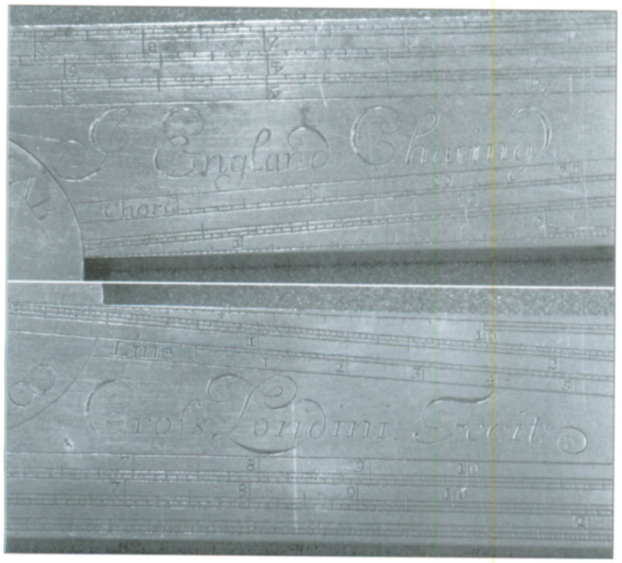

Fig.4. John England's signature on his 18" sector.

The universal equinoctial ring dial shown in Fig. 6 is of a fairly standard form but it is of a good size (252mm or 10" in diameter) and is again of high quality with the latitude scale being divided down to half-degree intervals. The bridge carrying the sliding pinhole nodus allows it to be set for the individual day, or to half a degree of the sun's declination, as befits an observatory instrument

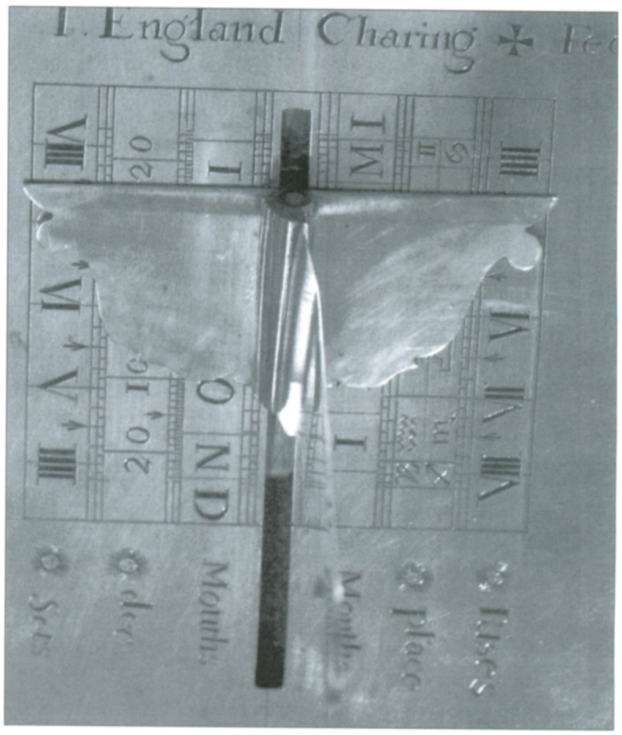

Fig.5. John England's 1703 analemmatic dial with the elliptical dial furthest from the observer and (inset), the scales along the base of its sliding vertical gnomon.

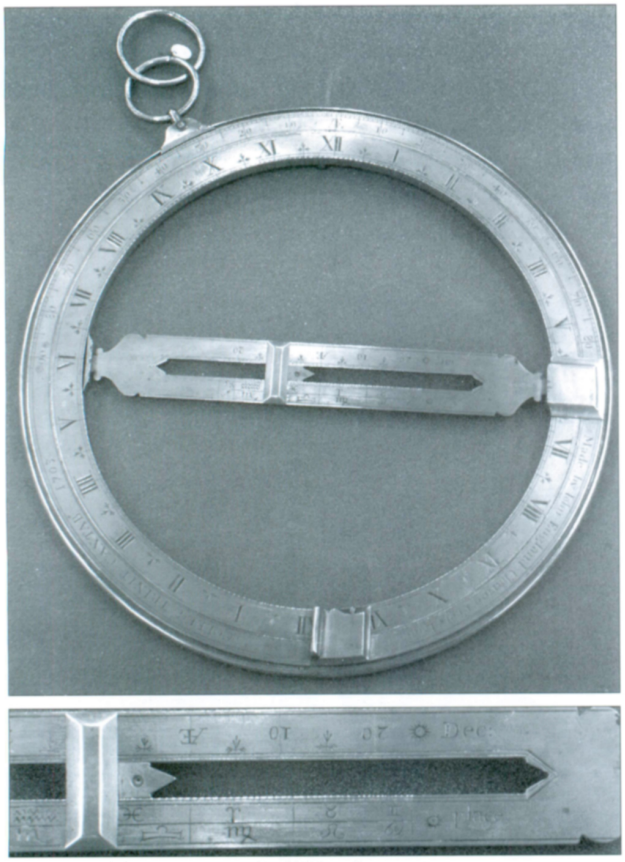

Fig.6. John England's 10" universal equinoctial ring dial showing (inset) the scales for the sliding pinhole nodus giving the sun's declination and place (in the zodiac).

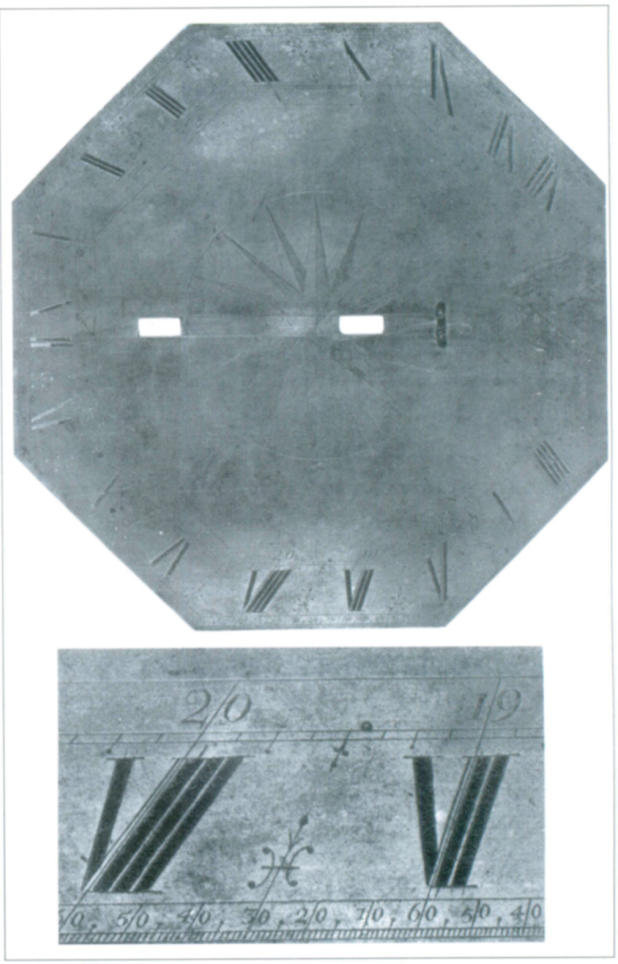

Fig.7(i) The dialplate for John England's horizontal dial, recently rediscovered in the Wren library. Note the two small screws at the toe of the gnomon and, in the lower picture, the alternative markings (19, 20 etc.) of the morning hours using astronomers' time.

SCIOTHERICUM TELESCOPICUM

In his 1952 paper, Price[3] states that John England also set up a horizontal dial in the Great Court of Trinity in 1703 but that it was removed in 1795 as it had "lost its gnomon". The dialplate was not transferred to the Whipple with the other instruments and it was believed lost until it was rediscovered in a cupboard in the Wren Library in 2002 (Fig.7(i)). Upon examination by the author and the Bulletin Editor in June 2003, several unusual features were apparent. Firstly, the plate was in very good condition with most of the black wax infill of the engraving still in position. Secondly, as well as the standard IIII-XII-VIII numbering, the chapter ring was engraved 16-24, 1-8. This is the time in the old Astronomers' measurement system, with the day measured from noon rather than midnight and hence avoiding an awkward date change during a night-time observation session. The system was not officially abandoned until 1925, but to the author's knowledge is unique on a sundial and clearly shows that the dialplate was part of the Observatory inventory. The third feature was a pair of small screws, approximately 3mm high, at the two origins where the very substantial gnomon would have met the dialplate. At first, these were attributed to a later, botched repair of the missing gnomon but further thought produced a much more interesting deduction. The 1703

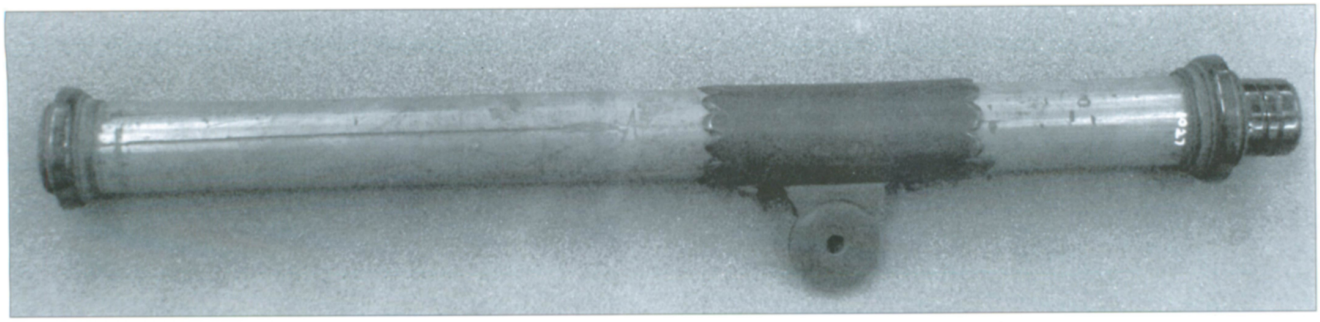

Fig.7(ii) The 13" wooden telescope, with crosswires, which may have been part of the sciothericum telescopicum.

manuscript inventory lists one item as "William Molyneux his Telescopick dial". Price did not identify this item amongst the extant instruments but did suggest that an unlisted 13" wooden telescope was associated with it.

William Molyneux[9] (1656-1698) was an FRS and a gifted amateur astronomer living in Dublin. In 1686 he published a 56 page booklet[10] entitled "Sciothericum Telescopicum - or a new contrivance of adapting a telescope to an horizontal dial.....". The key diagram showing his instrument is reproduced in Fig. 8; Molyneux had a prototype device made in London by Richard Whitehead (one of Henry Wynne's apprentices) and it is likely that the diagram shows this instrument. The fate of this instrument is unknown but it is likely to have passed to his son Samuel who was also an astronomer. On Samuel's death, his instruments were sold by auction[9]. Molyneux corresponded with John Flamsteed about the device, which he claimed could indicate the time to an accuracy of 5 seconds, and he published his own set of Equation of Time tables[11]. Molyneux's diagram clearly shows the dial with an astronomers' time scale and, vitally, a pair of pivots at the gnomon toe for the swivelling telescope assembly. Thus it seems highly likely that the screws on the England dialplate also retained a telescope support and that it was the "telescopick dial" listed in the inventory. Searching in the storerooms of the Whipple produced the telescope which Price had found (Fig. 7(ii)) although no trace of the gnomon assembly has been found either there or at Trinity. The thought of observing the sun through a telescope is horrific; Molyneux does not seem to have mentioned the dangers anywhere in his publication and the telescope in his diagram does not show provision for dark filters or for observation by projection. Similarly, the Trinity telescope has no provision for filters though it does have crosswires. Perhaps it was only intended to be used to tell the time by the stars, using the tables Molyneux provided. Why Roger Cotes should have commissioned such an unusual instrument, previously thought unique, 17 years after the prototype had been made, is unknown. It is perhaps a

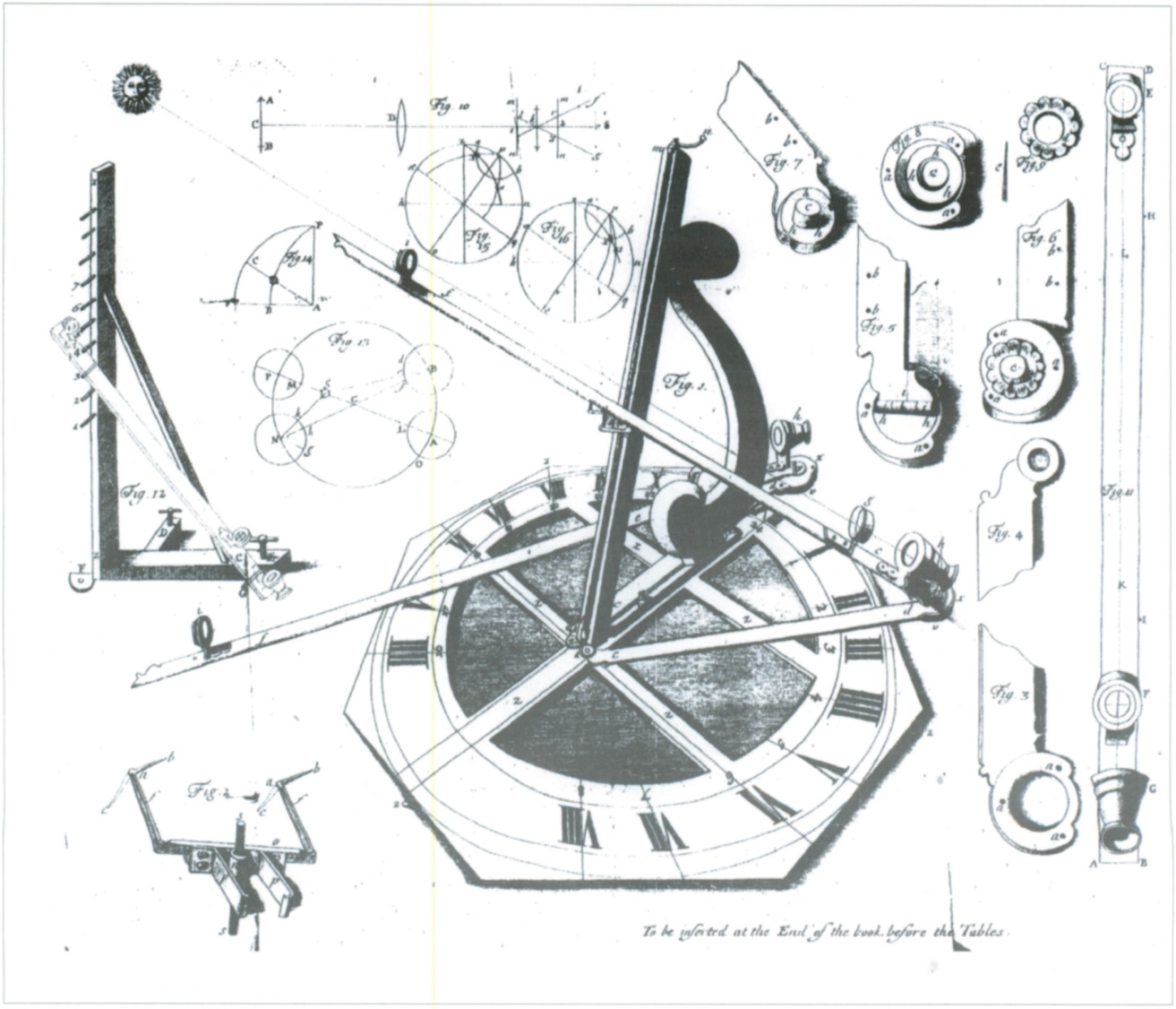

Fig.8. William Molyneux's sciothericum telescopicum, as shown in his original 1686 publication.

coincidence, but amongst the items transferred to the Whipple is a contemporary engraving of Trinity College Dublin where Molyneux was a Fellow.

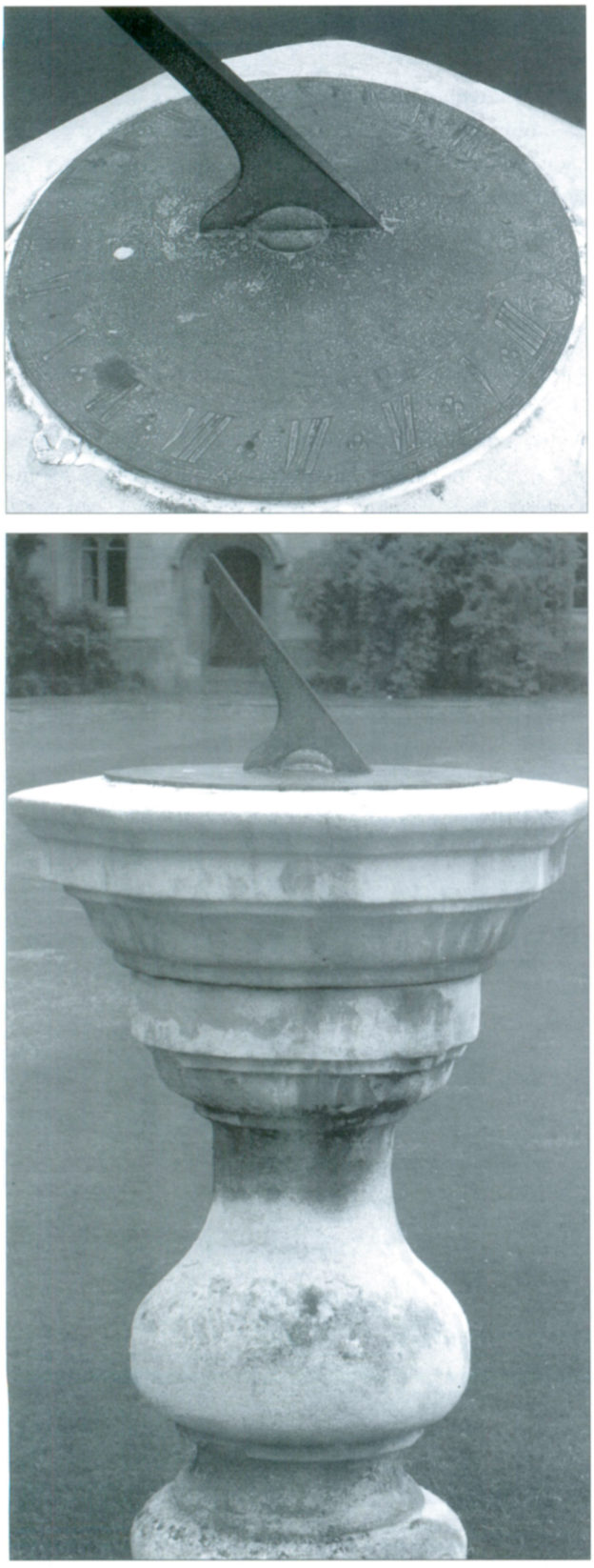

Fig.9. The badly corroded 1795 horizontal dial by Edward Troughton, still in the Great Court of the College. SRNO 1715.

TROUGHTON DIAL

The extant dial (Fig. 9) in the Great Court which Price says was installed in 1795 to replace the gnomon-less England dial is signed simply "Troughton London". The latitude given, 52° 13', is the same as the modern figure for Cambridge. It has a $16\frac{1}{2}$" circular dialplate let into the top of the pedestal, which suggests that this was not the support used for the larger octagonal England sciothericum telesopicum. In contrast to the condition of the England dialplate, the Troughton one has suffered greatly from its two centuries of exposure to the elements during the coal-burning period of English history. Nevertheless, it can still be seen to be of high quality with the normal features of an elaborate compass rose and a set of Equation of Time rings, showing Troughton's continuing use of the design pattern of his predecessors in the Grocers' Company[12]. There was a considerable dynasty of Troughtons[6] but if the date is correct the dial would have been made by the firm of John and Edward Troughton (w. 1788-1804). Unfortunately, the values of EoT cannot now be read so it is not possible to date the dial by this means[11].

FELLOWS' GARDEN DIAL

The College's interest in dials continued into the 20th century with the horizontal dial (Fig. 10) in the private Fellows' Garden, just the other side of Queens' Road to the main college. Brookes and Stanier[13] describe how the idea for the dial came to Walter Morley, a Fellow of the College, in a dream in which he was walking with his colleagues Keith Lucas, G B Taltham and C E Stuart who had been killed in the First World War. The pedestal for the dial, incorporating the initials of these Fellows, was carved by a friend of Morley's, the famous sculptor Ernest Gillick. The dial itself, which appears to have been cast in bronze, was made by the Cambridge Scientific Instrument Company. This company's managing director and chairman was none

Fig.10. The First World War Memorial dial, made by Cambridge Scientific Instruments Ltd., in the Fellows' Garden. SRNO 1774.

other than Robert Whipple, whose private collection of portable dials formed the foundation of the Whipple Museum in 1944. Whipple had first come to Cambridge in 1898 as the personal assistant to the founder of the company, Horace Darwin (Charles Darwin's youngest son). The dial is notable for the very deep and crisp lettering of the motto (IN SAPIENTA AMBULATE TEMPUS REDIMENTES - Walk in wisdom, redeeming the time) which is carved with V-cut letters in the manner of an inscription on stone. Also, as befits a scientific company, the Equation of Time is presented as a graph[11].

Now that we have moved into the 21st century, perhaps we can hope that Trinity will continue the tradition of other Oxford and Cambridge colleges of commissioning dials to adorn their building and grounds.

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H.M. THE QUEEN, SHAKESPEARE AND WAUGH
A CONSPICUOUS ANALEMMATIC DIAL

FRANK H. KING

Analemmatic dials are not to everyone's taste and the name-dropping in the title is a blatant attempt to hold the attention of readers. There is quite a story to this particular dial, and a little technical interest too...

In the run-up to the Queen's Golden Jubilee, a joint committee of the Houses of Lords and Commons was set up to consider an appropriate gift from Parliament to the Sovereign. After some deliberation, the committee decided on a sundial. Never let it be said that nothing good ever came out of a Parliamentary committee!

The chosen site was Old Palace Yard, opposite the entrance to the House of Lords. There is a triangle of roadway chained off from normal traffic as can be seen in the general view in Fig.1.

THE DESIGN

A short list of possible designers was drawn up and one of the teams tendering for the work showed me the specification and asked for comments. The committee wanted an analemmatic sundial and I duly explained why there had to be a scale of dates in the centre and why the hour points had to be arranged in an ellipse.

The submitted design was not selected so I archived my files and bowed out. Two months later I received an unexpected e-mail. Although the committee had not accepted the design that I had had a hand in, they wondered whether I might 'serve as the official Astronomer/geometrician for the project'.

If a sundial is involved, I don't much mind what I am called. This was clearly a prestigious project so I readily accepted the invitation. An additional motivation (which I kept to myself) was that I had never previously worked on a serious analemmatic dial and this was a golden (sorry!) opportunity to try something new.

Fig.1. A New addition to the Parliamentary scene

The project was driven by the architect Julian Bicknell (of Julian Bicknell Associates) and the principal designer was Quentin Newark of Atelier Works. The overall design was both simple and elegant. There was to be a circular bronze disc for the scale of dates and this was to be surrounded by four concentric rings of stone. The hour points were to be accommodated in the second ring out. In outline, the disc and the first two rings of stone are as in Fig.2.

The outside diameter of the outermost ring was fixed at 5m at an early stage but it took some time before the other diameters were agreed. My insistence that any change in the length of the scale of dates required a change in the dimensions of the ellipse for the hour marks did not help! Eventually it was settled that the bronze disc should have a diameter of 1350mm and that the internal and external diameters of the all-important second stone ring should be 2400mm and 3600mm.

In keeping with the ethos of the project, the rings were to be made of stone from the four countries that make up the United Kingdom: England, Scotland, Wales and Northern Ireland. They were to be flame treated to withstand the impact of countless feet.

INSCRIPTIONS

A prominent inscription records the Golden Jubilee and another inscription explains that the user has to stand on the

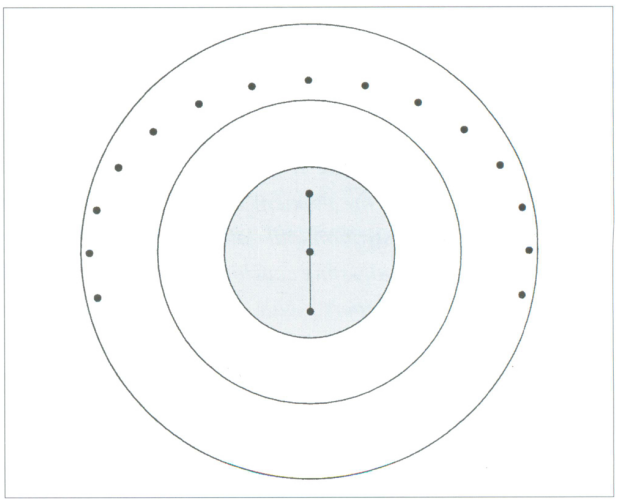

Fig.2. The bronze disc and the first two rings of stone

scale of dates. There is also a reminder that the sundial approximately indicates GMT rather than BST.

Inscribed into and running right round the outermost ring of stone is the well-known quotation from *Henry VI Part III* which begins:

To carve out Dials quaintly, point by point,
Thereby to see the Minutes how they run:
How many makes the Hour full complete...

It is second nature to anyone who has worked in stone to check and double-check inscriptions before cutting, and I instinctively query every detail of spelling, capitalisation and punctuation.

With Shakespeare, my preference is to take the First Folio rendering as definitive so I consulted a copy of the Norton facsimile[1] where the quotation is more like:

To carue out Dialls queintly, point by point,
Thereby to ſee the Minutes how they runne:
How many makes the Houre full compleate...

Perhaps unsurprisingly, local Shakespeare scholars in Cambridge also urged use of the First Folio version so I passed the message on. It was not well received. The version with modern spelling but original grammar had, it transpired, been a principal reason why this design had been selected in preference to others that had been submitted. This was not a matter for the Astronomer/geometrician!

THE LIE OF THE LAND

The dial was to be set into the side of a road and had to follow the camber of the road surface. Accordingly, one of the first questions I was asked was, 'Will it matter if the dial is not on level ground?' This was easy. As long as the dial is marked out accurately in plan, the ups and downs do not matter at all. Using a surveyor's total station, it is not even necessary to measure the undulations.

Unfortunately, the dial was to be made off-site where it would be laid out on a level surface. What allowances would have to be made to ensure that it would be correct when laid on the cambered surface of the site? This required a proper survey.

Happily, even at its steepest, the slope is never greater than 3° and the length of a line drawn along such a slope exceeds the length of the same line viewed in plan by a factor of 1 / cos(3) (about 1.0014). This is not very much but in the extreme case of the 6 a.m. hour mark (which is about 1760mm from the centre point in plan) the required correction was over 2mm.

The survey included determining true north. For this exercise two linked GPS stations were used. The two stations do not simply compute their positions independently. Instead, they compare the phase differences of signals from corresponding satellites. Their relative positions can thereby be determined with millimetric precision and true north can be established to within a few arc-seconds.

THE SCALE OF DATES

A stiffer challenge was the scale of dates. The designers wanted a 13-point line. In Fig.2 only the centre point for the equinoxes and the end points for the solstices are shown. The designers asked for five well-chosen additional points in each half so there would be six intervals from, say, the vernal equinox to the summer solstice. Each interval should correspond 'to about a fortnight'.

Moreover, each point (except those for the solstices) was to have a label on each side, one giving a date for the point when the declination was increasing and one for when it was decreasing.

These constraints can be satisfied only approximately and it may be of interest to outline the steps used:

1. Start from the vernal equinox and determine the number of days until the summer solstice (about 92.76 days).
2. Divide this number by six to determine an interval which I shall call an approximate-fortnight (about 15.46 days).
3. Note the declination of the sun at the vernal equinox and determine the declination at successive approximate-fortnight intervals until the summer solstice.
4. Repeat the exercise starting from the summer solstice and ending at the autumnal equinox. Here the approximate-fortnight is a little longer (about 15.61 days).
5. There should now be 13 declinations which can be arranged in six pairs (the two members of each pair having approximately the same value) and on odd one for the summer solstice.
6. For each pair, determine the average of the two values. Record seven declinations: the six averages and the one odd one.
7. Repeat for the period from the autumnal equinox via the winter solstice back to the vernal equinox.
8. Step 7 adds five new pair averages (the pair for the

equinoxes has been attended to) and an odd one for the winter solstice. Record these six additional declinations.

The 13 declinations derived in this way are shown in the central column of Table 1 which also shows associated dates...

THE DATES

The Gregorian calendar defeats any attempt to decide which date (or pair of dates) to associate with a given declination. The best that can be achieved is to choose the date that applies most often. Even then the answer has to be qualified by specifying the time zone and how long you believe the sundial will survive.

Consider the problem of deciding which date to assign to the vernal equinox or, more pedantically, to a declination of 0° when that declination is increasing.

Fig.3 will be familiar to most readers. Using rather rash assumptions, this shows the instant of the vernal equinox graphically for each year from 1900 to 2300, one Gregorian cycle. In 1900 the vernal equinox was early on 21 March and in 1901 it was nearly six hours later. This pattern repeats in 1902 and 1903 but 1904 was a leap year so the equinox was again early on 21 March, indeed slightly earlier than in 1900.

This figure applies to the time zone associated with the Greenwich meridian. Each shift of time zone west or east requires the date boundaries to be shifted up or down respectively. In the United States, the vernal equinox in 1900 was on 20 March.

Notwithstanding the limitations of the figure, it is clear that in the United Kingdom the vernal equinox falls most frequently on 20 March and that is the date chosen for the Jubilee sundial.

Had the sundial been laid out in 1900 the decision would have been more difficult. Over the 20th century the vernal equinox fell most often on 21 March and the designer, noting that the site is rather vulnerable, might have felt it unlikely that the sundial would last 100 years. It could therefore have made sense to have chosen 21 March as the date for the vernal equinox.

This kind of analysis and assessment was made for every date on the dial, 24 altogether. Accordingly, 24 plots like Fig.3 were prepared and assessed. Somewhat optimistically perhaps, a design-life of 150 to 200 years was assumed.

Table 1 shows the 24 decisions for the 13 declinations. There are 11 pairs of dates and two isolated ones at the top and bottom for the solstices.

On the finished dial, each declination translates into a point on the centre-line. The 13 points are not, of course, evenly spaced.

	21 JUNE	
	+23.439°	
6 JULY	+22.614°	5 JUNE
22 JULY	+20.216°	21 MAY
6 AUGUST	+16.449°	5 MAY
22 AUGUST	+11.604°	20 APRIL
7 SEPTEMBER	+6.006°	4 APRIL
22 SEPTEMBER	0.000°	20 MARCH
7 OCTOBER	-5.815°	5 MARCH
22 OCTOBER	-11.342°	18 FEBRUARY
6 NOVEMBER	-16.223°	4 FEBRUARY
21 NOVEMBER	-20.084°	20 JANUARY
6 DECEMBER	-22.576°	5 JANUARY
	-23.439°	
	21 DECEMBER	

Table 1: Dates for the selected declinations

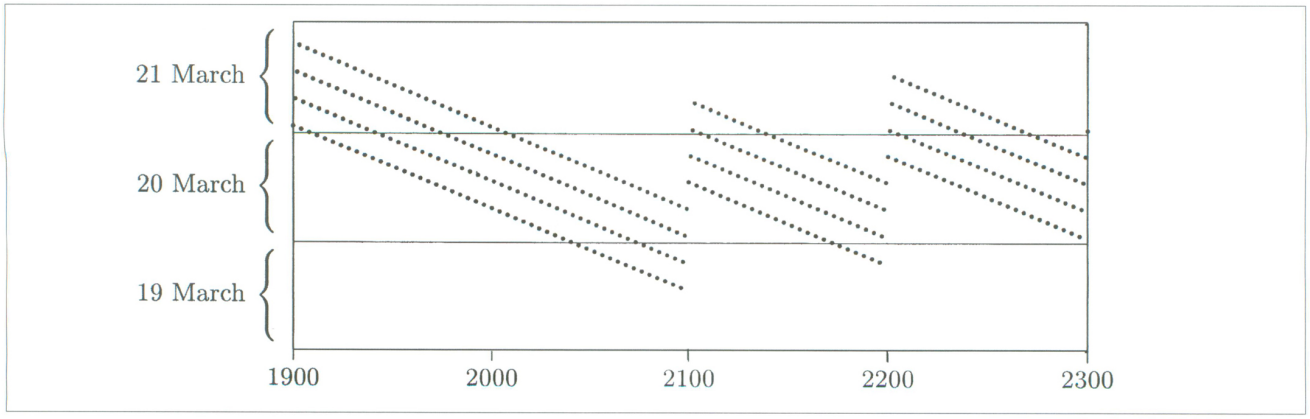

Fig.3. The dates of the Vernal Equinox over 400 years

In his chapter on the Analemmatic Dial, Waugh[2] addresses the reverse problem of deciding which declination to associate with a given date. He provides a table giving declinations for the first day of each month of the year.

Waugh was interested in choosing declinations to serve as month separators and it would be appropriate to chose declinations that apply to 0h on the first day of each month. Unfortunately no explanation is provided and no caveats are given either.

The caveats are the same as for choosing dates for declinations, and the decisions depend on both time zone and assumed life-span. The extreme cases in Fig.3, in 1903 and 2096, indicate that the vernal equinox may fall anywhere in an interval of about 2¼ days. In that interval, at that time of year, the declination changes by almost a degree.

If the values in Waugh's table are appropriate for some time zone in the United States in the mid-20th century then they are not the most suitable choices for use in the United Kingdom today!

POSTSCRIPT

The design for the Old Palace Yard dial was formally approved by H.M. the Queen in the summer of 2002. Precise measurements were supplied to those preparing the bronze disc and the stone work. Much of the laying out was carried out in wet weather but the sun shone obligingly for the inauguration by the Earl and Countess of Wessex on 23 October 2002.

Post-installation checks suggest that some slight shrinkage occurred in the casting of the bronze disc. The offsets of the points on the scale of dates are a little over 1% short of the values specified. The hour marks are close to specification. with allowance for the sloping surface duly taken into account.

On a sunny day in summer, a steady trickle of people try out the sundial and it is amusing to listen to their comments. Not very many will be concerned about the slight mismatch of the scale of dates to the hour marks!

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ACKNOWLEDGEMENT

The photograph in Fig.1 is by courtesy of Dr Mark Collins, Parliamentary Estates Archivist.

Postscript: This is the "Sundial at the House of Lords" mentioned in Bull.BSS. 14 (iv) p143. - Ed.

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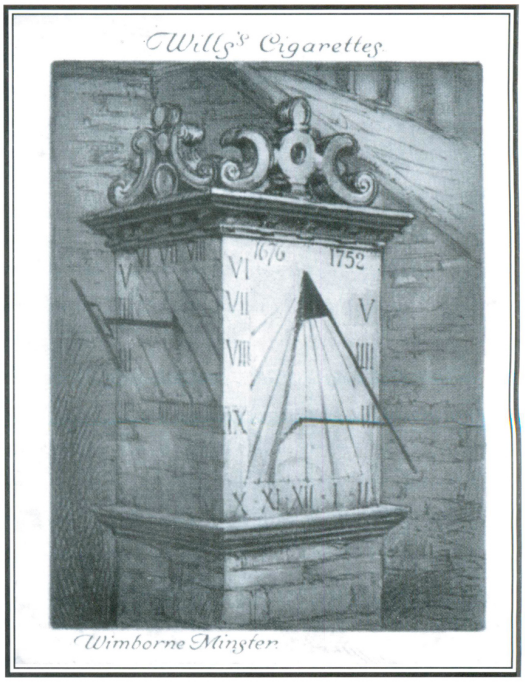

A SPHERICAL SUNDIAL AT ILKLEY, YORKSHIRE

ANDREW OGDEN

In June 2003 I was visiting friends at Middleton near Ilkley; Yorkshire, with a position approximately 53 degrees 56.3 minutes North, 1 degree 51 minutes West and was shown the start of a new rockery in the garden. The main feature of the rockery was the stone capital of a column on top of which was a stone ball approximately 18 inches in diameter, cut from the local millstone grit. One side was rather eroded but a line around it was clearly visible, together with Roman numerals.

With a piece of chalk drawing out the lines we discovered that we had a Spherical Sundial in reasonably good condition, though not level and not properly aligned. As the stone had become blackened over the years of being near an industrial area, no shadow was visible. When originally erected it would have been printed white with black filling in the numerals, or at least have had a white stripe painted round the equatorial line, so that a shadow would have been visible. The owner seemed reluctant to move it and paint it so it remains a secret sundial. Apparently it had already been moved from Baildon, about 5 miles South so it was no longer in its original position anyway.

Peter Drinkwater's article "The Spherical Sundial" *Bull.BSS 90.* **3.12** (1990) quotes this type of dial as being commonplace, and indeed there are plenty of gateposts and pillars surmounted by stone balls. Perhaps we should examine them more carefully!

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THE VERTICAL SUNDIAL OF HOSSIOS LOUKAS CONVENT

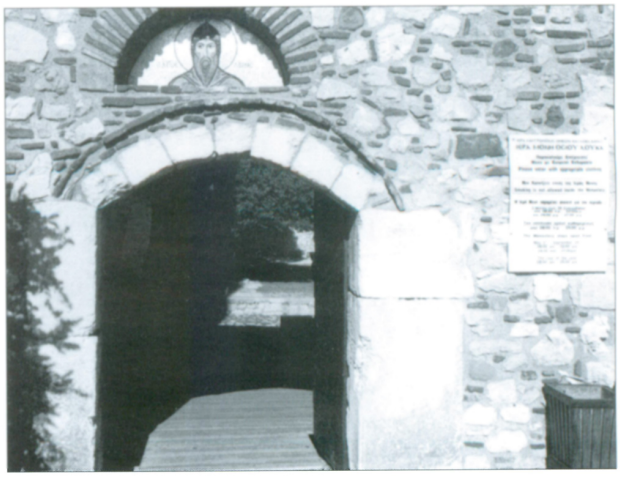
E.TH. THEODOSSIOU & A. DAKANALIS

ABSTRACT

The most important monument of the middle-Byzantine period in Greece is the Convent of Hossios Loukas Steiriotis, built in the middle-10th century AD on the western slopes of the mount Helicon. Its construction began during the reign of the Byzantine emperor Romanos II (959-963), and the Byzantine emperor Vasileios II (976-1025) completed it.

During the Frankish occupation of Central Greece it passed into the possession of a catholic monastic order, and subsequently suffered from the destructive malice and plundering of Catalan and Turkish conquerors. It was in this Convent on the 27th of March 1821 where the Bishop of Salona Isaias (Isaiah) blessed the armaments used in the uprising of the area of Roumeli against the Turks. The Catholikon of the Convent is a unique extant specimen of Byzantine architecture, the "Parthenon" of the Byzantine period in Greece as it is called, and it served as the prototype for the building of other churches such as the Catholikon of the Convent in Daphni and, later on, for the Russian church in Athens. It is truly astonishing that the convent is adorned with a vertical sundial. It is one of the very few (possibly less than ten) extant sundials on Byzantine buildings in Greece.

Key words: Convent of Hossios Loukas, Boetia, sundial



The entrance of Hossios Loukas Convent

THE HOSSIOS LOUKAS CONVENT

In the middle-10th century in the region of ancient Steiris, the monk Loukas Steiriotis settled at the foot of the mount Helicon - the mountain of the Muses - and along with other monks established a monastic community in 946. After his passing in 953, a great number of monks began to flock in his cell to bow to his relic, which - according to the relevant rumour - had the ability to work miracles. It was due to this rush of people that the initial small structures gave way to larger and more imposing ones; and thus, the overall complex came into being.

The Hossios Loukas Convent, the most imposing Byzantine monument in Greece, has been restored, and can be found near the town of Distomo, at the boundary of the Boetia and Fokida prefectures. Following the route from Distomo one arrives firstly at the village of Steiris and, a bit further, at the area of the Convent. The Convent is consecrated to its founder, Loukas Steiriotis (896-953), who was declared an Hossios (Blessed) by the Orthodox Church after his death and is commemorated on February the 7th. According to the legend, the incentive for the Convent's creation was provided by the Hossios' prophecy, which said that the Byzantines would liberate the island of Crete from the Arabs. The fulfilment of the prophecy was the reason that the Byzantine general Necophorus Arotras provided the means for the construction, beside the Hossios' cell, of the small church of Aghia Varvara, (Saint Barbara) or Crypt, where the Hossios was later buried.

The whole Convent suffered serious damage during 1943 from the bombardments by the German army during the Second World War. The damage was repaired in the restoration process in 1958 through 1960.

We now describe the three churches within the Convent complex: the Church of Aghia Varvara; the Church of the Theotocus, (or Panayia); and the (main) Church (Catholikon) of Hossios Loukas. The vertical sundial is on the wall of the second of these three.

THE CHURCH OF THE AGHIA VARVARA (SAINT BARBARA) OR CRYPT

The small church of the Aghia Varvara or Crypt was founded in February 953. Nowadays, the entrance to the church lies between the southern wall of the Catholikon of the Convent and the restored old Refectory of the monks. Giant plane trees with lush leafage provide a shadow in the precinct of the Convent, and a bit further, seen from a height, the views to the mount Helicon as well as to the small valley are truly magnificent. The Crypt is dated at an earlier period than the church of Hossios Loukas. The posterior Catholikon of the church of Hossios Loukas has been built in such a way that it uses the Crypt as its foundation.

THE CHURCH OF THE THEOTOCUS (VIRGIN MARY)

The Church of the Theotocus (Church of Panayia), built in the 10th century AD, is placed at a relatively higher level than the great church of Hossios Loukas (Catholikon). It is older than the Catholikon but it is connected northerly through a portico with it.

This church is the earliest known example of the four-column cross-in-square type; it has a spacious two-column narthex on the west side and a portico to the west of it. Its oblong marble stones came from the ancient temples and the wall of the ancient city of Steiris. In the gaps between the stones, built-in ceramic bricks in various shapes can be seen. The Church of the Theotocus is distinguished for its architectural symmetry, and the type of the church is a pioneering one in Central Greece. It is that of the complex tetrastyle (four-column) church, which in that period was very widely found in Constantinople. The Church of the Theotocus suffered serious damage by the powerful earthquake in 1790, but was fixed during the restoration work of 1848. Some restoration was done in 1939. This work was continued after the Second World War. The Church was fully restored in the three-year period 1958-1960.

The Church of the Theotocos and the vertical sundial

THE CHURCH OF HOSSIOS LOUKAS

The Church of Hossios Loukas constitutes the Catholikon of the Convent, and it must have been built during the first half of the 11th century AD. It is said that its donors were the abbot Philotheos or Theodoros Leovachos, lords who belonged to eminent land-owning and Byzantine office-holding families in the city of Thebes. Others think that its donor was the emperor of Byzantium Constantine Monomachos himself

In the Catholikon of the Convent, a new architectural type was employed, that of the octagon church, the main feature of which was the huge dome supported on squinches, leaving the main area unified and unbroken.

The Church of Hossios Loukas has a large, tall cupola with a diameter of 9m. The domed central space is surrounded by two-storied constructions, which were modelled as cross-vaulted chapels. A two-storied narthex was built on the west side. The perfect architectural composition, the perfection of its execution, and the wealth and quality of the decorative materials used in the paved marble floor, and the murals, all make this monument one of the most important of its kind.

One can say that it is a unique, exquisite specimen of Byzantine architecture, the "Parthenon" of the Byzantine era in Greece, as it is often called. It has served as the prototype for the building of the Catholikon of the Convent in Daphni and, more recently, of the Russian Church in Athens.

The Catholikon was severely damaged by the destructive earthquake in 1593 and its dome collapsed, but it was restored in 1848, since the Convent had been characterised as a monument of the struggle against the Turkish conquerors.

HOSSIOS LOUKAS CONVENT TODAY

Today, the Refectory of the monks has been restored - after a donation of the ship-owning Karas family - and has functioned since 1993 as a sculpture museum. One can find exhibits of excellent quality, mainly marble parts from the Convents' buildings, as well as from other buildings of the wider area. The Catholikon of the Convent functions as a museum, but the Church of Theotocos officiates as a church. In the restored Bordonareion (Stables), 18th century paintings that have been taken off the walls are on view; the paintings once belonged to the church of Aghios Spyridon Medeon (Saint Spyridon of Medeon) which is in the Antikyra area.

We note that the Convent has been characterised as a national monument and has been listed in the UNESCO World Heritage Listing.

THE VERTICAL SUNDIAL OF THE HOSSIOS LOUKAS CONVENT

On the exterior south eastern side of the Church of the Theotocos (Church of the Panayia), we discovered by chance a simple vertical sundial. It was unknown previously, except to a few monks belonging to the Hossios Loukas Convent; but even they did not give much attention to it, since it is a very simple sundial with no decoration, and is quite shallow. This vertical sundial has probably never been listed anywhere, and it is difficult to be seen owing to the irreparable attrition of time and weather conditions. It is located on the exterior south eastern wall of the church, scratched on the tallest of the six ancient marble stones which are part of this wall, as it can be seen in the relevant photos.

One can distinguish the rusted iron gnomon, placed perpendicularly to the dial face, and an experienced eye can also distinguish the hour-lines. There are eleven hour-lines, dividing the semicircle to 12 nearly equal hour sectors. The hour's numerals are indo-arabic numbers from 6a.m - to 6p.m, scratched in the end of each hour sector. The hour-lines and numbers are badly preserved and not very well visible. The semicircle covers half of the marble stone's surface. The sundial has been placed very high (about 5m above the ground) and this prevented us from conducting

The vertical sundial of the Hossios Loukas Convent.

any measurements. But it seems that the hour-sectors of the sundial are equally spaced.

We note that the simple shallow sundials scratched on the wall of a church are familiar in the monastic tradition of the Western Christian Church, but are very rare in the corresponding Orthodox tradition. Although there are hundreds of such 'scratch-dials' in northern Europe, there are only nine on the walls of Byzantine churches in Greece. The Hossios Loukas sundial uses indo-arabic numbers, and as we know the Italian mathematician Leonardo da Pisa Fibonacci (1170-1250) was the mathematician who introduced the indo-arabic numbers in Europe. So this sundial is not earlier than the late 13th century. Additionally, there is no evidence that it was carved on the marble stone while the church was being built. Any monk, or any building-restorer, could have carved it at any time from the 13th to the 20th century; we do not know the date of the sundial's construction. Nevertheless it is interesting to find this item of simple, practical and useful stone-carving among all the ornamental and elaborate stone work adorning the churches of the Convent.

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MRS. ALFRED GATTY, AUTHOR OF 'THE BOOK OF SUNDIALS'

FRANK EVANS

Mrs. Alfred Gatty is today remembered by three separate groups of people for different aspects of her legacy. These are firstly her children's stories, secondly her sundial book and thirdly her seaweed volumes. In all these fields she produced remarkable work.

She was born Margaret Scott on 3 June 1809. Her mother was Mary Ryder who, in 1807 had secretly and against her family's wishes married a clergyman twice her age. The clergyman was Rev. Alexander Scott, DD. He was a former naval chaplain and a man with a considerable claim to fame for Admiral Nelson had died in his arms at the Battle of Trafalgar in 1805.

Immediately after Trafalgar Scott had come ashore to a parish at Southminster, about three miles north of Burnham on Crouch, but from there in 1817 had moved to a larger parish in Catterick. At this time he was also appointed a royal chaplain. Meanwhile Mary Scott had borne him two daughters, Horatia in 1807 and Margaret in 1809, followed by a short-lived son. Sadly Mary had died at the age of only twenty six when Margaret was two. The motherless children spent part of their growing years with their father in Catterick and part with the Earl and Countess of Tyrconnel who lived nearby, a couple said to be childless, wealthy and probably bored. They also visited Ryder relatives in Hendon and from there had easy access to London, where the growing Margaret spent much time in the Print Room of the British Museum, copying prints. She possessed many skills and had considerable artistic talent including in etching on copper. As a young woman she received painting lessons in the fashion of the time but her forte, as she in time discovered for herself, lay in drawing in pencil. She played the piano and spoke several languages, being apparently self taught. These languages included French, German, Latin and Italian and she even attempted Chinese. For a time she kept her diary in German, writing it up in black letter script. Some of her translations from German and Italian including verses from Dante's "Inferno" were published around 1830. This linguistic facility had been inherited from her father and in time passed to her second daughter, Juliana. At one point in her life Juliana noted that her library included books in twenty five different languages.

During the period up to her marriage we may imagine Margaret Gatty pursuing the interests of a young woman of good family in provincial surroundings, supervising the household, formally calling and receiving, and attending balls and functions. However, it is likely that she and her older sister also followed the clerical tradition of the time in acting as unpaid curates to their father.

One day in 1839 a young priest named Alfred Gatty arrived in the Vicarage for a visit. He was the man Margaret was to marry. He had been invited from a parish ten miles away to spend a few days with Rev. Alexander Scott. After some vicissitudes Alfred Gatty and Margaret Scott were wed on 8 July 1839.

Alfred Gatty was born in 1813 and was thus four years younger than Margaret. He was the son of a well-to-do solicitor who practised in central London, and it was there that Alfred was born. A small event of his childhood was his acquaintance with Admiral Bligh, on whose knee he sat from time to time. The admiral wore around his neck a bullet suspended on a blue ribbon. This was the bullet which had been used to weigh out allowances of food during the heroic open boat voyage following the "Bounty" mutiny. From Admiral Bligh the bullet in time came into the possession of the Gatty family.

From Charterhouse and then Eton the young man went up to Oxford, graduating BA in 1836. He entered the church and became curate in charge at Bellerby and it was from here that he visited Alexander Scott. Following the wedding it was arranged that Alfred Gatty should become curate in charge at Southminster, the parish still held in plurality by Alexander Scott. But the unexpected death of the Vicar of Ecclesfield, an aged Ryder relative of Scott's wife, Mary, altered this arrangement dramatically. The living was in the gift of another Ryder relative, who despite Alfred's youth proceeded to appoint him to Ecclesfield as vicar. And there he remained for the next sixty four years accompanied, for thirty four of them until her death, by Margaret.

Married at thirty, Margaret proceeded to bear ten children, eight of whom survived to adulthood and most of them to a considerable age. Of the eight, four were boys and four girls. Some became distinguished and two of the sons were knighted. The oldest boy, Reginald, had a law degree from Cambridge and in time took holy orders, becoming a vicar like his father. The second son, Alfred, rose to become Garter King of Arms. He began his working life as a prolific popular song-writer and hymnodist and is perhaps still remembered for his hymns. He changed his name from Gatty to Scott-Gatty and was knighted in 1904. The Gatty family made extensive use of nicknames and Alfred was known in the family as "Brownie". It is said that this name, having crept into one of Juliana Gatty's children's stories, a fairy story called "The Brownies"', was picked up by Lord Baden-Powell as the name for the junior branch of his newly formed Girl Guide organisation. Lady Baden-Powell later confirmed this.

The third son, Stephen, also became a lawyer and practised as a barrister before becoming a colonial law officer. His final post was as Chief Justice of Gibraltar. He, too, was knighted. The fourth son, Charles, unlike his brothers did not go to university. He had a varied life as an author, shopkeeper in central London and parliamentary candidate.

Mrs. Gatty's first-born was her daughter Margaret, known as Madge. Madge's life's work appears to have been to marry a local squire and bear him nine sons. The second daughter, Juliana, ("Julie") is probably the one best known to the world. Unlike her siblings she died fairly young, aged only forty three but during her working life she continued in her mother's tradition of writing children's stories. She was renowned in the family as a teller of tales and her mother's publication, "Aunt Judy's Magazine" gave her an outlet for many of them. In all she wrote over a hundred stories before her unfortunate early death from cancer, leaving behind numerous volumes of tales.

The third daughter was Horatia, known in the family as Dot. (It may be noted that the names Scott, Nelson, Horatio and Horatia abounded among the Christian names of the Gatty children.) Horatia was the child whose interest in collecting most paralleled Margaret Gatty's. She was said to have become a minor authority on seaweeds at an early age. She accompanied her mother on all her seaweed collecting expeditions and undertook much of the laying out and preserving of specimens. She was later to take a large part in continuing her mother's work with "Aunt Judy's Magazine", being first joint editor with her sister Juliana and subsequently sole editor. The year before her mother's death she saw Mrs. Gatty's two books, "The Book of Emblems" and "The Book of Sundials" through the press. Horatia lived to a great age, dying in 1945 within two months of her hundredth birthday.

The fourth daughter of the family was Undine ("Diney"). She was born in 1848 and it was in this year that Mrs. Gatty retired to Hastings for some five months to recover from the birth and it was then that she first took up her interest in seaweeds.

Margaret Gatty, by this time nearly forty and having borne seven children, was doubtless a little weary. Although not very domesticated (for the first twenty five years of her occupancy there were no curtains in the vicarage dining room) there were for her the constant strains of motherhood and worries about money. A court case about an inheritance was not settled in her favour until after her death. Her husband's incumbency of the parish was at first a temporary one. But her character has been described as that of a scientist.

During her life she evoked an interest in fungi, she introduced homeopathy into her family and welcomed the use of chloroform, especially in dentistry and childbirth and indeed made use of this new anaesthetic herself on such occasions.

Although much of her energy went into the production of children's stories her interests, her powers of observation, her orderliness, accuracy, curiosity and persistence were those of a researcher. She had always been a collector and her gathering of mottoes, particularly sundial mottoes, began as a girl. Here, in seaweeds and away from domestic cares, was a new and totally untested field for her to sample.

Her granddaughter, Christabel Maxwell wrote of her: "She threw herself into her new hobby with the enthusiasm of youth and studied voraciously all that she could find on the subject. She collected seaweeds wherever she went and encouraged her friends to do the same; she kept an aquarium and welcomed rapturously any addition to it; and her letters became full of strange drawings and algological names." She began to put together hand-prepared books of seaweeds and to sell them to friends; the profits from this endeavour she distributed among the needy of Ecclesfield parish.

Her absorption in the subject prompted Juliana to compose a parody of Charles Kingsley's "Sands of Dee", the first couple of verses of which ran:

O Gattys! Go and call your mother home,
Call your mother home
At least in time for tea!
The breakfast, lunch and dinner go and come
Unheeded, at the sea.

The creeping tide came up along the sand,
And round and round the sand,
But not a step moved she.
Her children shouted to her from the land.
She shouted to the sea.

It was while she was at Hastings that a local doctor introduced her to the work of Professor William Harvey of Trinity College, Dublin. His *Phycologica Britannica* (1846-51) was currently appearing and Margaret Gatty fell upon it. She commenced an extensive correspondence with him which lasted for ten years until he finally called at the Ecclesfield vicarage to meet her. He described her in the following words: "She is slight, tallish and intellectual looking and withal quiet: at least as yet nothing very mercurial has broken out. But there is evidently the mercury below the surface.." Their accord was immediate and she obtained his permission to produce, with some guidance from him, her popularising version of his book. This appeared in two volumes in 1863 under the title: *British Sea-Weeds. Drawn from Professor Harvey's "Phycologica Britannica"*. In them she attempted to avoid technical terms and to keep her presentation simple.

A comparison of the two works shows that Margaret Gatty's illustrations are original and she did not make direct use of the plates of the earlier publication. It is likely from an occasional resemblance that she did not see all the species she lists but redrew some of her nearly four hundred figures from Harvey.

The other possible source for her illustrations would have been "Nature-Printed British Seaweeds" by Johnstone and Croall (1859), but the prints of these authors are different again.

Mrs. Gatty's "Seaweeds" was in use by students well into the twentieth century until the nomenclature finally became badly outdated and newer publications displaced it. Modern readers will find the long introduction to her work of historical interest. In it Mrs. Gatty describes the appropriate attire for a lady shore collector of her time. On the subject of petticoats she says: "If anything could excuse a woman for imitating the costume of a man, it would be what she suffers as a seaweed collector from those necessary draperies." Trousers were impossible, of course. And: "Verily we women are all 'more or less' (as seaweed descriptions have it), at the mercy of our dress!" But she strides across the shore devoid of jewellery, in her boy's boots and her woollen skirt, wearing no shawl or draping lace until we may encounter her, as she says, face down on a rock, peering into a rock pool for half an hour at a time, collecting weed. From her introduction we learn of places where she collected, Filey, Scarborough, Berwick, Douglas in the Is. of Man and the Scilly Is., to which must be added Hastings. What remains of Mrs. Gatty's extensive collection of seaweeds is currently held at the University of St. Andrews where they came to rest after the closure of the Gatty Marine Laboratory (named after a Gatty nephew) and additionally there are said to be a couple of thousand of her seaweed slides at the Weston Park Museum, Sheffield. Algologists at the Natural History Museum are currently enquiring further about this.

During much of her married life Margaret Gatty wrote stories for children. Her first book, entitled "The Fairy Godmothers", appeared in 1851 and by the time her seaweed book was published, twelve years later, the number of her children's books had also risen to a dozen. These included "Parables from Nature", which became a series, continuing until the fifth and last of the issue in 1871. It is indicative that she requested for payment for her "Fairy Godmothers" not a royalty but a copy of "Dr. Johnston's book on zoophytes". This would presumably be the 1847 edition of *A History of the British Zoophytes* by the Berwick physician George Johnston. For the second edition of her own book she received from the publisher a

copy of *A History of the British Sponges and Lithophytes* by the same author. Over the years she visited Johnston, collected with him and corresponded with him from the time of her first interest in seaweeds up to his death in 1855.

From 1866 she edited a new monthly magazine for children for the publishers Bell & Daldy, which she called "Aunt Judy's Magazine". For this she was paid £10 a month, all of which she appears to have passed to her husband. The magazine continued for some years after her death, edited first jointly by her daughters Juliana and Horatia and subsequently by Horatia alone until its demise in 1885. During the life of the magazine its readers contributed through Margaret Gatty and her daughters towards a fund for the Great Ormond Street Hospital for Children in London. By 1871 £1000 had been raised and an Aunt Judy's Cot was established, to be joined by a second in 1876, and other gifts followed.

In 1863, at the height of her literary and scientific powers Margaret Gatty's health began to fail. She started to suffer the initial symptoms of the paralysis which would eventually be the cause of her death. Over the next ten years she slowly deteriorated, finding it difficult and then impossible to write, first with her right hand and then with her left, and suffering the advance of what is now believed to have been Multiple Sclerosis. She died on 4 October 1873. In the year before her death she published two volumes that represented another aspect of her life's interest. The first was a book of a hundred and twenty four pages entitled "The Book of Emblems". In the book she takes mottoes of various sorts and writes two to four pages about each, with the addition of a picture. Examples of the thirty one rather odd titles are:- "The hunchback sees his neighbour's hump, not his own," and "Roasted pigeons fly into nobody's mouth."

The second book of 1872 was more significant and while the emblem book collected together a few mottoes "The Book of Sundials" represented a lifetime's work of recording sundial mottoes. The first edition was hers with a few continental additions by Eleanor Lloyd, a family friend. It contained 377 sundial mottoes. In 1889 a second edition was produced by her daughter Horatia, again with the assistance of Miss Lloyd. It was much enlarged, listing 759 dials and now included an appendix on dial construction. This was contributed by Wigham Richardson, a Tyneside shipbuilder who in time was to unite with Swan and Hunter to form Swan, Hunter and Wigham Richardson, the builders of the famous liner "Mauretania".

A third edition, little changed from the second, appeared a year later. The fourth edition and the one best known and now much sought after was brought out in 1900. It was completely rewritten by Horatia and Miss Lloyd, being enlarged to 530 pages and with many line drawings and a few photographs. The number of dial mottoes rose to 1682. Astronomical tables were added, together with a section on portable sundials. The final result is magnificent but most credit must go to Horatia Eden as she had now become. It is nevertheless a most fitting tribute to Margaret Gatty.

And what of her husband following her untimely death? He had settled comfortably into the parish and was respected by his parishioners to the extent that they contributed the sum of £120 to pay for the expense of a Doctorate of Divinity from Oxford for him. (Were such doctorates really bought and sold by universities in those days?) He continued as vicar of Ecclesfield for the next thirty years and in 1887 married again, a woman twenty four years younger than himself. He died in 1903, ending the Gatty connection with the parish and leaving a small literary legacy. But of the many remarkable Gattys the most outstanding of all was the one who always wrote under the name "Mrs. Alfred Gatty".

ACKNOWLEDGEMENT

I am much indebted to Mike Cowham for his help, both directly and through the literature, in the preparation of this account.

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THE LATE MRS. ALFRED GATTY

TRANSCRIPTION OF MRS. GATTY'S OBITUARY AS PUBLISHED IN THE ILLUSTRATED LONDON NEWS, 18 OCTOBER 1873

This estimable and accomplished lady, whose death was recorded last week, has long been known as one of the best authors of wholesome and pleasant reading for young people. She was a daughter of the Rev. Dr. Scott, Lord Nelson's chaplain on board the Victory at Trafalgar. Margaret Scott afterwards Mrs. Alfred Gatty, was born, in 1809, at her father's rectory of Burnham, in Essex. In 1839 she became the wife of the Rev. Alfred Gatty, D.D., Vicar of Ecclesfield, near Sheffield and Sub Dean of York Cathedral. After her marriage, and with her husband's assistance, she brought out, in 1842, the " Life of Dr. Scott," her father, which had something of an historical character. Mrs. Gatty's first independent work appeared from the press in 1851 being a graceful melange of fanciful stories, entitled " The Fairy Godmothers, and other Tales." In 1855 she followed up this first success with the earliest of the five volumes of her " Parables from Nature." The rest followed at uncertain intervals, until the fifth series completing the whole appeared, just two years ago, in 1871. Mrs. Gatty, in 1856, published her "Worlds not Realised," and a year afterwards her "Proverbs Illustrated." Her next Production was a tale, issued from the press in 1858, and called "The Poor Incumbent." In the same year she laid before her increasing number of readers a volume of "Legendary Tales," which were embellished by Phiz. "The Human Face Divine and Other Tales," published in 1860, was illustrated, as were several of her subsequent volumes, by the pencil of Miss C. S. Lane. A little over a twelve month afterwards Mrs. Gatty brought out, in 1862, the good-humoured record of a holiday excursion in Ireland during the previous autumn, under the whimsical title of "The Old Folks From Home." During that same year she edited "Melchior's Dream," having done the like good office in 1860, when seeing through the press, this time an association once more with her husband upon the same title page, "The Travels and Adventures of Dr. Wolff, the Missionary." Just ten years ago, in 1863, Mrs. Gatty first brought out her work on "British Seaweeds," reprinted last year in two quarto volumes. A twelvemonth afterwards she translated, in 1864, from the French of Professor Macé, "The History of a Bit of Bread." Mrs. Gatty was by this time beginning to extend her reputation as a writer for children. "Aunt Judy's Tales" had been originally published in 1858. "Aunt Judy's Letters" still further popularised the sobriquet. From the later collection there appeared in a separate form, in 1865, "Aunt Sally's Life "—the indefatigable writer producing within the last-mentioned twelvemonth, her "Domestic Pictures and Tales." In the May of 1866 she began her well-known monthly organ for children, entitled Aunt Judy's Magazine. Selected and reprinted from "Mission Life," she passed through the press in 1869, first "The Children's Mission Army," and afterwards "Mission Shillings". During the year 1870 she penned " Waifs and Strays in Natural History," and in 1871 put together "Aunt Judy's Song-Book for Children." Three works came from her hand only last year—"A Book of Emblems, with Interpretations Thereof;" a charming compilation, called "The Mother's Book of Poetry," adorned with engravings; and a sort of archæological autograph, entitled " The Book of Sun-Dials."

The portrait of Mrs. Alfred Gatty is engraved from a photograph by Messrs. Maull and Co.

ACHTUNG – SONNENUHR!

TONY WOOD

Nobody ever did give Gottfried Treue a warning about a sundial but on the 25th of July 1940 he came up (or down) against one in Gloucestershire and provided one of those byways in the history of sundials (and World War II).

His Ju 88 was apparently attempting an attack in daylight on the Hucclecote factory of the Gloster Aircraft Company and was intercepted by both a Spitfire and a Hurricane. It is possible that the German aircraft was brought down by being rammed by the Hurricane flown by Fl/Lt. Charles Bird.

Fig. 1.

At all events the crew of the Junkers baled out with Gottfried Treue landing in the grounds of 'The Folly' at Oakridge Lynch; he pitched forward onto the dial (Fig. 1) and broke his jaw.

'The Folly' was large enough to support a maid, Mavis Young, who was quickly on the scene followed by the owner of the house and dial, Mrs. Isobel le Bailly (Fig. 2). The German airman, obviously in pain, was treated with a stiff whisky as his introduction to England.

Fig. 2

The pilot of the Ju 88 and of the Hurricane both died and legend has it that the Spitfire pilot claimed the victory.

The sundial plate and gnomon are still at 'The Folly', no longer on the brick and concrete pedestal but nailed up over the door of an outbuilding Fig. 3). The octagonal brass plate sports an 8-point compass star, a couple of playful dragons and a split noon. It qualifies as a 'fixed dial' but is now a timeless memorial. The motto is admonitory as usual but concerned with here rather than hereafter: 'Time is Money' - unique to my knowledge.

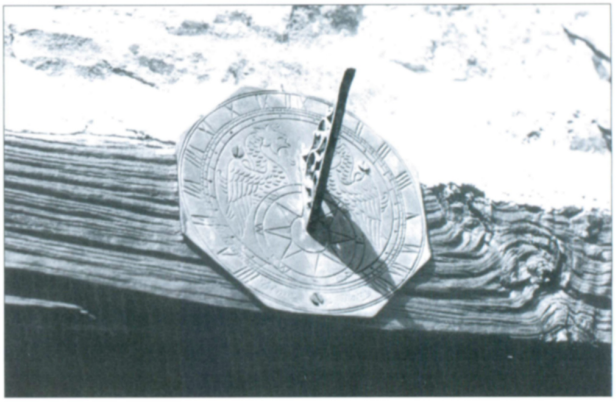

Fig. 3.

Oakridge Lynch still talks about it all, being a small village near Stroud, but boasting a museum where trustee Mr David Battisford told me of these events, provided photographs and took me to 'The Folly'. The village is not manorial and consisted in those days largely of artisans and craftsmen associated with the Arts and Crafts Movement who had settled in Gloucestershire from London. The 'Butcher's Arms' is the village pub and has a plaque (Fig. 4) presented in 2000 commemorating Fl/Lt Bird and also a framed extract from the local paper of July 1940 reporting all the details.

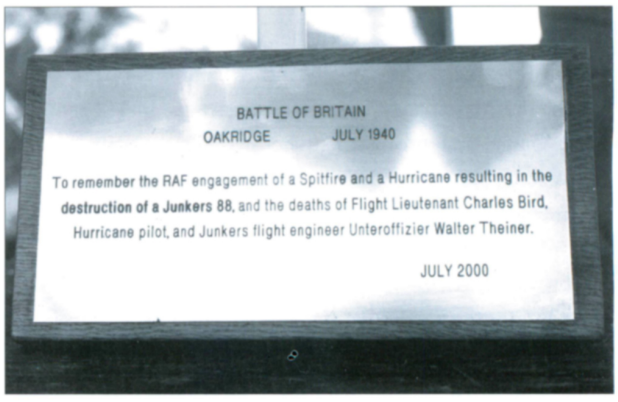

Fig. 4.

My thanks to Mr D E Battisford of the Oakridge Lynch Museum who responded to my Museums Survey and to Mr and Mrs Gue, present owners of 'The Folly'.

APPENDIX

Crew of Ju 88:
U/O Friedel Dorner (pilot)
U/O Walter Theiner (flight engineer) died
Wilhelm Hugelschaffer (observer)
Gefreiter Gottfried Treue

HURRICANE PILOT:

Fl/Lt C Bird died
Spitfire Pilot: ?

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DIAL DEALINGS 2003

MIKE COWHAM

The year 2003 was quite an interesting one for the sale of sundials, particularly portable ones. In the following pages I have picked out just a few of the dials that caught my attention. Where sale prices are quoted they include buyer's premium but not VAT.

CHRISTIE'S, 10 APRIL 2003.

In this sale a good 9" diameter brass Universal Equinoctial Ring dial, signed ***'C. Lincoln, London'***, was sold for £1997. Charles Lincoln was a little known instrument maker from the late 18th Century and this dial was well engraved with an attractive oak-leaf border around its inner ring: Fig. 1.

Fig.1. Signature of Charles Lincoln on Ring Dial

SOTHEBY'S, 28 MAY 2003.

This sale contained several interesting dials. An early oval silver Butterfield type dial by ***'Pierre Sevin'***, still housed in its original case, made £2280. I always find these earlier Butterfields most attractive and delicate, and Sevin (sometimes spelt Ceuin), was one of the better makers of French pocket dials.

A very interesting String Gnomon Dial housed in a gilt brass snuffbox was signed ***'M GIZL'***: Fig. 2. He worked in Salzburg in the late 18th Century and is only known for one other instrument, a theodolite. Both sides of the box are beautifully engraved with scenes of stag and bear hunting. It sold for £3120.

The dial that really drew my attention was another String Gnomon Dial signed ***'Franz Antoni Knitl - fecit Linz'.*** Knitl is well known for his complex mechanical dials that could be read to an accuracy of better than one minute. This one (like a similar one at Greenwich[1]) does not use gears but simply a rotating arm with a line inscribed on it: Fig. 3. In use, the dial is set level by its four adjustable feet and then to North by its compass. The arm is then rotated so that the shadow of the string gnomon falls exactly along the line on

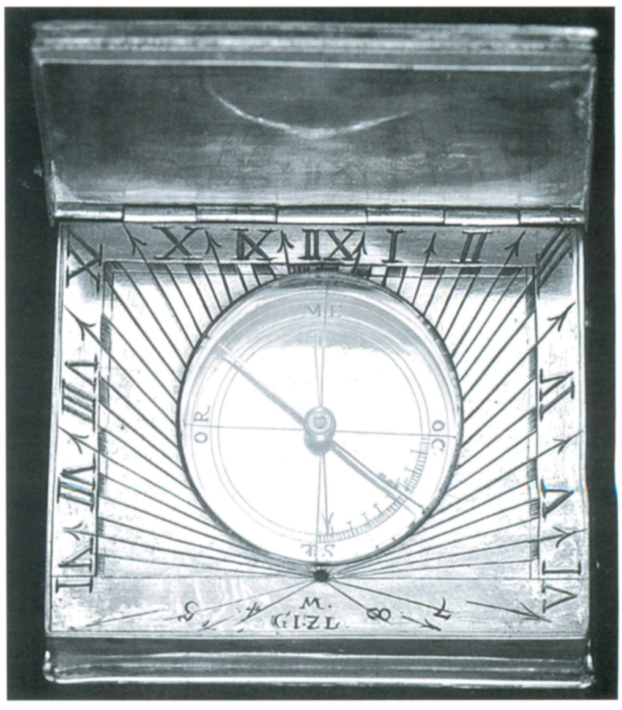

Fig.2. Brass Dial in Snuffbox by M GIZL.

Fig.3. Minute Dial by Franz Knitl.

the arm. The 'bottle-opener' shaped arm then shows the time in hours, halves and quarters inside its 'loop' from the main scale and the small pointer at its end indicates the minutes on two outer scales. Each of these scales are concentric and divided into 2 minute divisions but are transposed from each other by one minute. This arrangement avoids placing too many divisions all on one scale. The surface of the dial is beautifully engraved with a rural scene and decorative scrolls. This excellent dial sold at its lower estimate of £9600.

The following lot was a brass Miner's Dial signed ***'I A S 1707'***: Fig. 4. Some readers may wonder what a miner would do with a sundial, as sunshine is rather rare at the bottom of a mine! Of course, such a dial would be used for surveying purposes on the surface but it would also be useful underground because of its compass. This too sold for its lower estimate of £6000.

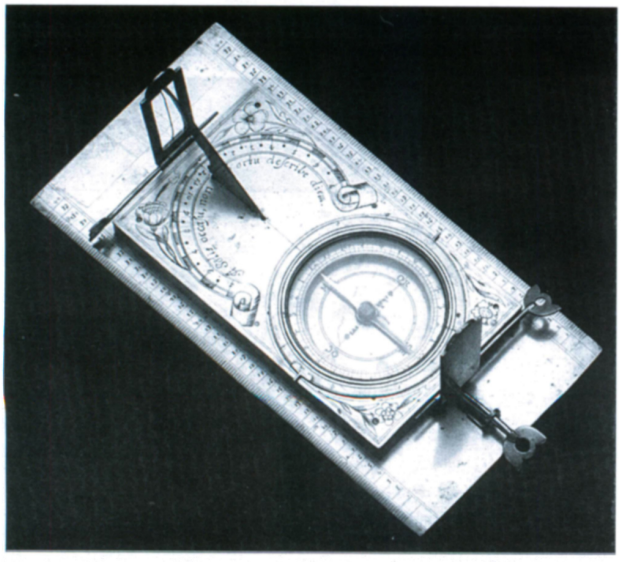

Fig.4. Miner's Dial by 'I.A.S.' 1707.

CHRISTIE'S, 1 JULY 2003.

This sale had a wonderful brass Universal Equinoctial Mechanical Dial signed ***'Godfrid Weÿs'***. It was elaborately engraved and is fully gilt with silvered scales: Fig. 5. It made a staggering £58,750. In many ways this minute indicating dial is similar to the fine Mechanical Dials of Knitl, (already mentioned).

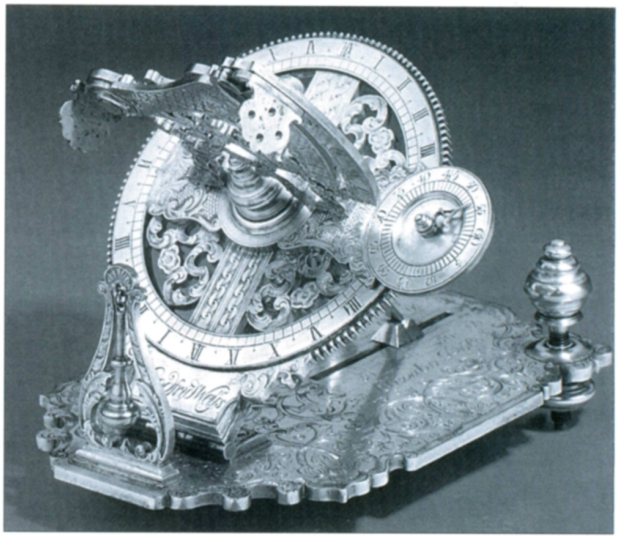

Fig.5. Impressive Universal Equinoctial Mechanical Dial by Godfrid Weÿs.

Later in the sale a small Ring or Poke Dial signed ***'·IO·H·S·THON·'*** and ***'·ANNO·1721·'*** was sold for £881: Fig. 6. This dial looks very like one of the 150,000 reproduction dials made by Metallwarenfabrik in 1975 as a promotion by Piz Buin.[1] I hope not for its new owner's sake! However the Piz Buin dial was an excellent copy of an original model by Johannes Thon, dated 1721 and it seems inevitable that some day these could be confused with the real thing. Looking back through my Makers Database I have noticed several of these Thon dials that have gone through various auctions in the last few years. In my last 'Dial Dealings' I warned about some replica Equinoctial Dials signed ***'West - London'*** that are flooding the market and have since noticed several of these too in my Database!

Fig.6. Poke Dial signed ·IO·H·S·THON· and dated 1721.

THOS. MAWER & SON AT THE LINCOLN SALEROOM, 25 SEPTEMBER 2003.

A really rare and valuable compass dial by Augustine Ryther, signed ***'AR fecit 1585'*** was offered: Fig. 7. Apparently it has been unearthed in a field at Glentworth Hall in Lincolnshire, the home of Sir Christopher Wray, Lord Chief Justice of the Queen's Bench. It was slightly damaged by a plough or spade and had lost some of its gilding due to corrosion. Amazingly the original paper compass scale remains intact although its original steel needle had virtually rusted away. This dial caused much excitement, even in its 'as found' condition and there was fierce bidding for it. Inside its lid is the name of ***Geo. Seyntpoll***, (George St. Paul), together with his arms. He lived closeby at Snarford and research is underway to find the link between the two families[2]. The dial sold for just below £20,000.

Fig.7. Rare Elizabethan Dial by Augustine Ryther.

CHRISTIE'S, 5 NOVEMBER 2003.

This sale had very few dials but I have picked out one, a 19th Century wooden dial of Chinese origin. It is fairly typical of the many Chinese dials of the period and is an ideal type for a low budget collector: Fig. 8. I find these Oriental dials fascinating and wish that I knew more about the various scales etc. A knowledge of Chinese would obviously be an asset. Included in the lid of the dial's case was a Geomancers Compass. It sold for just £376.

SOTHEBY'S, 16 DECEMBER 2003.

Their first dial was a very large wooden diptych with thin ivory plates covering most of its outside, engraved with various scales and tables. It is signed ***'M. Le Bourgeois à Lisieux'*** and dated 1599: Fig. 9. Lisieux is very close to Dieppe in Normandy and it would be interesting to think

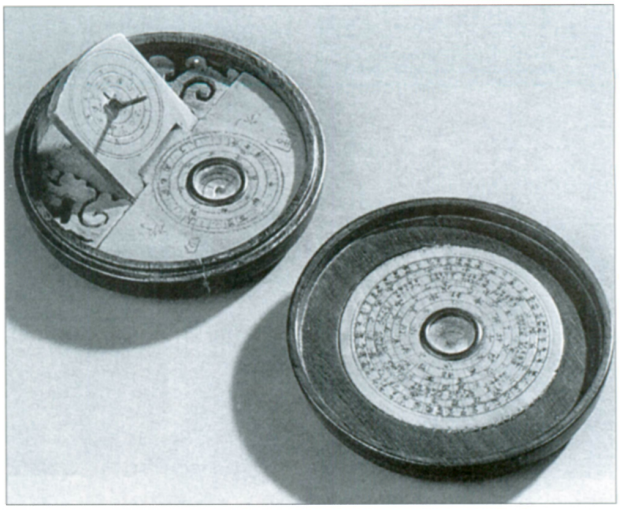

Fig.8. Chinese Dial and Compass.

that the tradition of making ivory dials began here before they were made in Dieppe. Certainly the date is some 50-60 years before the bulk of Dieppe dials were made. This dial has survived remarkably well but does show some shrinking of the wood and lifting of the thin ivory sheets. The quality of its engraving is not outstanding but its scales are extensive. It deservedly made £28,800.

The real surprise for me in this sale was a Persian Astrolabe dated 1429/30 that was estimated £6000 - £8000 and it actually made £62,400. Someone obviously thought it better than Sotheby's expert had predicted.

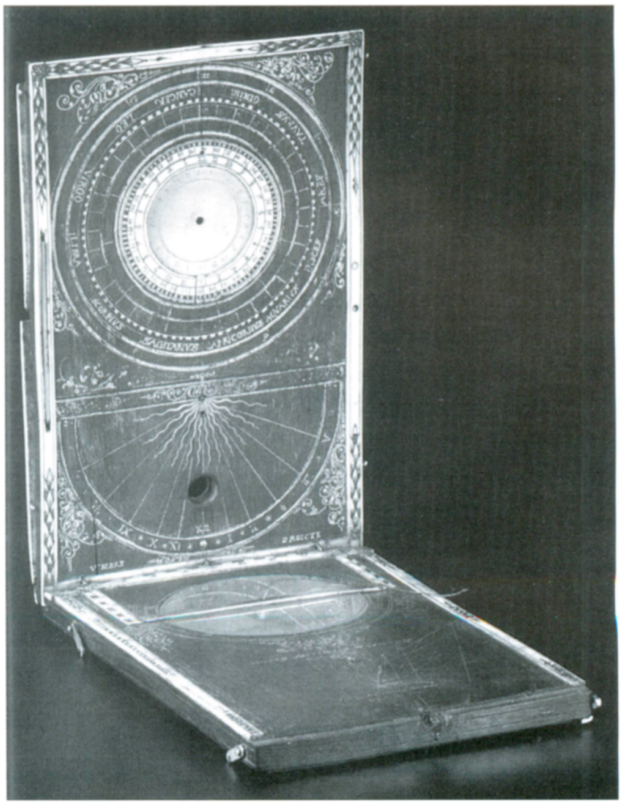

Fig.9. Large Ivory and Wood Diptych Dial by M. Le Bogeois à Lisieux, 1599.

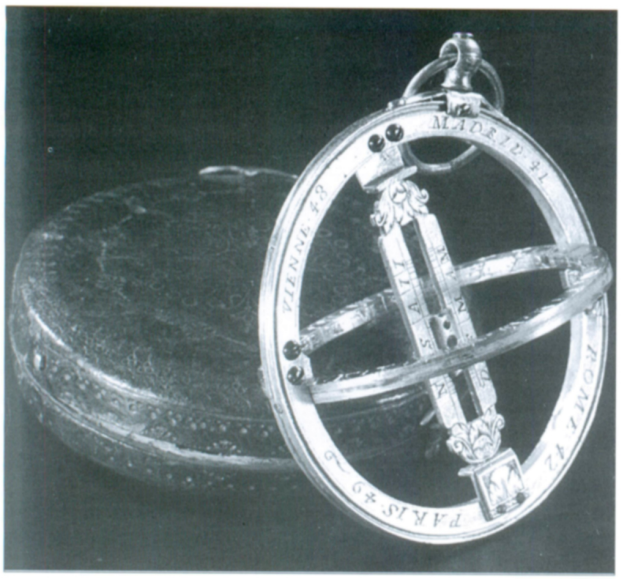

Fig.10. Swiss Ring Dial by I. Martin of Neuf châtel, 1693.

The majority of the dials in this sale were from one single collection and I have chosen just four to illustrate these. The first is a gilt Universal Equinoctial Ring Dial, complete with its original leather case, signed ***'I. Martin à Neuf châtel 47(°) 1693'***: Fig. 10. It was well made by this virtually unknown maker who is thought to be a watchmaker who was working in Neufchâtel at the period. It is certainly different in style and engraving to the dials of his namesake Johann Martin of Augsburg.

One of the most attractive lots was an ivory Finger Ring Dial signed ***'L M'*** and dated 1631. It may be attributed to Leonhardt Miller of Nuremberg: Fig. 11. It actually contains a miniature Diptych String Gnomon Dial that is revealed by opening its lid. Such dials are always greatly sought after and it made £10,200, which was over three times its estimate.

Another rather small Nuremberg ivory dial, thought to be from the Karner workshop was attractively decorated with a flower with red petals: Fig. 12. It was unsold in the sale

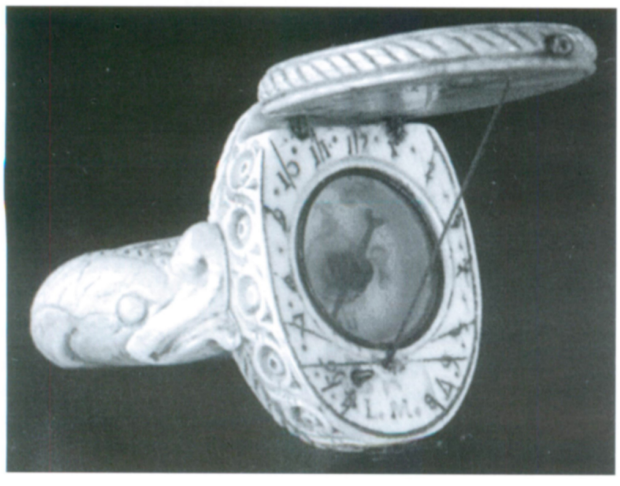

Fig.11. Ivory Finger Ring Dial signed L.M.

although a most desirable piece. However, I understand that it was sold later by private treaty. Most dials, we believe, were made for the gentleman but in this case I believe that it could be a lady's dial. Its decoration is surely feminine and its size small enough to fit into any pocket or bag.

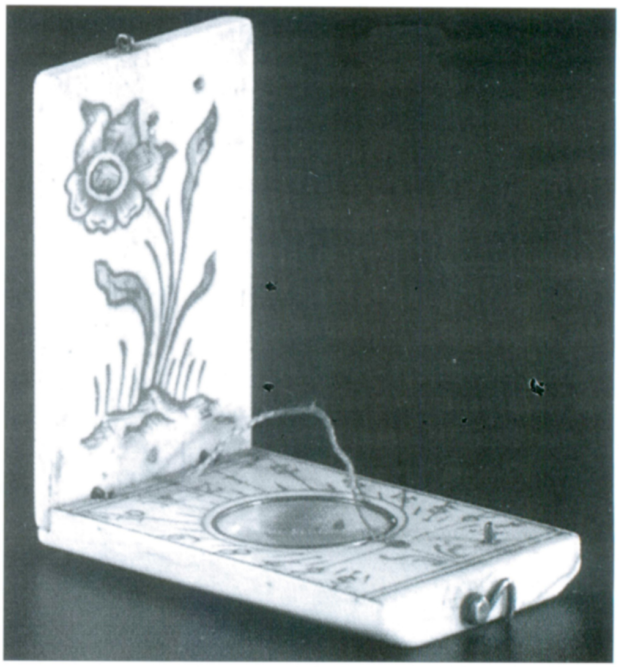

Fig.12. Small Ivory Diptych Dial decorated with a coloured flower.

As my final example from this sale I have chosen a very attractive dial by ***'Charles Bloud'*** from Dieppe: Fig. 13. The design of this dial is typical of his Magnetic Azimuth types but he has used a rare decorative technique, (probably of acid etching with a wax resist), to produce a red mottling to parts of its surface. Another Dieppe dial - almost identical - signed by Nicolas Crucefix is known and similar mottling techniques to this are used on two dials in the Museum for the History of Science in Oxford. This dial sold for £4200, well above its top estimate.

Just before Christmas I received a call from a friend who had seen a 'Ring Dial' in a local antiques fair. I just had to go to see it. The dealer produced this small Poke Dial which was in a much too shiny condition. It had obviously been 'over-restored' and its new gnomon band was completely wrong. He admitted that the dial had been found in the ground, completely split apart, 'like a ribbon'. It had been restored by a silversmith, who admittedly had done a fine job - apart from getting the gnomon wrong. For me, the dial would have been more interesting in its 'as found' condition and was completely ruined by its restoration. Its restored price of £650 was far too high and more like the price for a perfect piece. Unrestored it would be valued at less than one tenth of this figure.

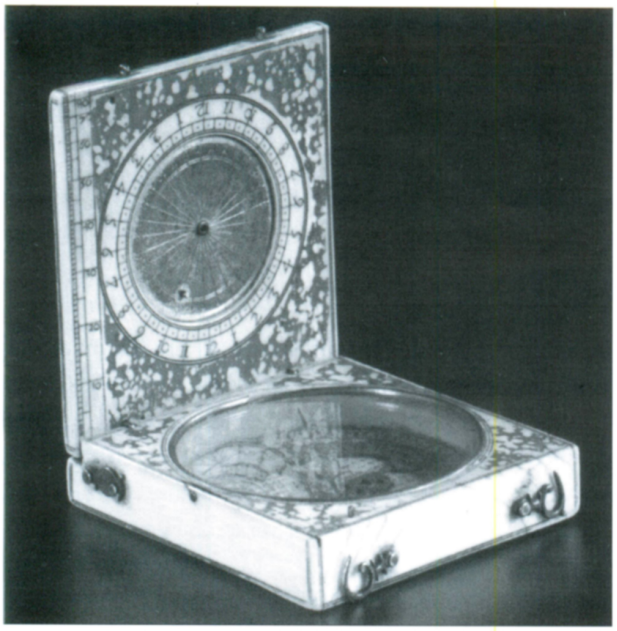

Fig.13. Attractive Magnetic Azimuth Dial by Charles Bloud, Dieppe.

PROJECTED SALES FOR 2004

Bonhams.

25th February - Scientific Instruments
6th October - Scientific Instruments
Contact:- Jon Baddely. 020 7313 3149.

Christie's South Kensington.

8 April - Exceptional Scientific and Engineering Works of Art
30 June - Scientific, Medical and Engineering Works of Art, Instruments and Models
20 October - Scientific, Medical and Engineering Works of Art, Instruments and Models
Contact:- Tom Newth. 020 7752 3147.

Sotheby's. (Note that Instrument Sales have now returned to their Bond Street premises).
15 June - Scientific Instruments
14 December - Scientific Instruments
Contact:- Catherine Southon. 020 7293 5209.

FAIRS

Sunday 25 April 2004.
36th Scientific & Medical Instrument Fair.
Sunday 24 October 2004.
37th Scientific & Medical Instrument Fair.
Both are held at the Radisson SAS Portman Hotel, Portman Square, London, 10:00 to 16:00.
Contact:- Talbot Promotions. 020 8969 7011.

ACKNOWLEDGEMENTS

I would like to thank the following for allowing me to use their photographs. Christie's South Kensington for Figs. 1, 5, 6 & 8. Sotheby's Olympia for Figs. 2, 3, 4, 9, 10, 11, 12 & 13. Trevor Philip & Sons Ltd. for Fig. 7. These pictures remain their copyright.

REFERENCES

1 H. Higton: *Sundials at Greenwich*. OUP, Oxford, 2002.
2 Private Communication. Trevor Philip & Sons Ltd.

NOTES FROM THE EDITOR

VENUS OBSERVED: This is the title of a one-day seminar, to be held on Saturday 8th May 2004, at the National Maritime Museum.

Members of the BSS who are interested in astronomy will know that a transit of Venus (this planet will pass between the earth and the sun at a time of day when it can be observed) is due to take place on 8th June this year. Transits of Venus are rare events: there have been only 6 such transits since the invention of the telescope, an early one being in 1769, observed by the explorer James Cook on the island of Tahiti.

The seminar covers the topics: 'Transits of Venus: the Big Picture'/ Transits of Venus in the Netherlands' / 'Venus and the development of astronomical photography'/ The Royal Observatory's expeditions'.... The Day is from 10.00 until 16.15 Cost £29 concessions £17.

DAMAGE LIMITATION: Readers will have observed several errors in the production of the December Bulletin. The most serious was the wrong Volume Number; but there were others: poor Figure-caption placing, changes of font size and so on. The stickers supplied with this issue will, we hope, allow you to cover-up the misleading **16** on the cover and title page of the December issue, replacing it by the correct number...**15**.

GUERNSEY SUNDIALS: This is the title of a 50-page booklet by our members David and Dorothy LeConte, published in February 2004 by La Société Guernesiaise. 'The most interesting Sundials in Guernsey, with a general history of sundials and designs specific to the Island'. The booklet 'describes 18 of the best, as well as some which are not accessible to the public, and some on the islands of Alderney and Sark'.

Here is a good reason for taking your holiday this year in the Channel Islands.

Price £4.75...from La Société Guernesiaise, Candie Gardens, St. Peter Port, Guernsey, GY1 1UG

We hope that a supply of the booklets will be available at the BSS Annual Conference in April.

BOOK REVIEW

Time by Silke Ackerman and Paul Buck. British Museum Press; @ £8.99 inc VAT (32 pp, plus 4pp of stiff 'Cut-Outs') (A4 size), 1999. ISBN 0 7141 0595 3.

This instructive booklet is most attractively presented. It describes clearly and concisely how time is measured: by the apparent motion of the Sun; by the use of Sundials; by studying the apparent motion of the Stars; by means of Sand-glasses; by the use of Water-clocks; and by means of Clocks and Watches. The various World-Time Zones are discussed, as is the design of a Perpetual Calendar.

The booklet is well illustrated in a clear, appealing manner, and is designed to be appreciated by young readers. Five coloured, stiff 'Cut-Out, Cardboard Models' are provided in the centre of the booklet. These are simple in concept, instructive and easy to construct. Full instructions concerning their assembly are given at the end of the booklet. The models include: an adjustable Equatorial Sundial for use in the Northern Hemisphere; another, similar, Equatorial Sundial for use in the Southern Hemisphere; a Nocturnal for telling the time by the Stars in the Northern Hemisphere; a similar Nocturnal for use in the Southern Hemisphere; and a Perpetual Calendar for use during any of the years from 1984 until 2032 (thereby enabling young readers to ascertain the Day-of-the-Week when they were born!).

A small liquid-filled Compass is provided (attached to the front cover of the booklet) suitable for insertion into either of the Equatorial Sundials, in order to enable these instruments to be correctly oriented, after being placed on level ground in the sunshine, and before the time is determined.

This booklet is most informative, without being over-complicated, or unduly sophisticated. Indeed, surprisingly but perhaps deliberately, even the Equation-Of-Time Graph, or Chart, is excluded, no doubt in order to avoid complexity. The Authors seem to have aimed this booklet at bright and inquisitive young readers. Nevertheless, this volume can certainly be appreciated and enjoyed by interested adults.

At present this little book is 'Out-Of-Print'. However, cut-price copies may still be obtained through 'Publishers' Outlets' such as 'The Works'. Peter Ransom, a BSS Member, has managed to acquire copies by this route and copies may (while the stocks last) be obtained directly from him @ £3.00 including postage, or at £2.50 in person.

Even at its published price, the original copies of this booklet are understood to have been sold extremely quickly from the shelves of the British Museum Book Shop.

Maurice J Kenn
West Wickham, Kent

FROM THE MENTAL HOME AND WORKHOUSE

A.O.WOOD

Recently discovered sidelights on Britain's social history have been provided by a sundial at a Nottinghamshire workhouse and the calculations for a meridian line at a Mental Home in Wiltshire.

Both were made by 'inmates' who would not usually have been regarded as likely people to create such items.

The Museums Survey has now reached phase 3, i.e. a third batch of about 50 museums has been targeted, mainly 'smaller' establishments. The results from the first two phases were very encouraging and included a door in the little village museum at Market Lavington in Wiltshire. (Fig. 1)

Fig. 1. The Door at Market Lavington Museum

The door was from a now demolished (in the 1950's) Mental Home nearby. It was covered with calculations, apparently for a meridian line using a 'sunhole' aperture and no doubt checked by the church sundial, which must have been visible as the patient complained about its timekeeping.

Harriet James was dispatched to find out further details following the Museum's initial reply. She took photographs of the door and found that the Curator was delighted that someone could tell them about the mysterious diagrams.

The door was painted by a patient with initials J.L.M. who was known in the village as he regularly complained to the church authorities that their sundial was twenty minutes slow. This dial now has a missing gnomon so it is impossible to check his complaint. J.L.M. seems to have had access to a lean-to outbuilding where he constructed the meridian line.

The diagrams on the door are drawn in white paint and dated 1933 – 1934. Along the top is written (all upper case but with the I dotted) 'Please Take Care. The Equation of Time. Add 8 minutes for Greenwich'.

Below is an Equation of Time table: with 'The Equation of Time is the difference between sundial or solar time. Sundial time is the true suntime for the day. Clock time for the year (average) JLM'. To the right of the EoT Table is a list of what the 'suntime sundial' can show, including wind direction from the clouds crossing the sunlight aperture!

Then we have 'This sundial shows that the sunbeam (spotlight) obeys sundial laws' and 'The centre of the sunline is in the inner distant corner'.

Each of the two panels below this has a diagram.

The left-hand one shows a meridian line with lengths marked to various dates: Jun 21, Apr 4, Mar 21, Nov1 and Dec 22. Two solstices and an equinox, Nov 1 is All Saints' Day and it is speculated that Apr 4 was J.L.M.'s birthday. The line is marked with N and S and at the lower end are faint traces of a circle divided into 15° intervals. A 'height' of 5' 11" is quoted and below is written 'Shadow shortest at solar noon. N & S. The equinox line forms a cross. John 11.9 (Holy Bible) J.L.M.'

The right hand panel has a diagram and the latitude and longitude for Market Lavington with the appropriate correction from GMT. The 'spotlight' height is quoted as 10' 6".

The crossrail below has on it written 'To obtain true mean clock-time from the spotlight add 7 mins 52secs (Lavington is nearly 8 mins or 2° W of Greenwich). 1° 58' apply Equation of Time for the day (table above). The Equation

of Time is the difference between local solar time (sundial) and mean clock-time'

So far, so good and it would be nice to report that our patient was correct in all his calculations and wonder why he ever finished up in a mental asylum if he could produce sundials and meridian lines.

The problems begin with the N and S marking on the left-hand diagram (surely reversed) and the 'calculated' distances are very inaccurate. They should be:

Jun 21	3' 11"	J.L.M. has	3' 6"
Apr 4	6' 1"		6' 4"
Mar 21	7' 5"		7' 6"
Nov 1	13' 1"		12' 4"
Dec 22	21' 9"		20' 1"

i.e. an error varying steadily from +5" to -20".

It has been suggested[1] that this may be due to the fact that the figures are taken from measurement rather than calculation and the error possibly due to a sloping floor.

Turning to the right-hand diagram, the sentence about the sundial centre being in the distant corner was originally rather baffling. However 'centre' here refers to the foot of the notional gnomon which might have been expected to lie *outside* the building. The aperture for the sunlight spot however was not in a wall or window but in the roof of the outhouse. Probably a missing slate which may go some way to explaining the apparent 'calculation' errors if the hole were rather large and the lengths again measured.

Harriet James has commented 'Perhaps not really mad, just enthusiastic about sundials'; this must be his epitaph.

Harriet is about to undertake restoration of the Church sundial (SRNo 1921) and refit the missing gnomon. There is a suggestion it may have been bent by accident at some stage. She says she will check to see if the complaint was justified – rather naughty, but a permanent twenty minute error would be a lovely memorial!

The sundial at Southwell is on The Workhouse, now a National Trust property, open to the public and dating from the 19th century and resulting from the New Poor Laws enacted in 1824[2].

The dial itself (Fig. 2) is scratched on the south wall of the building to the lower left of one of the ground floor windows on the east side. This overlooks the Able Bodied Men's Exercise Yard.
Although consisting of only a couple of horizontal lines and

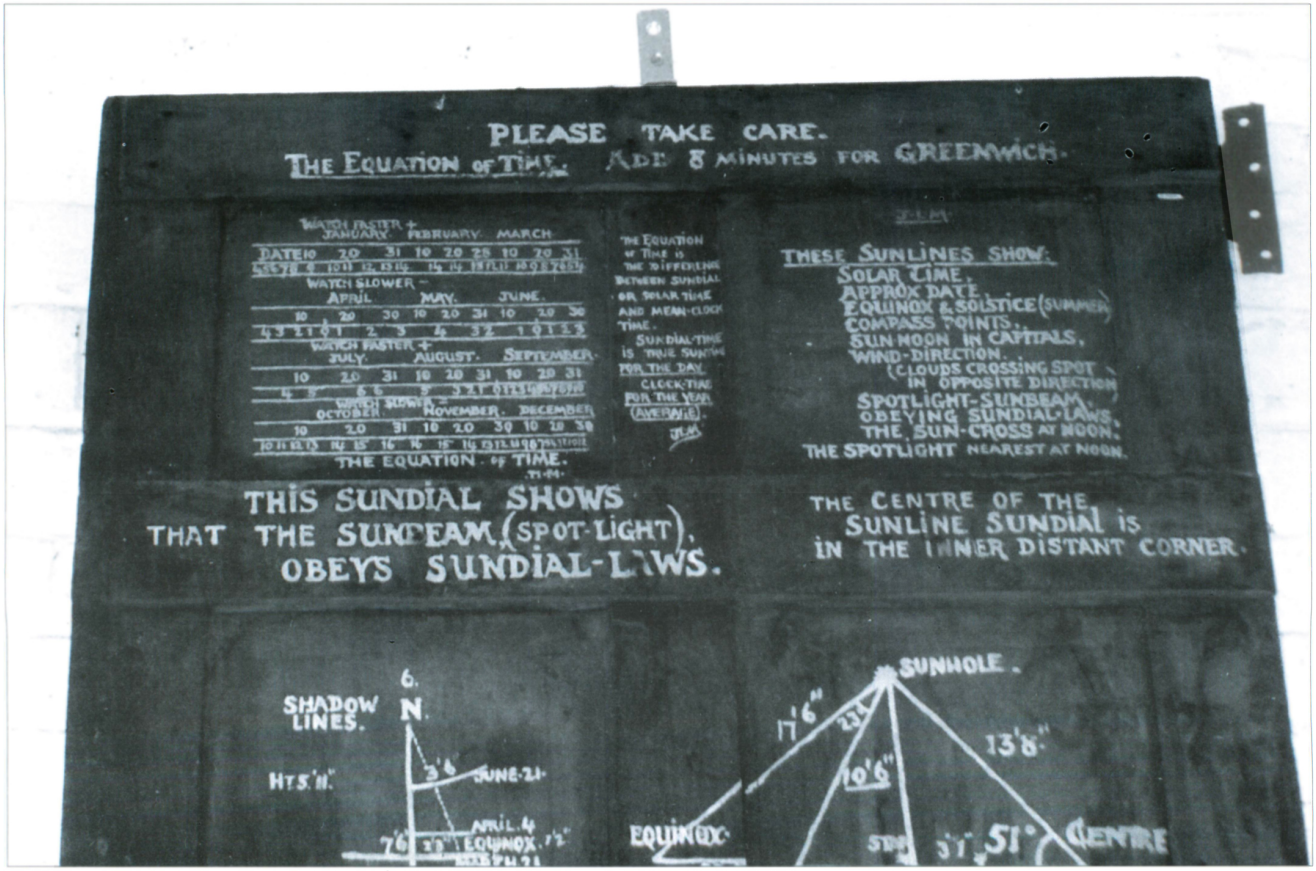

Fig. 1a.

Fig. 2. Dial at the Workhouse, Southwell Notts by Kind Permission of the National Trust

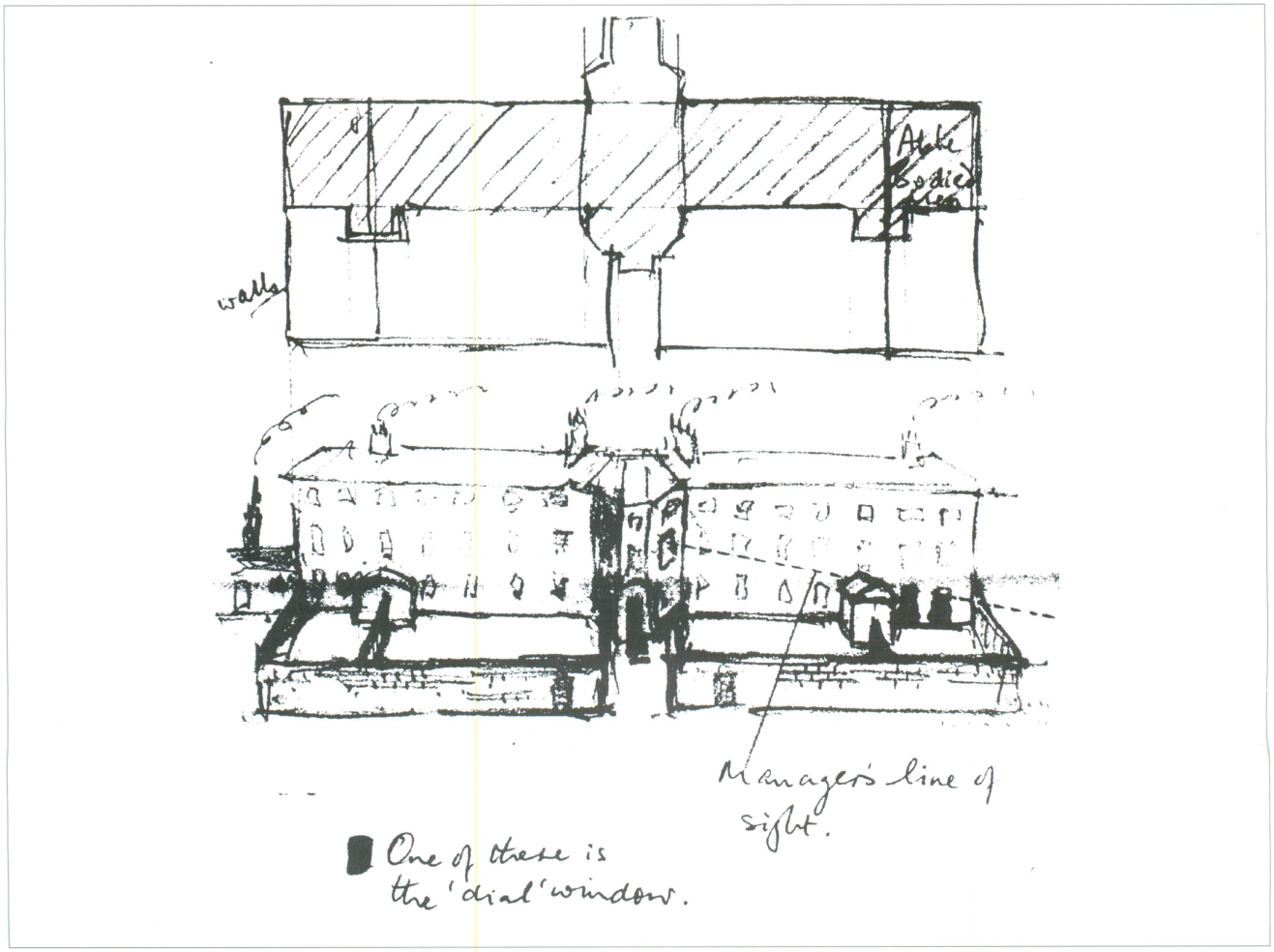

Fig. 3 Sketch of The Workhouse Southwell, Notts

a few cross markings, it is clearly a dial. Moreover, one based, by memory probably, on a vertical church dial. The gnomon is the stone window sill which has a sloping top surface and casts a shadow in the morning up to around noon.

As can be seen in Fig. 2 the shadow of the vertical face of the sill is the bit that actually crosses the marker lines at times near noon in August. And of course the dial would not mark hours at all accurately since the sill top edge is practically horizontal.

The location of the dial is shown in Fig. 3 and it is speculated that it is sited deliberately out of sight of the manager's office window.

Historically one would have expected the life of a Victorian workhouse to have been governed by at least one clock – why was a sundial thought necessary, were the workers kept in ignorance of the time? Apparently so, the Master and Matron had a clock but otherwise ran the establishment by natural light.[3]

There are a couple of unanswered questions from this apparently innocent dial.

1) Is there a corresponding 'afternoon' dial to the right of the window?

2) What is its classification?, and here we are on slippery ground. I am minded to call it a 'vernacular scratch dial' and put it in the same category as marks on the kitchen windowsill made in countries more blessed with more sunshine than we are. However a scratch dial might be classed with such medieval dials which the Society refuses to archive and so the records may well disappear. Sundial taxonomy is a tricky subject!

ACKNOWLEDGMENTS

Mrs Peggy Gye, Curator, Market Lavington Village Museum, also husband Tom.
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Dr J. R. Davis, Flowton Dials, Suffolk.
Nicola Williams, Property Manager, The Workhouse (NT), Southwell, Notts.
C. M. North, Guiseley, W. Yorks – Workhouse dial photograph and sketch.

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Holy Bible: Gospel of St. John 11, 9 'Are there not twelve hours in the day?'
1) J R Davis, personal communication.
2) The National Trust Handbook - East Midlands - The Workhouse, Southwell, Notts.
3) Nicola Williams, personal communication.

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GL3 1LA

SUNDIALS PUT CLOCK IN THE SHADE

BRIAN MOSS

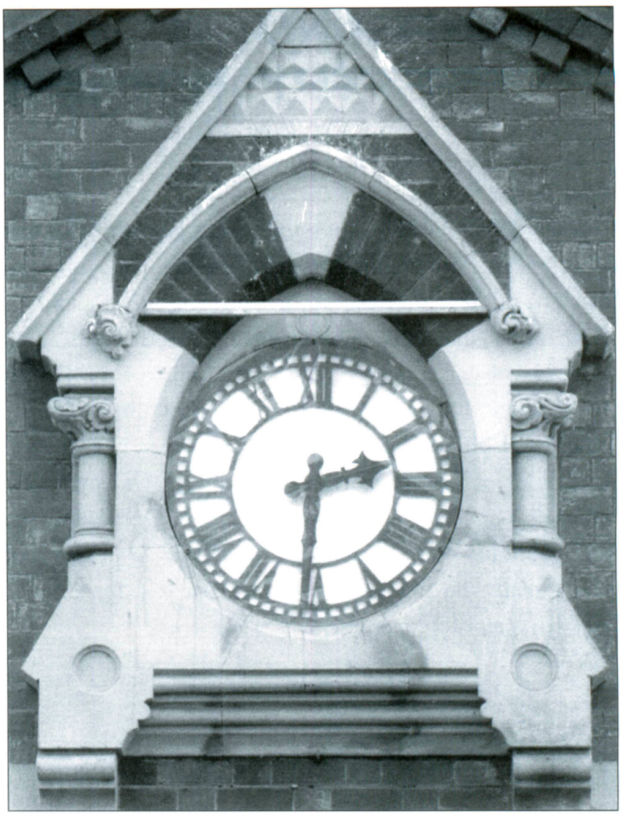
The BSS set out its stall on a sunny bank holiday morning on Monday 26th May at a Fair held in the Victorian railway station Tynemouth. Gordon Adam, European MP, was one of the distinguished visitors.

There were other stalls too displaying timekeepers of general interest and one especially for children who were encouraged to make paper sundials for colouring-in. Time was clearly the overall theme for the day and the station clock - now restored to its original condition - was to be the centre of attraction. And, to help draw the crowd, TV's John Grundy had been invited to carry out its unveiling.

One in particular attracted a great deal of interest, because on duty were members Frank and Rosie Evans with Tony Moss and new members Brian and Maureen Moss. Under a BSS banner a range of dials by Tony and Frank were on

display, which kept the 'Staff' very busy dealing with a variety of questions including the usual 'what is the sticky-up-bit on a sundial for?'

Waiting for the dignitaries to arrive, Friends of Tynemouth Station together with folk just out for the day, wandered from stall to stall.



A most enjoyable, sunny and successful occasion summed up by an onlooker who remarked that the BSS display had put the station clock in the shade.

Report by Brian Moss, Whitley Bay

FINDING NORTH WITH A MAGNETIC COMPASS - THE ACCURACIES ACHIEVABLE

D A BATEMAN

Considerable accuracy is possible, but a number of factors give practical limitations. Even so, the magnetic compass can give a valuable back up or check on other methods. Few realise that it is possible to determine north to an accuracy of one minute of arc within most of the British Isles, albeit with specialised fluxgate theodolites. On the other hand, all are aware that the compass can be disturbed by iron objects or magnets in the vicinity. This particular quest for understanding began with the purchase of an unusual liquid-filled compass at, of all places, a clock fair. Ten Pounds did not seem too much to pay for what is clearly a precision instrument - see Fig 1.

Fig 1. An ex-Navy projector binnacle compass.

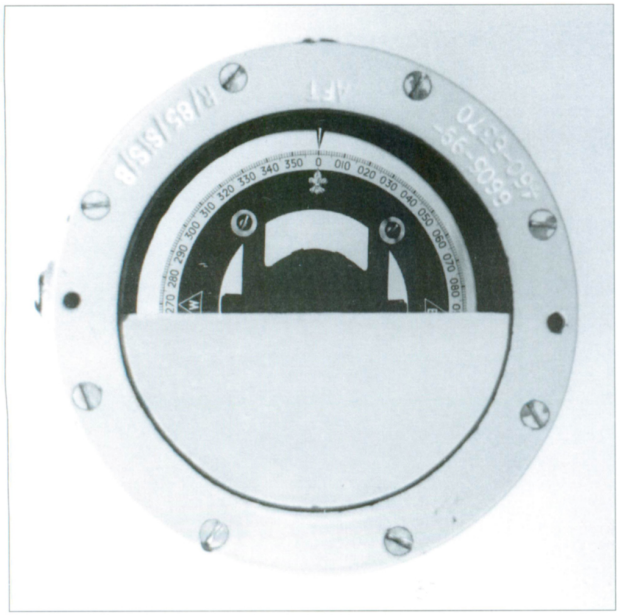


Fig 2. The compass card illuminated from below and viewed from above.

The compass is government surplus and from the inspection note, still in place, ex-Royal Navy. It has a NATO Stock Number 6605-99-460-6370, and the Ministry of Defence numbering agency has it recorded as Compass, Projector, Binnacle. No other information was available, but the description fits with the design having two flat glass 'windows' top and bottom. Fig 2 shows the compass card illuminated from below. Fig 3 shows that with a lens, it is capable of being read to a fifth of degree. The quest then, is how to exploit this accuracy, delving into some of the fundamentals of geomagnetism and map making on the way.

MAGNETIC NORTH

It is well known that the earth acts like a magnet, and equally well known is that the magnetic north pole does not always coincide with geographic north. Furthermore it is known that the direction to the magnetic north varies across the globe and that this *magnetic variation* can change gradually over the years. The British Geological Survey maintains three magnetic observatories in the British Isles at Lerwick (Shetland), Eskdalemuir (Scottish Borders) and Hartland (Devon). The records from 1840 to the present day show that during this period the variation changed from about 25°W to about 5°W for the Hartland observatory (partly computed from data from its predecessor locations at Greenwich and Abinger). The observatories produce data for global models of variation, and for home use, with additional data from 50

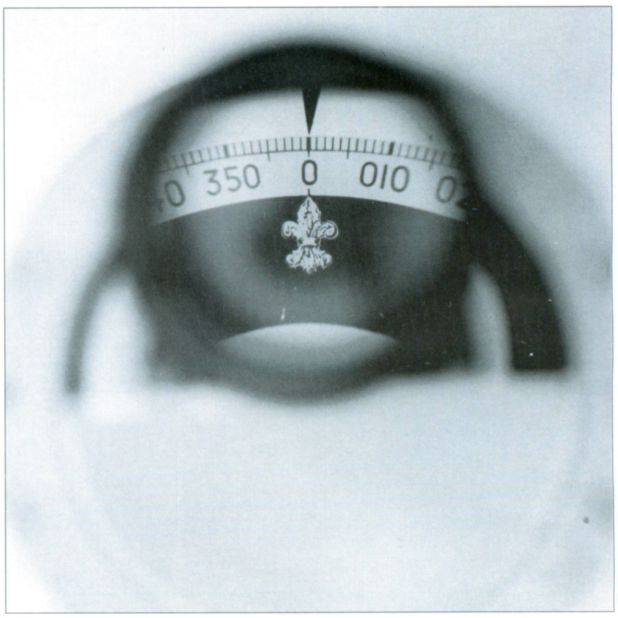


Fig 3. A magnified view of the card and lubber's point.

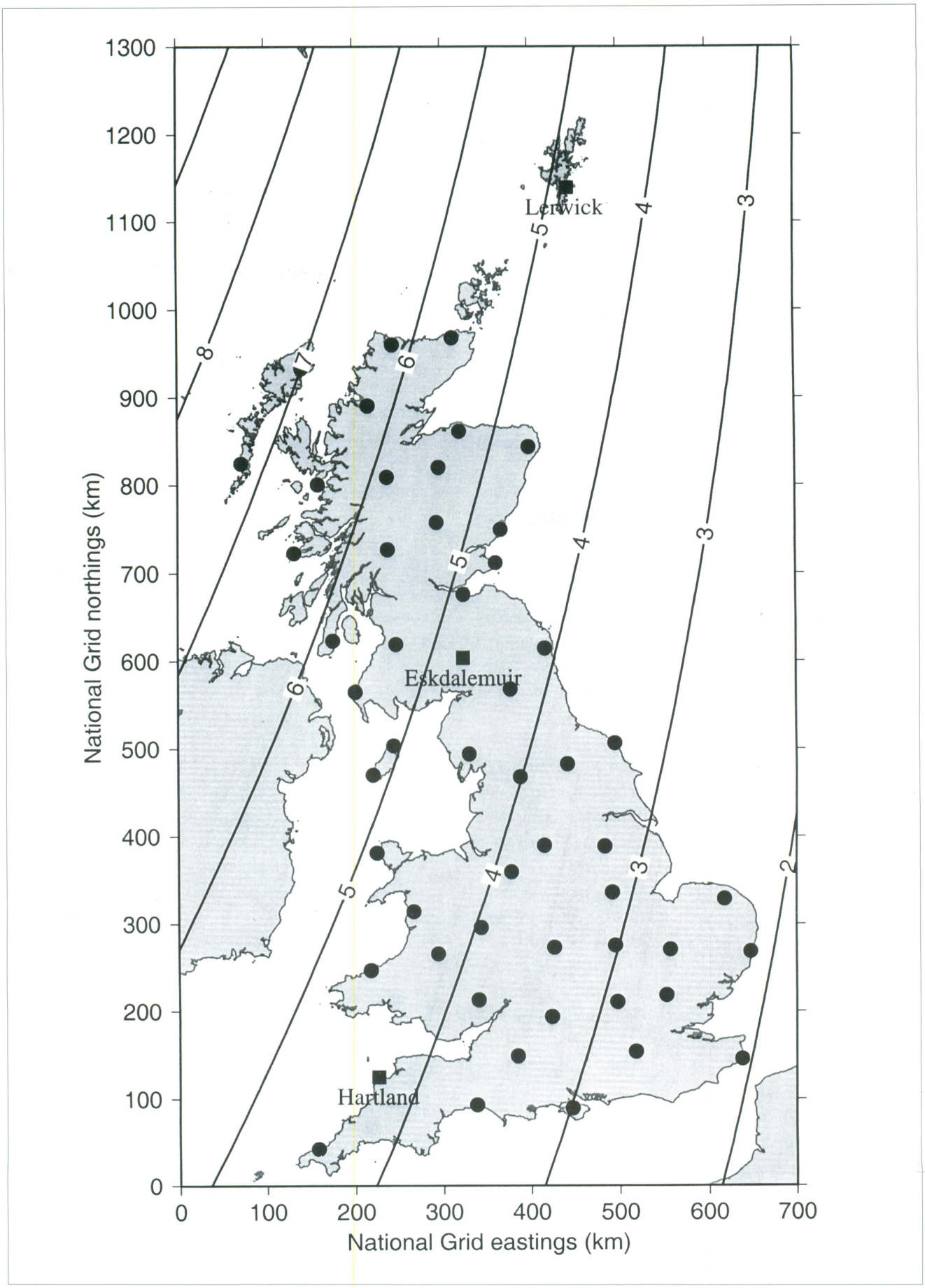


Fig 4. The locations of British Geological Survey observatories (squares) and repeat stations (circles). Declination or magnetic variation (degrees west of true north) shown for 2003.5.

other locations in the country, a model is produced for Ordnance Survey. This gives the familiar variation diagrams on the smaller scale maps. For example, the local Sheet 175 Landranger 1:50 000 scale gives "Grid Magnetic Angle 03° 35' (64° mils) W of Grid North July 2004 at the centre of the sheet. Annual change about 11' (3 ½ mils)E". (One notes the use of mils, 1/6400 of a circle, the angular measure used in artillery, which links to the origins of the maps for the ordnance.) For the British Isles as a whole, the contours of variation are shown in Fig 4.

However, another and more recent method of obtaining the local variation is to use the geomagnetism page in the website of the British Geological Survey. Enter www.geomag.bgs.ac.uk then click on the link entitled - Models, Charts and Magnetic Data for Navigation. This in turn gives options: choose Grid magnetic angle calculator. Enter your e-mail address and the grid reference of the site of interest. This has to be the full coordinates in metres, for example the centre of the Sheet 175 is 480000 175000 (the normal six-figure reference would be SU 800 750). Click submit, and the answer is given as "Magnetic north is estimated to be 3° 51' west of grid north in July 2003". Note that in both the case of map or website derivation, the map must be referred to in order to measure the angle between grid north and true north. At the time of writing, this particular web page only gives the variation for the month of July, and is recalculated annually by the British Geological Survey.

An alternative website page gives a global model, and this one has the advantage of giving the result relative to geographic north. It has another advantage in giving the variation at specific dates with a time resolution of 0.1 year. Following the website and links to the models and charts page as above, one then links to International Geomagnetic Reference Field (IGRF) and then to the IGRF Synthesis Form where you input the data for your site as altitude, latitude and longitude. Both models will give slightly different results being revised at different intervals, and the British Geological Survey consider the IGRF as more than adequate for aligning sundials.

THE PRACTICAL LIMITATIONS

Given the accurate measurements from above, what then are the limitations? The main part of the Earth's magnetic field is generated by electric currents flowing in the liquid metallic core. However, the Earth's crust can contribute to the overall magnetic field where the rocks may have a magnetic field of their own, or have an induced field from the main magnetic field. The crustal field may deflect a compass from the direction of the main field, although in most of the British Isles the effect is much less than one degree. Some locations, such as Skye and Mull in the Hebrides, the crustal deflection can amount to a few degrees. Generally the deflection is small enough to be ignored, although the British Geological Survey gives a warning that it could be greater that 0.5° in a few isolated locations.

A compass needle can also be influenced by the so-called external magnetic field. One component is due to electric currents circulating in the ionised regions of the Earth's atmosphere at altitudes greater than 100km. The effect is sometimes called the ionospheric dynamo. This has a mainly diurnal effect and is greatest when the sun is heating the upper atmosphere. There are links with the solar cycle and seasons, and the effect is generally less than ±0.1° in the British Isles. I have looked for the effect with the compass in question (and a large World War II P8 aircraft compass), but have not detected it.

The second external effect is due to magnetic storms that result from clouds of ionised gas ejected from the sun. Such storms can disrupt high frequency radio communication and create the aurora. In the British Isles a compass needle can be deflected by more than 1° on a couple of dozen days a year (depending on the time in the 11 year cycle of solar activity). The effect is typically present for only a few hours during magnetic storms, and more severe in northern latitudes. The advice from British Geological Survey is "If the aurora is visible then compass errors should be expected".

So much for the Earth's magnetic field, but what about man made influences? Any magnets nearby will obviously have an effect, but most magnets are quite small and experiments with a selection of 'toy' magnets, some cannibalised from instruments, and a strong 'pick-up' tool, showed that as long they were kept at least 2 metres away, their presence was undetectable. Non-magnetic ferrous objects can distort the

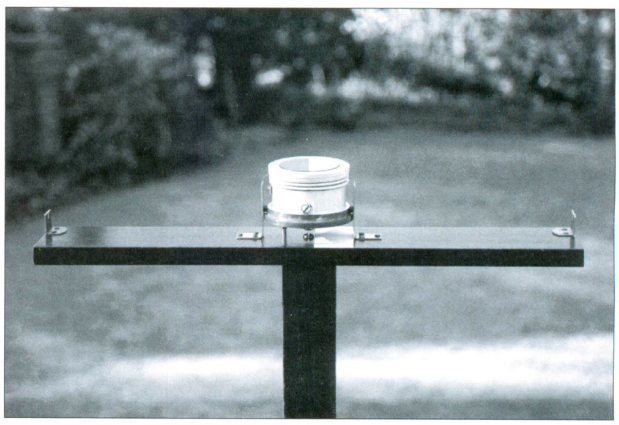


Fig 5. The compass mounted on a board with brass sighting vanes to make an improvised surveying compass.

local earth's magnetic field, and in one case, I kept detecting a mysterious swing of the compass whenever I went near to it. The effect was due to the spiral metal binding of the shorthand note pad I was holding in my hand. The answer is - check your pockets or nearby tool kits!

Large ferrous objects are a different story. A motor car is detectable at many metres, and the main danger is from large diameter buried iron pipes. The advice, therefore, is to be aware of the risk and take the compass bearings from at least two different locations.

Put to the test, the compass was fitted to a sighting board as in Fig 5 rather like the surveying compasses advertised amongst collectable scientific instruments. This was then used to sight along some long straight roads to obtain the magnetic bearing. As a precaution against any asymmetric errors in the compass card, at least 4 readings were taken with the compass and board reversed, and rotating the instrument clockwise and then anticlockwise to counteract any swirl of the alcohol and allow time to settle. On one road the variation over 6 readings was ±0.2°, and another only ±0.1°. A credit to the quality of the compass card and mounting is that I could not detect any variation when the compass was reversed to give the reciprocal bearing.

The next step was to determine the alignment of the road relative to magnetic north on the dates of the tests. Firstly the bearing of the roads were measured against the National Grid on large scale maps. With care, this can be done to within 0.1°. Using the map alone, even more care is required to calculate what the magnetic variation is at the grid points of the road. For example, the local Landranger map shows the magnetic variation changing by almost 0.5° across the 40 kilometres 'width' of the map. One then has to apply the annual rate of change given on the technical information part of the page from the date of issue of the map. This seems relatively cumbersome, which is where the internet information mentioned earlier comes in, being both easier to use and potentially more accurate.

GRID NORTH AND TRUE NORTH, AND 'CONVERGENCE'

True north (or south) is always of primary interest to diallists, and it is worth a short review. The grid system is designed for flat sheets of paper, and the curvature of the earth means that the latitude and longitude of a particular location has to be derived from the respective scales drawn on the edges of the sheet. Once again, the internet can assist by visiting the Ordnance Survey website, and in particular, their related GPS site which will deliver to your PC an Excel spreadsheet that is the program for converting grid reference to latitude and longitude or vice versa. The site may be found at
http://www.gps.gov.uk/additionalInfo/images/ProjectionandTransformationCalculations.xls

For details about the different map reference systems, the website also gives a download of a booklet that is extremely useful for definitions of the Terrestrial Reference System, World Geodetic System 1984 (widely known as WGS84), the coordinate systems used by Ordnance Survey.

One of the many conversions that the program can carry out is to give the difference between grid north and true north at any given grid reference or latitude and longitude. This is defined as *grid convergence* by the map makers.

WORKED EXAMPLES.

The road that I live on is straight for over a kilometre, and using the compass as in Fig 5 and 'swung' for 3 pairs of readings, the mean magnetic bearing of the road is 353.98°. From a large scale 1:1250 site plan the bearing against grid north is 349.96°. Putting the grid reference of the position of the compass 483544 164010 (a site plan enables the reference to be given to the nearest metre), the transformation program gives the latitude and longitude as 51° 22' 6.60"N and 0° 47' 59.04"W, and a convergence 0.94°W (rounded to two decimal places). The bearing of the road relative to true north is therefore 350.90°. From the IGRF website calculation, entering the latitude, longitude, altitude and time of observation in decimal years, 2003.1, the magnetic variation was 3.02°W. The bearing of the road relative to magnetic north at that time was 353.92°, giving a difference against the compass observations of +0.06°, a very satisfying result.

The same procedure applied to another road with an average magnetic bearing of 78.93° gave a difference of +0.34°. To have obtained even more reliable data the tests should have been made on different dates and times to average out the diurnal magnetic variation, or ensure avoidance of the unlikely occurrence of a magnetic storm.

To summarise, used with care, a compass with a good card that can be read to a fraction of a degree should be able to give a bearing relative to geographic north to within ± 0.5°. The sun is always the first choice for a diallist, but a magnetic compass has its place if dogged by cloud, and is useful for checking other methods.

Footnote: In the December 2003 Bulletin, Patrick Powers also considers finding north with the compass, quoting from a military handbook for 1927-1940. The note mentions compass variation as another factor that may have to be taken into account. Of course, in a ship or

aircraft, the surrounding metalwork will have an effect and "swinging the compass" by aligning with known directions will show errors and these will be recorded near the compass. For a free standing compass with a long needle, and where the needle is the pointer as well, it can be safely assumed that the needle will lie in the direction of the magnetic field. However, for a compass with separate needles and a card it has to be assumed that the north-south line on the card has been fixed precisely in line with the needles. For the military compass described here, this is a safe assumption, especially as an inspection label records a satisfactory calibration.

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FURTHER READING:

Earth Magnetism: a Guided Tour through Magnetic Fields, Wallace Hall Campbell, Harcourt Academic Press, 2001, ISBN 0-12-158164-0. *A short and readable primer on magnetism and geomagnetism.*

A guide to coordinate systems in Great Britain. An introduction of mapping coordinate systems and the use of GPS datasets with Ordnance Survey mapping. Ordnance Survey, v1.4, May 2002.

D. A. Bateman

AN EARLY PLANISPHERE FROM THE HANSE TOWN OF HAMBURG

HEINER THIESSEN

{A Planisphere: The Structure described in this article, though not a sun dial, appears to have a function similar to that of the set of place-names to be found on 'geographical' sundials; for this reason, and for its inherent interest, it may appeal to readers of this journal. We may view with sardonic amusement the idea that the study of gnomonics has ever been considered sacrilegious. - Ed}

An historical etching of mysterious origin found its way into my home fairly recently. It certainly made my day when it arrived unexpectedly and I would like to share my delight with fellow readers of the BSS Bulletin. The original print from which my copy stemmed is 325 x 400mm and thus approximately four times the size of the reproduction in this Bulletin. It is an abstract presentation of the globe as seen from above one of the poles, so that the actual circumference of the planet coincides with the equator ring itself

Instead of longitudinal lines from equator to pole, the print features some 48 linear entries arranged in circular fashion around the polar region and giving names of usually three, four, five and in some cases even 12 geographical locations, associated with a particular longitudinal distance from the reference meridian of Hamburg. While the distance from one text line to the next thus represents an interval of 7.5 degree longitude, the actual place names sound wonderfully mysterious and only a few of them seem well familiar today. There are reassuring entries for Amsterdam, London, Lissabona, Stockholm, Sophia or Jerusalem, but what about such places as Raconicza, Yezd, Golconda, Jamba or St. Jago?

Around the centre of the global sphere, perhaps the size of the entire arctic circle, is a clock face featuring 24 Roman numerals, arranged in a clockwise manner, with one XII o'clock for midday and pointing up to Hamburg, and another XII o'clock for midnight, pointing down to Neu-Seeland. The day is visually divided into 'white' day time (Tag Stunden) and 'shaded' night time (Nacht Stunden) along a line from VI in the morning to VI in the evening, as would be correct on the days of the equinoxes, when the terminator would go right through the North and South Poles and sunrise and sunset would happen at 6.00a.m. and 6.00p.m. L.A.T. anywhere on the planet.

The outer surface of the planet shows some representations of people, animals and plants as perhaps imagined by the artist and his master. A townscape at the top of the sphere and thus near the reference meridian suggests an association with Western Europe and its dreaming spires of Christianity. Is this Hamburg? The townscape does show a few sea-going vessels but the hills in the background seem a little high for the Hamburg I grew up in.

The text at the bottom of the picture is full of captivating comments. It is interesting to see the display of apparent pride in having mastered all aspects of the sciences for the 'most accurate' workings of the planisphere. But even more

fascinating is the unexpected expression of a clear pre-scientific sentiment towards the use of sundials at the time of going to print. Dialling as a sacrilegious activity? But judge for yourselves. Please find below the German original text with all its variants on modern standard spelling and then my poor attempt at freely translating same into English.

DER GROSSE STUNDEN-WEISSER ALLER LAENDER AUF DER GANZEN RUNDEN ERD-KUGEL

Was unterstehet sich doch nicht die frevele Kunst, die Aeffin aller natürlichen Wunderwercke. Sie ist so vermessen, daß sie elnen Stab in die Erde pflanzet, wohin sie wil, und denselben mit etlichen Zahlen umsetzend, Gebotts-Weise Rechenschafft fordert von der Sonnen Welt-weiten Tag-Raysen.

Der Sonnen Himmels-Wagen kan nicht einen Schritt hinter sich bringen, dass dessen Stuffen durch den Schatten Strich nicht alsobald solten erkandt werden. Dieser Stab ist der Tags-Calender, der Stunden-Zeiger, ja, der alle Augenblicke Lauff weiset, und nach dem verjüngtem Mass-Stab Kunst-richtig abbildet.

Gegenwärtiger Stunden-Weiser, welcher über die ganze Erd-Kugel die Stunden aller vornehmsten Länder und Königreiche nach unserm *Meridiano* allhier zu Hamburg regulirt, zeiget an, wann die Glocke hieselbst 12 oder die Mittagsstunde ist, was alsdann an anderen Orten die Glocke, oder Stunden bey Nacht oder bey Tage sey.

Als nemlich, wann es bey uns Mittag ist, so ist es zu Golconda um den Abend oder die Glocke sechs, in *Bermudes* um die Glocke 12 in der Mitternacht, zu St. Jago die Morgen-Stunde oder 6 Uhr Vormittag. Die übrigen Länder und Städte sind auf den neuesten und accuratesten Land-Karten also eingetheilet, dass man weiss, was an einem jeden Orte die Stunde halte.

Die äusserste umgehende Figur ist auch nicht vergeblich, oder nach dem Gutdücken des Zeichners ersonnen, sondern man hat zuforderst dahin gesehen, dass sich die 4 principalesten Nationes, so wie sie sich in den Stunden-Weiser geschickt, in ihrer Kleidung präsentieret, und gleichwie die Persianer (praeter propter) 3 Stunden, oder einen achten Theil der Erd-Kugel, also sind die Chinesen und Japonesen 9 Stunden oder 3 Acht-Theile nach morgen zu. Die aller-Oestlichste Brazilianer bey Pernambuco hingegen 3 Stunden, oder einen achten Theil, und die wilden Nord-Amerikaner 9 Stunden oder 3 Acht-Theile, nach dem Westen hin entsessen oder unterschieden.

A very free translation of the above follows:

THE GREAT HOUR INDEX OF ALL COUNTRIES ON THE ENTIRE ROUND EARTH SPHERE

Oh sacrilegious art, aping all of natures works of wonder, how dare she be so arrogant by planting stakes into the earth, surrounding them with numerals of sorts, wherever she pleases, and then commanding the Sun to give account of his daily world-spanning journeys.

The hour's indicator, here presented, it orders time in all the noblest countries and in kingdoms, according to the Meridian here in Hamburg and at 12 o'clock or midday here at home it indicates which hour it be elsewhere by night or day. As for example when it's midday here, so in Golconda it's the evening hour six o'clock or midnight even in Bermudes, or in St. Jago morning six o'clock.

All other towns and countries are entered on the latest and most accurate of maps in such a way, that one can know what hour it be at each and every place.

The figures on the surface of the globe have not been dreamt in vain or imagined merely by the artist, but an attempt was made, to present the four principal nations in their typical attires. You thus can see the Persians approximately three hours or 1/8 of the Earth's circumference, and the Chinese and Japanese 9 hours or 3/8 away towards the sunrise.

The most easterly Brazilians at Pernambuco are three hours or 1/8 of the globe's sphere and the wild Americans 9 hours and thus 3/8 of the planet's circumference away from home towards the sunset.
[end of translation]

The actual entries for the *midnight* line, exactly opposite the midday line for solar noon in Hamburg, includes place names such as 'Baja de St. Michael', 'Insul Berbudos' and 'Neu-Seeland'. This seems to have been no more than an educated guess as New Zealand, ranging from longitudes 165° to 178° East, is nowhere near 180 degrees from Hamburg. With the old Hanse Town on the river Elbe located at longitude 10° East, its opposite longitude, on the same great circle, would thus be 170° West, which is either a mere 12° East from the most eastern part or a massive 35° East from the most western part of New Zealand.

The same would apply for the 90 degree intervals from Hamburg, implying 6.00 o'clock a.m. or 6.00p.m. LA.T. when solar noon hit Hamburg. The 6.00p.m. entry includes place names such as Delly (76°), Agra (77°), Golconda (78° East). The resulting angular distances from Hamburg with

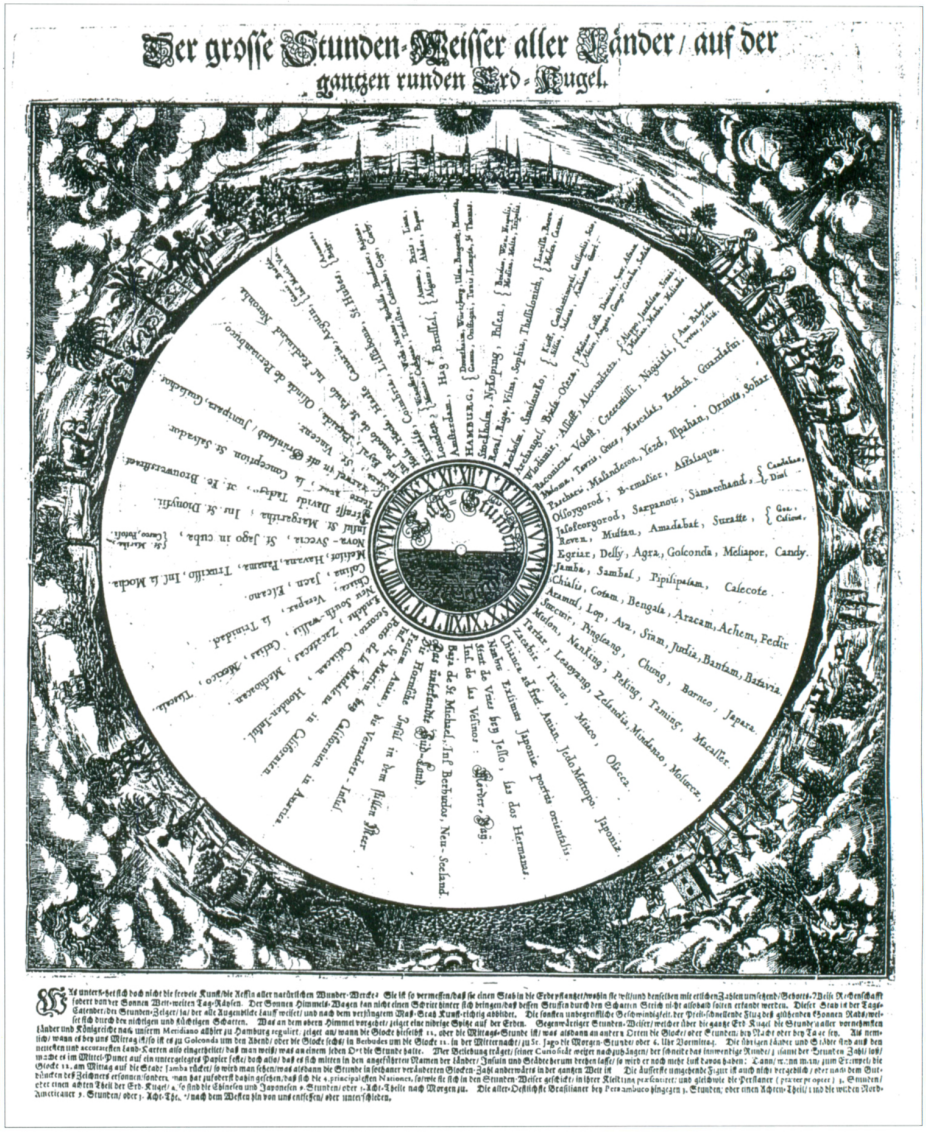
66°, 67° and 68° are far from the expected 90 degrees. A much better guess is the 6.00a.m. entry for 'St. Jago in Cuba'(today's Santiago de Cuba at 76° West), resulting in a surprisingly close angular distance to Hamburg of 86°.

So on the whole, the general level of accuracy is far from what the reader was promised in the historical text. Does this perhaps imply that the 'latest and most accurate of maps', used for the production of this planisphere were printed well before John Harrison's system of determining longitude (1773) had finally led to more precise measurements around the entire globe?

And when would the knowledge of the discovery and the naming of New Zealand by the Dutch navigator Abel Janszoon Tasman in 1642 have reached the cartographers producing their 'latest and most accurate of maps'?

Are we perhaps looking at a time frame for the dating of this etching from approx. 1650 to 1780? And does the pre-scientific sentiment of the text point towards the earlier part of this period? It is of course all guess work on my part but it would be fascinating to find out. Who can provide further information on the use of such devices and perhaps even on the age and origin of this particular print? The author would be pleased to hear from you.

A number of variants of this woodcut were issued during the period 1680 - 1700, differing in spelling and in actual wording. German art dealers specialising in prints from the 17th century consider this to be a rare print.



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Postscriptum: Just days before publication I have finally received some information about the origin of this print. There are two libraries in Gemany holding copies of what turns out to be a woodcut:

1. Staatsbibliothek Berlin, Preußischer Kulturbesitz: Woodcut, publication ca. 1680. The town of St. Petersburg (founded 1703) is not one of the place names.
2. Herzog August Bibliotek Wolfenbüttel: Woodcut, publication Hamburg, ca. 1700

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