The British Sundial Society

BULLETIN

VOLUME 16 (iv) DECEMBER 2004

Front cover: BSS members Walter Wells and Helmut Sonderegger (President of the Austrian Sundial Society) studying minute marks on the Troughton & Simms dial at St Michael's Mount, Cornwall (SrNo 0131).

Back cover: An unusual gnomon support, St Uley's Church, Leland, Cornwall.

Photos: Don Petrie.

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VOLUME 16 (iv) - DECEMBER 2004

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BULLETIN
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VOLUME 16 (iv) - DECEMBER 2004

EDITORIAL

The well-planned programme of the BSS Italian tour of October 2004 was rich and varied. On every day, the participants experienced one item (or more than one) which was intellectually demanding; and one or more that was pleasing-to-the-eye. Our mental and aesthetic faculties had plenty to work on. This hints at an editorial desideratum: each issue of the Bulletin should cover this same range of stimuli. If you yourself as a Bulletin reader have not yet offered an item for it (article, photo, or snippet) what about a contribution in the form of an entry in one or other of the competitions described on page 151 within?

CORRIGENDA

The author G.E.T. of 'Where is the Sun', Bulletin 16(iii), has sent the following small corrections:
p. 122, col. 1, line 21: for '100' read '1900'
p. 122, col. 2, lines 19 & 20: for 'Almanac' read 'Almanack'.

THOMAS WRIGHT'S HORIZONTAL SUNDIALS

JOHN DAVIS

Thomas Wright (fl. 1718-1747) was probably the pre-eminent mathematical instrument maker of his time, holding the appointments of maker to the Prince of Wales from 1718 and later to King George II. He made instruments of many types - for example, amongst the eight instruments signed by him at the Oxford Museum of the History of Science there is an orrery, a drainage level, a simple theodolite and a waywiser as well as three portable sundials. This paper will concentrate on his horizontal sundials, of which around ten are known, as shown in Table 1.

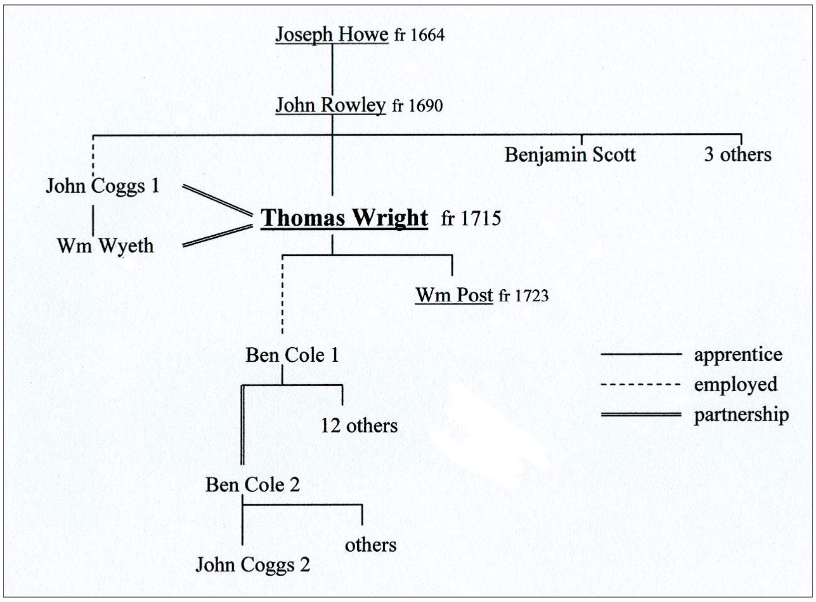

Fig. 1. Thomas Wright's 'family tree'. Names underlined were members of the Broderers' Company

THOMAS WRIGHT

Thomas Wright[1-4] was born around 1693 in Southwark, London and was the son of William Wright, a clockmaker. He served his apprenticeship under the great John Rowley in the Company of Broderers, being bound in 1707 and made free in 1715. Rowley had been Master of Mechanics to George I in 1715 and made a wide variety of mathematical instruments including dividing engines, sundials, micrometers, telescopes etc. He is particularly well remembered, though, for his planetariums and orrerys, having made the first so-named for the Earl of Orrery. Rowley had about six apprentices (including Benjamin Scott, who became a member of the Grocers' Company[5]), but clearly Wright was his star pupil. Wright continued to work for him after his freedom and, when Rowley died in 1728, he took over the business. He continued making orrerys for customers at the highest social levels; one example made for George II is in the Science Museum, Kensington and another is at the Oxford Museum of the History of Science. His address for many years was given as "at the sign of the Orrery and Globe", Fleet Street, London. Wright held the title "Mathematical Instrument maker to ye Prince of Wales" from around 1718, and then to George II after he succeeded to the throne in 1727. This was the most important appointment of the time and put him ahead of his younger contemporary George Adams snr. who was in the "rival" guild of the Grocers and who held the lesser rôle of instrument maker to His Majesty's Office of Ordnance. Wright had a number of business connections, including the employment of John Coggs snr. (from Rowley's workshop and known to have made universal equinoctial ring dials) and an association with Richard Cushee in the selling of globes - some of which were incorporated into his orrerys. In 1740-41, towards the end of his career, he went into partnership with William Wyeth who was a land surveyor and instrument maker and who had previously been in partnership with his former master John Coggs snr. A waywiser by Wright & Wyeth from this period is in the Oxford MHS. Wright was a prominent member of the Broderers' company, holding several offices in it although in 1746, shortly before his retirement, he preferred to pay a fine of £20 rather than take on the duties of its Master. Although Wright is believed to have retired in 1747/8, he was reported as continuing to live at Hoddesdon, Hertfordshire, until his death in 1767.

Wright is credited with only one apprentice, a William Post about whom little is known. However, he did employ Benjamin Cole snr. who was a well-known instrument maker and who took over the business when Wright retired. Together with his son Benjamin Cole jnr., the partnership of Cole & Son was responsible for training almost thirty apprentices. This shows that Wright comes at the end of the period of the great lone instrument makers and at the beginning of the period when instrument making became a major business with large workshops. As will be shown below, his style of engraving tends to look dated when compared to his contemporaries so that Wright may in some ways be

Location/name	Diam (mm)	Gnomon	EoT	Transversals	Geographical	Signature (see below)	Comments
Lacock Abbey (NT), Wilts	451	Rht angle	CW	Y	Y	A	SrNo 0140
Private, Wilts	453	Curved	CW	Y	Y	B	579/291
S. Britain (church)	320	Rht angle	None	N	N	C	SrNo 2723
"Rudge"	449	Curved	CW	Y	Y	D	579/263 and 419/300
Kent	368	Curved	CW	N	N	D	SrNo 1710
Manchester area	330	Rht angle	None	Y	N	A	SrNo
British Museum	368	Curved	?	N	N	E	
NMM, Greenwich	382	Curved	CW/ CCW	N	N	D	
Belton House, Lincs	380						SrNo 0619 (stolen)

Signature forms:

A	Made by Tho Wright Instrument Maker to His Royal Highness ye Prince of Wales
B	Made by Tho Wright / Instrument Maker to his moft / Excellent MAIESTY
C	Tho Wright Fecit
D	Made by Tho Wright Instrument Maker to His Majesty GEO IId
E	Made by Tho Wright Instrument Maker to His Majesty

Table 1. List of Thomas Wright's known horizontal dials.

regarded as the last of the 17th century engravers and instrument makers. The complex linkages between Wright, Coggs (father and son), Wyeth, Cushee and then the Coles show (Fig. 1) a close-knit grouping of makers forming a wide variety of business arrangements.

Thomas Wright is a common name and care has to be taken to distinguish between the several instrument makers and natural philosophers of this name. Clifton[1] lists five Thomas Wrights, four of them in the 18th century. Perhaps the most important of the "other" Thomas Wrights who may cause confusion is Thomas Wright of Durham (w. 1730-1773). He was largely an inventor and teacher of natural philosophy, but he was also an instrument maker known to have sold sundials. He is also associated with Thomas Heath, a very prolific instrument maker[5].

Fig. 2. The large Thomas Wright dial at Lacock Abbey (NT), perhaps the finest extant horizontal dial from the early 18th century.

HORIZONTAL DIALS

Several of Wright's horizontal (garden) dials are listed in Table 1. Most of them follow a fairly standard format: he had a general pattern for his largest dials which he then simplified for the smaller ones by omitting some design elements. Unlike some other makers, such as those in the Grocer's Company, he did not keep exactly to his pattern and there are some interesting variations between his dials. Examples of his most complex designs are the dial at Lacock Abbey (NT), Wiltshire, as shown in Fig 2, and a similar though slightly later dial in Hampshire, drawn in Fig 3. The Hampshire dial was made after 1727 as Wright's signature refers to George II, and is thought to have been for a member of the Rudge family as it bears the arms of that family. A full-size brass replica of the dial has recently been made (Fig. 4) so that the original can be removed indoors for safety.

Fig. 3. A drawing of Wright's 18" dial for the Rudge family, as used for making the modern replica shown in Fig. 4.

Transversals

The use of transversals (or diagonal scales) was quite common in the 17th century on astronomical instruments such as quadrants[6], where they were used to sub-divide angular scales to small increments. Their use on sundials is much more restricted and Wright was one of the few makers to employ them regularly, although usually only on his larger (18" diameter) dials: see Fig. 5. It seems that Wright learned this feature from his master John Rowley who employed it on one of his St. Paul's Cathedral dials and on at least two of his Blenheim Palace dials. The earliest use of transversals on a horizontal sundial appears to be by Thomas Tompion right at the end of the 17th century: see, for example, the dial he made for Wrest Park and which was sold by Sotheby's in 2004[7]. It seems likely that Tompion first encountered transversals on astronomical instruments when working at the then-new Observatory at Greenwich, being employed by both Robert Hooke and John Flamsteed.

There are a number of mathematical reasons why transversals do not provide an exact solution to the measurement of small time intervals on a horizontal sundial. Firstly, equal increments of time do not produce equal increments of angle for the hourlines. Thus, for the scheme used by Wright with five concentric circles each representing a 1 minute increment, the hour-line angles do not step equally. This

Fig. 4. A photo-etched brass replica of the "Rudge" dial by the author.

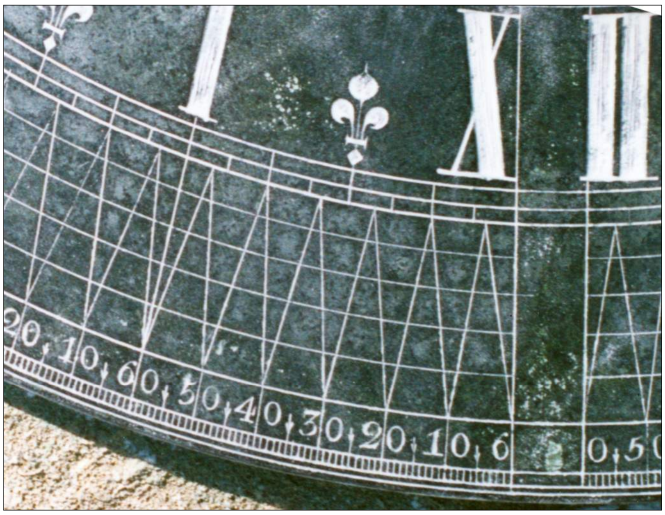

Fig. 5. An example of transversals, on the Lacock Abbey dial. The slopes of these lines near noon are nearly symmetrical.

effect is very small and can be neglected. The second problem is that the classic scheme of a transversal scale is only precise if the width of the band of transversals is small compared to the overall radius of the scale. Tycho Brahe understood this limitation and restricted himself on his large quadrant to a band 1/48th of the radius[6]. On Wright's dials, however, the width is typically 1/8th of the radius. The errors introduced can be compensated for by not drawing the circles with equal increments of radius (Fig. 6). The technique would not work well on an astronomical instrument, where there is a moving linear scale along the fiducial edge, but is quite acceptable on a dial. The third problem is that the centre of delineation of the dial is offset from the centre of the transversal scale, which is in the physical centre of the dialplate. This leads to the diagonals taking on a "sawtooth" appearance with different slopes on the leading and trailing edges, particularly around 7am and 5pm. It is not possible to find a single set of radii for the concentric circles which will work for both slopes. Wright appears to have used an averaged set so that the error is minimised. It appears never to be worse than 15 seconds, which is better than the reading accuracy for a single-edged shadow.

Despite the above compromises, the use of transversals gives Wright's dials a very distinctive appearance and hints of a high scientific background. It is noticeable that other dial-makers used different approaches to showing small time intervals. For example, Christopher Wren on his celebrated All Souls, Oxford, vertical dial uses what might be described as "stepped diago-

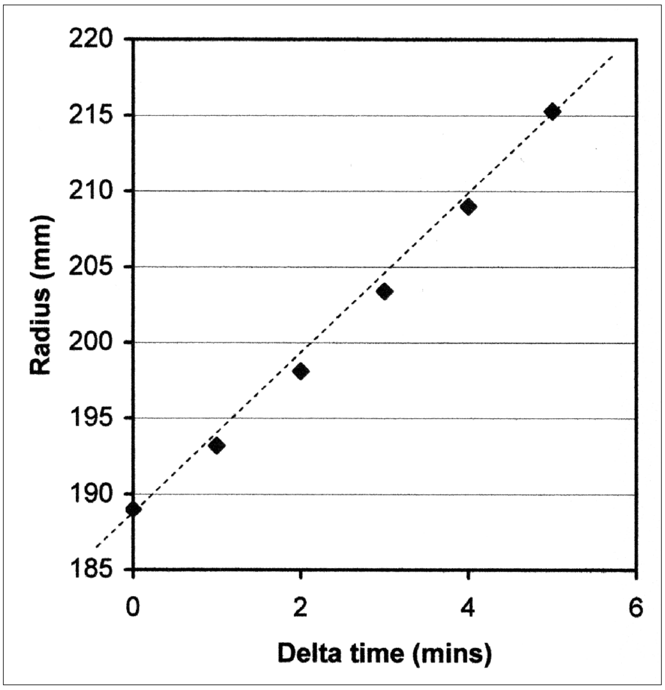

Fig. 6. The spacings of the intermediate minutes circles of the transversals of the "Rudge" dial. Note how the spacing increases towards the outside. Gnomon offset from plate centre = 80mm; gnomon thickness = 12.5mm.

nals" so that the increments could be individually adjusted. A similar arrangement is found on a portable inclining dial[8] by Bartholomew Koch which features a heart-shaped chapter ring, thereby achieving equi-spaced hour points (an equant dial[9]) and removing the sawtooth problem. An alternative approach was to have two outer rings each divided into two-minute increments but with a 1 minute offset between them. This scheme was adopted by Thomas Heath (a member of the Grocers' Company[5]) for his dial at Erddig, and also by his apprentice George Adams snr. for a dial in Essex.

Fig. 7. Part of a typical 'geographical' ring. Note the difficulty in reading the exact time of noon.

EAST	WEST
Pekin	
Bengall	Mexico
Fort St. George	Port Royal in Iamaico
Surrat	Berbadoes
Ispahan	St. Sebastion
Moscow	Ferdinando Isle
Ierusalem	Madrea
Constantinople	Lisbon
Hanover	Dublin

	Fort St. Thomas
Cape Comorin	Charles Town
	Cape Farewell

Table 2. Top: list of place names on Wright's Lacock Abbey dial with their original spellings. Bottom: replacement places on the 'Rudge' dial.

Geographical Features

Wright's larger dials are often "geographical" as well as carrying transversals; that is, they give the times of noon for a number of places around the globe. The format (Fig. 7) that he invariably uses is to have two dedicated rings just inside the main chapter ring, and to put each place name with a XII at the appropriate point. This is the format that was originally developed by Henry Wynne for his Drumlanrig Castle dial[10] and was also used by John Rowley for his Cranbury Park, Hampshire, dial and, with three rings of place names, at Blenheim Palace. In contrast to the makers of the Grocers' Company[5], Wright did not have a single list of place names which he always used, though many names, shown in Table 2, were common to several of his dials. It is not easy to read the time of noon, running through the first I of the XII, to the nearest minute on the main time scale, so no attempt has been made to analyse the accuracy of his longitudes.

Fig. 8. Part of the EoT scale on the Lacock Abbey dial. Note the division to half-minutes and the day numbers increasing right to left.

Equation of Time Rings

Virtually all of Wright's dials have an Equation of Time ring. This usually takes the form (Fig 8) of two arcs separated at the south of the dial by a cartouche with the signature and at the north by a coat of arms or other decoration. The rings usually have the months on the outside, then the divisions to days (numbered in 10s), then the tick-marks for the EoT and finally, on the inner ring, the number of minutes. On the largest dials, the EoT is divided into half-minute intervals and numbered in minutes whilst the smallest ones are divided to minutes and numbered in 2-mins. Generally, the ring does not carry the title "Æquation of Natural Days" or similar often found on other makers' dials. The months, in common with all the engraving on Wright's dials, are oriented to be read from the outside of the dial, as had become common by the early 18th century. However, the date ring is arranged to run clockwise round the dial so that although the names of the months are read from left to right the days increase from right to left, creating an opportunity for misreading the scale. One exception to this is the dial in the National Maritime Museum where, bizarrely, the arc for January to June is reported to run anticlockwise[11] although the other half is clockwise. Other makers of the period had realised that by running the dates anticlockwise round the dial, it was possible to make all the scales read left to right. The names of the months are generally written in capitals and abbreviated to three letters. Wright uses "I" for "J" in IAN, IUN and IUL, a usage which was beginning to die out; Wright himself engraved "MAJESTY".

Only a small number of Wright's EoT scales had the number of extra seconds at the maxima/minima engraved on them. The division to half-minute intervals, though, allows the data tables used to construct them to be extracted with good accuracy. Analysis[12] of the data from the Lacock Abbey dial (pre-1727) indicates that Wright was using the same source as Thomas Tompion had printed on a table for his longcase clocks in 1683. This data had long-since been superseded by later tables published by John Flamsteed and his successors and adds to the impression that Wright was slow to adopt new trends and information. One Wright instrument which does show the EoT maximum of January (Julian calendar) as 14m 49s is a mechanical equinoctial ring dial[8] dated to c.1735: this value indicates that he has updated his source to Flamsteed's table published by John Smart in 1702.

Gnomons

Wright used a variety of gnomon designs on his horizontal dials. They were invariably substantial and most were attached to the surface of the dialplate by a four large, hand-made, bronze screws passing through the plate into the gnomon and its supporter. In addition, the gnomon would be located by a pair of close-fitting bronze pins. In this respect, Wright was remarkably up-to-date as dials just a generation earlier would have had tenons on the gnomon passing through slot in the dialplate and secured by tapered pins or wedges. The gnomon supporter(s) generally took the form of one or two pairs of truncated pyramids, a shape shared with Tompion and Rowley's dials.

Fig. 9. A Wright dial in southern Britain showing the characteristic solid right-angled triangle gnomon.
Photo: Michael Davis.

One gnomon shape which is very characteristic of Wright is shown in Fig 9 and incorporates a solid right-angled triangle. At a first glance, it appears similar to the gnomon found on a double horizontal dial but in this case the vertical edge of the triangle is not in the centre of the plate. It also has a substantial foot and no knife-edge, so it is clearly not intended to act as a vertical style for indicating the sun's azimuth. The design cannot be regarded as elegant but it does provide a robust structure. Thomas Tompion and John Rowley also sometimes used this right-angle triangular shape, although they lightened the appearance with elaborate piercing. This similarity, together with the use of transversals, strengthens the case for a connection between this line of makers. In at least one case (Tompion's Wrest Park dial[7]) provision was made to hang a plumb-bob from the tip of the gnomon to a small mark on the dialplate in order to set it level. The tips of Wright's gnomons do not have sufficient overhang to allow this feature.

Wright also used a more conventional gnomon shape with an elegant curve to the back. Examples of this shape are on the 'Rudge' dial (Fig. 4) and the dial in Kent (Fig. 13). The shape incorporates a 'step' about two-thirds of the way up the underside which gives an impression of sturdiness and support for the gnomon tip.

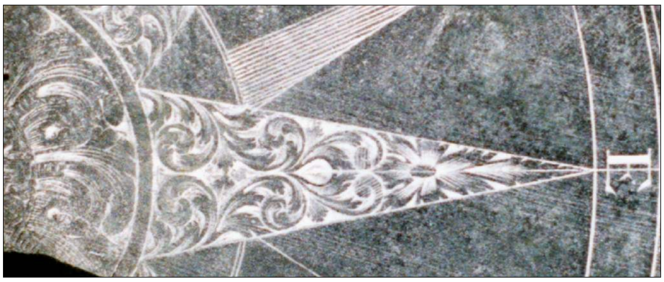

Fig. 10. The floral engraving pattern commonly used on Wright's compass roses.

Other Furniture

Like many dialmakers, Wright usually filled the centre of his dialplates with an elaborate compass rose (Figs. 3 and 10). He favoured a design with the relatively small number of 16 points, each labelled with their direction and alternately filled with floral engraving and half-shaded with parallel lines. Unlike some other makers, though, he had the foresight to modify his pattern to allow for that part of the rose which would be covered by the gnomon and its supporter. This can be seen in Fig. 3 where the N and S points have a simplified engraving and the central area around the gnomon supporter is filled with a separate pattern.

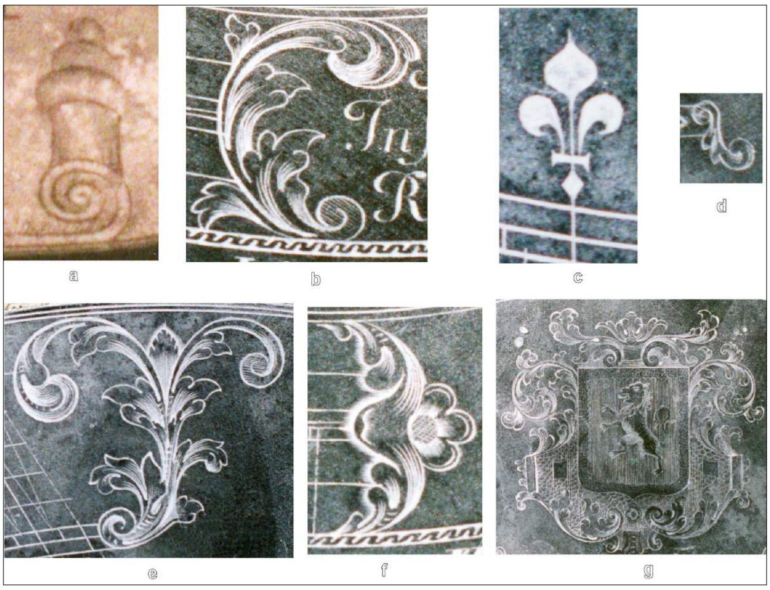

Fig. 11. Examples of Wright's decorative engraving: (a) Bobbins, (b) "C" curves, (c) fleur-de-lys, (d) small border end, (e) chapter ring end, (f)scale end and (g) coat of arms.

Fig. 12. The form of Wright's engraved lettering, from a TrueType™ font prepared for the replica dial of Fig. 4.

The engraving patterns which Wright used to terminate the ends of chapter rings, EoT arcs etc. are very characteristic. One common shape, called here a "bobbin", is shown in Fig 11(a) and is often found at the ends of the main chapter ring in the position where other makers typically used scroll-ends. Other decorative features shown in Fig. 11 are re-used on several dials, indicating that Wright was working from his own pattern book. The feature seen in Fig. 11(c) is curiously truncated at the top and bottom, suggesting that it has been fitted into a smaller space than it was originally designed for, although it has the same appearance on more than one dial.

The fleur-de-lys which Wright used to mark the half hours (Fig. 11(c)) was simpler than the elaborate shapes used a generation earlier by makers such as Henry Wynne[10] and Thomas Tuttell. It was similar to the shape used by his contemporaries in the Grocers' Company[5] but, in common with much of his engraving, somewhat bolder.

Most of Wright's dials have coats of arms for their original owners: an example is shown in Fig 11(g). The engraving style for these arms vary with some examples, such as that on the 'Rudge' dial, being shaded from one side, giving a bas-relief effect. The variations suggest that the arms were not engraved by Wright himself but by one or more of the specialist engravers who were well established in London by that time.

Wright's lettering (Fig. 12) shows a very assured and bold hand. Comparisons with earlier makers are particularly marked by the very rounded '2' and '3', and the elliptical rather than circular '0'. Also very characteristic are the lower case 'd' and 'f'.

PUZZLE DIALS

The dial which Wright made for a location in the Manchester area is a considerable puzzle. The 330mm diameter dial features transversals and a triangular gnomon but no place names, and is signed "Made by Tho Wright Mathematical Instrument Maker to His Highness ye Prince of Wales", thus dating it to pre-1727. However, it has a unique EoT scale using the Gregorian calendar. Although it is possible that some Catholic families adopted the calendar prior to the official change in 1752, this scale carries the added inscription in what appears to be Wright's hand "According to the New Style 1754 by Jno. Latham, Wigan". John Latham is recorded[13,14] as a clockmaker (b. before 1730, d. after 1757) in Wigan, Lancashire, though he seems[12] to have been using the EoT tables published by Charles Leadbetter soon after the 1751 calendar change. It is difficult to reconcile the conflicting dating evidence: perhaps Wright had an early part-finished dial which he completed after his retirement in 1747 and possibly it was even to complement a clock by Latham.

A second puzzle dial is at Leeds Castle, Kent, and is clearly signed "Made by Tho. Hogben Land Surveyor and Master of the Free School at Smarden 1750" so it would not initially appear to have anything to do with Thomas Wright. However, Hogben was mainly a local surveyor of country estates in Kent[15] and although he is credited with a small number of local dials none of the others show the sophistication of the Leeds Castle dial. Castle records suggest that the dial was actually engraved for Hogben by a London instrument maker so it is worth considering it in detail.

Fig. 13. A Thomas Wright dial on a contemporary pedestal in Kent, as drawn by Warrington Hogg in 1893 and photographed in 2002. A failed attempt to steal the dial has resulted in additional damage to the pedestal.

Looking at the stylistic features of the dial, one prominent component is the double ring of place names, just inside the chapter ring, exactly as on Wright's dials. Of the 18 places mentioned, 13 appear on the list in Table 2 and one of the others, Belvoir in Virginia, was the location of an estate belonging to the first owner. Only 10 of the places appear on the similar table of names used by the makers of the Grocers' Company[5] and they used a totally different format. The EoT ring, though, does not follow Wright's format as the months are on the inside ring, running anticlockwise and it has the unusual title of "A Regulator of the Æquation of Natural Days". Also, a double ring around the periphery of the dial indicates the time to individual minutes by means of the scheme with two 2-minute rings described earlier and occasionally used by members of the Grocers' Company. Other features of the furniture (fleur-de-lys, compass rose, scroll ends, decorative borders etc.) could easily have come from either set of workers. It is possible, though pure speculation, that Hogben knew his fellow land surveyor William Wyeth and commissioned him to make the dial. Though a member of the guild of the Pewterers, Wyeth would have had access to the same pattern book as his partners Wright and, earlier, John Coggs snr. It is worth noting that although another dial by Wright was (and remains) at a location a few miles from Leeds Castle; it is only 368mm diameter and does not show the geographical features. This Wright dial on its contemporary pedestal was drawn[16] by Warrington Hogg in 1893 (Fig. 13). Perhaps further evidence for the maker of the Leeds Castle dial will be found in the future.

CONCLUSIONS

Thomas Wright's horizontal dials are of uniformly high quality and were made just at the period when sundials were starting to become commodity items with standard designs. It is likely that there is a significant number of further dials waiting to be uncovered.

ACKNOWLEDGEMENTS

The author is pleased to thank the following people who contributed information and help for this paper: David Ellis-Jones, John Foad, Andrew James, Harriet James, Martin Jenkins, Eddie Mizzi, Peter Ransom, Michael Davis and James Methuen-Campbell, Gloria Clifton.

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TAILPIECE

Thomas Wright's tradecard, dated 1718 and found pasted into the lid of a circumferentor. It reads:

Thomas Wright

at the Orrery & Globe next the Globe in Marlborough Bead Tavern in Fleet Street LONDON. Mathematical Instrum^{t} Maker to His Royal Highn^{s}. GEORGE Prince of WALES. Makes & sells all sorts of Mathe matical Instruments for Sea & Land Ac cording to the best & latest Improvements.

The instruments are (clockwise from the top): globe, graphometer, nocturnal, Gunter's quadrant, orrery, octant, protractor, universal equinoctial ring dial.
Courtesy National Maritime Museum, Greenwich.

Author's address:
Orchard View, Tye Lane
Flowton, Ipswich
IP8 4LD

THE CYLINDRICAL BOX OF ANTONINUS PIUS
PART 2

P. A. AUBER

This is the concluding part of the article from Bulletin 16 (iii), September 2004.

ANTONIUS PIUS
Antoninus Pius, whose father Aurelius Fulvus came from Gallia, was born in Lanuvio (Rome) in 86 AD. After some steps in "cursum honorum", he was adopted by the Emperor Hadrian and then became Emperor himself in 138 AD. He was head of the Roman Empire until 161 AD. After his death, Marcus Aurelius Antoninus (Marcus Aurelius) became Emperor until 180 AD; after Marcus Aurelius, another adopted "Antoninus" became Emperor, namely Commodus (180-192 AD). Military campaigns took place under his reign, but the period (138-161 AD) is mainly considered to have been a peaceful time. In Britain he built the "Vallum Antoninum" (142 AD), a 59 km-long defensive wall extending from the mouth of the Forth to the Clyde estuary. Claudius Ptolemy, whose works place him among the most important astronomers in the history of science, has been believed to be one of his contemporaries. To date there is no evidence of any contact between Ptolemy and the Emperor. Anyway he refers explicitly to the beginning of the reign of Antoninus Pius in his Star Catalogue (Almagest, VII 4). Nevertheless, there are some very interesting links with astronomy and gnomonics in Pius' life. After his death, his adopted sons Marcus Aurelius and Lucius Verus built a votive column, the "Antonine Column", in Mars' Field (Campus Martis) - see Fig. 17.

A very well-preserved low relief on the column's base presents a complex scene of deification in favour of Antoninus Pius and his wife Faustina. They are represented as being transported to the world of the gods by a winged genius whose left hand is holding a celestial sphere. Represented on the sphere, as a further relief, are five stars, a quarter-moon, and the symbols of Taurus, Aries and Pisces on the belt of the Zodiac; said signs are surprisingly represented in a reversed order. To the right of the low relief, Minerva

Fig. 17. The base of the "Antonine Column", in Mars' Field (Campus Martis).

(maybe Rome dressed as Minerva), the goddess of science, helps the genius by supporting the sphere; it is surrounded by a snake, too. She is seated and resting upon a round shield with the images of Rome's wolf and twins. To the left, another young male-genius (the Genius of the Mars's Field?) embraces the Augustus obelisk with his left arm. It has been recognized by the bronze spherical gnomon on the top: its purpose was to project its shadow on the seasonal signs of a larger horizontal Meridian Line, also built in the Mars's Field (9 BC) by the Emperor Augustus. Everyone in the gnomonic field knows that the foundations of the Augustus obelisk presented problems right from its erection (Plinius the oldest - Naturalis Historia), so the Mars Field Genius' image, while supporting the obelisk, may have a specific meaning as if the Emperor was involved in works intended to consolidate the obelisk itself. Many arrows held in a quiver and several pieces of a suit of armour, say a shield, two helms, a couple of shin-guards, have been laid on the ground, maybe representing how science was overcoming savagery under the Empire of Antoninus Pius and Faustina. Since the lateral sides of the column-base, both of them, carry images of armed soldiers who proceed around on parade, following hypothesis could be argued: the contour of the scene of deification say the astronomical symbolism etc. could be inspired by Marcus Aurelius (The Philosopher- Emperor), whereas the other low reliefs, with the military scenes, on the sides could be the expression of Lucius Verus's nature which was, notoriously, different.

CONCLUSIONS

Could the Roman potentate who owned the sundial (cannot be excluded the *Emperor Antoninus Pius* himself) have used the "Antoninus Pius Cylindrical Box" when travelling? The answer is yes, under conditions, in both cases we have examined:

-*first*, the case of a, not clear, evidence of a lateral hole (Padre Secchi) which could laterally illuminate a cursor on the sundial all the year; the horizontality of a particular line should be assured by any reading but not any dedicated equipment has been found; the very wide range of latitudes is covered by the disk-captions but the related theoretical-astronomical differences are not taken in account; of course the possibility that the object could be originally incomplete cannot be excluded, and

-*second*, the case of a frontal use of the pivot as a gnomon feasible only by the supposed existence, inferred by some clue, of a higher number of disks; the verticality of the current day-lines should be assured only by approximate evaluation of the user. The dial was unsuitable to read the hours by northern latitudes.

The accuracy could be very poor in both cases. Finally we could underline that the similar object described by Padre Secchi (Museo Kircheriano, Rome) himself is free of the astronomical–conceptual deficiencies of the Antoninus Pius box so they cannot be ignored. We could imagine the mean level of the craftsmen at time and concluding that the Antoninus Pius box has been made by partially copying, in a rather rough manner indeed, a previous prototype. In any case we should accept the Price-Secchi hypothesis as the primary one. The question of the hole-pinnule or "V"shaped incision remains unresolved.

The astrolabe equinoctial plane is traced with repeated and conceptual mistakes: calculating sun-altitudes by different latitudes (clima) and the tracing of Padre Secchi sundial is (and was at time) more and more difficult so we could infer, as a secondary hypothesis, that the craftsman, being not familiar with sundials, adapted the previous design whom he partially copied (Rome and maybe Alexandria), to a new design with the sun in front of the dial instead of by side.

In any case the object can be considered a rather valuable status symbol for the potentate who owned it.

The representation of a chariot (two horses and a driver: "*biga"*) on the box's base could have a link with the chariots racing in Roman circuses and their (widely recognized) resembling with the revolution of the Sun, Moon etc. around the earth.

ACKNOWLEDGEMENTS

The author is grateful to: Eng. Alessandro Gunella, Biella, Italy, for advice and profitable discussions; Dr. Alfred Bernhard-Walcher, Kunsthistorisches Museum Wien, Vienna, and Dr. Paolo Liverani, Musei Vaticani, Rome.

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DIALLING MADE (ALMOST TOO) EASY

MIKE COWHAM

I guess that over the years most of us have had a go at making a sundial. I remember my own first feeble attempts using Waugh's book[1] and trying to construct the lines graphically. However, I did jump in at the deep end with an east declining vertical dial - with equinox and solstice lines. I did it geometrically because I did not feel confident with mathematics or trigonometry. Since that time I have tried all methods, including computer programs, but have never really fully understood the process. I have merely followed the instructions like a robot. When things went wrong I was lost.

Recently whilst trying to construct some spherical dials I tried a new approach that overcomes the problems that I was getting, but more of this later. It really boils down to absolute basics and understanding how the earth rotates with respect to the sun.

We all know that the earth does one complete revolution every 24 hours, (ignoring slight variations due to the ellipticity of its orbit). Therefore, during each hour the earth rotates exactly 15 degrees. This makes the armilliary sphere the simplest possible sundial to understand and construct. It is little more than a model of the earth with hour lines added. Its axis becomes its gnomon and is parallel to the earth's axis. Each hour is marked around its periphery

Fig. 1. A Roman heart-shaped scaphe dial.[2]

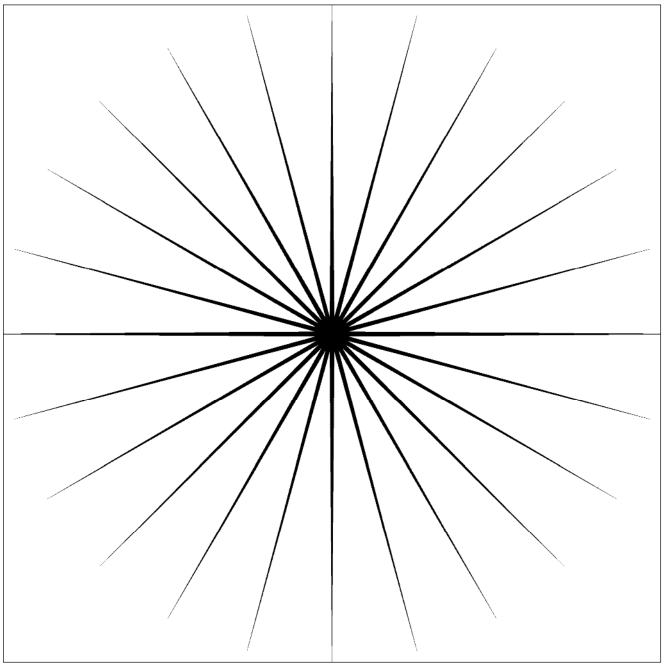

Fig. 2. The basic template of 24 hour lines.

and separated from the next by exactly 15°. If only all sundials were as simple as this! The problem is to try to relate this principle to dials in other planes and even to complex shapes. Imagine the difficulty in marking the lines in perhaps a heart-shaped scaphe dial such as shown in Fig. 1, and are the markings on this dial really correct? Constructing such a dial is not difficult using the simple method proposed; so read on.

To start with I have constructed a diagram with 24 radial lines set at 15° apart: Fig. 2. As long as this diagram, (constructed for convenience on a piece of card), remains parallel to the equator and is aligned correctly north - south it can be used to make almost any type of equal hour dial imaginable. It is then only necessary to transfer its lines to the appropriate parts of the dial surface. It is even useful in making an armilliary sphere in that a circle can be inscribed on the card of the exact diameter of the *inside* of its chapter ring. The card, (or template, as we should call it), may then be cut to this size with any necessary holes cut out to clear the gnomon etc., and the lines may be marked directly from where the edge of the card touches the inside of the chapter ring. This saves a lot of bother in trying to divide the circle from its inside or outside. It does not even matter if the chapter ring is not perfectly round, the results will still be correct. Therefore using this technique we could make a

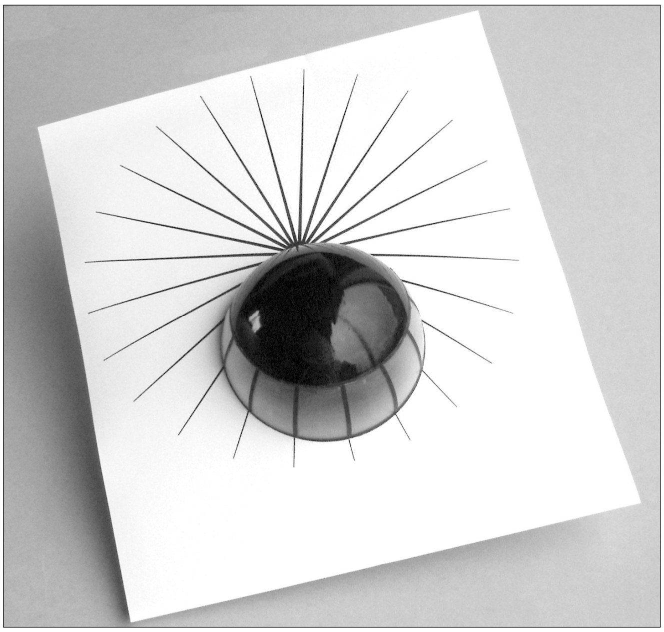

Fig. 3. Template used for marking the lines on an offset spherical dial.

similar dial with any shaped chapter ring be it elliptical, multisided or even irregular.

Returning to my original spherical dial problems, all that was necessary was to cut out a hole of the diameter of my sphere centred on my hour line pattern, place the card template around its equatorial ring and transfer the hours directly to the ball. It's that simple! My other and somewhat more difficult application was in the manufacture of a spherical dial from a semi-transparent ball, where the gnomon was a hole in its outer shell and the hours were marked on its opposite side. Maybe this is not too much of a problem but was so easily solved by my template method. I just drew a circle on my card the diameter of the ball, which was offset by the radius of the sphere, (i.e. with its outside diameter passing through the centre of my radial lines).

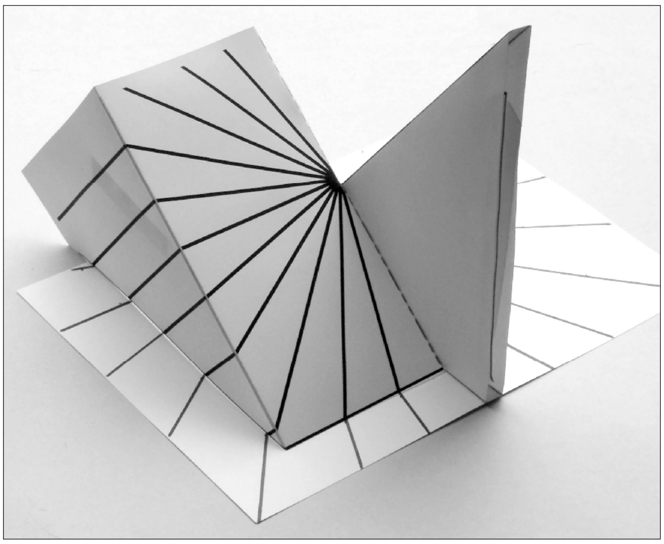

Fig. 4. Template used for one half of my 'Cambridge' dial.

Again the hours could be marked directly on the outside of my ball: Fig. 3.

A HORIZONTAL DIAL

Having used this method to make several spherical dials I realised that the same principle could be used for making a standard horizontal dial. I decided, as an exercise, to construct one for Cambridge at 52° north. In this case the plane of the equator, and my template, had to be at 90° minus 52° = 38°. Therefore it was necessary to tilt the card by 38°. This was most easily achieved by folding over its extremities and slicing off two corners at 38°. Along the two folds it was then necessary to extend the hour lines at right angles to the card until they reached the place where the two corners were sliced off, which was at the surface of my dial plate. To allow for the thickness of the gnomon, the card was made in two halves: Fig. 4. To align it to the dial, all that was then necessary was to set the centre of the hour line pattern exactly to the edge of the gnomon, checking that the template's 6 o'clock line fitted over the line going through the foot of the gnomon. Where the template touched the dial plate the hours were transferred directly to it. There are no critical dimensions to worry about, only the angular accuracy of the original hour lines on the template. If the size is wrong the diagram can be redrawn to a more suitable scale. It is also very simple to construct a dial for a place not on the prime meridian. We are lucky in Cambridge to be very close to the Greenwich Meridian, so no such compensation is required. However, to compensate for any other place all that is necessary is to rotate the hour line pattern by the appropriate number of degrees, 1° for each 4 minutes from the meridian, before lining it up north - south.

A vertical dial may be made in a similar fashion, using the card template, still at the same angle, but always parallel to the equator. If used from the vertical face of the dial it must be set at 52° or can be set on a shelf below as a horizontal dial with a tilt of 38°. I prefer the latter method for the following reasons. Many vertical dials are declining to east or west. The main problem then is to work out the angle for the gnomon, which still needs to be aligned with the earth's polar axis. Remember that we have not constructed the dial by usual methods and may have little idea of where to put the gnomon, so we need to start from first principles. First we should create a horizontal dial as already mentioned. We can make this on card or plywood, as it is only to be temporary. We can retain the original templates, as they may be useful for making or checking the vertical dial. The temporary horizontal dial is then set up just below the blank vertical dial on a shelf, a table or even on a ladder, as long as it is level. We need to know where north is for correct alignment. If we do not already know the wall's declination we can set the horizontal dial to time using a watch, correcting, of course, for the equation of time. Our dial should now be perfectly aligned, but if in doubt, we can do a rough check with a magnetic compass. The back of the card dial may then be cut at the correct angle such that the vertical edge of the gnomon is now up against the vertical dial face. This gnomon is then correct for both dials, horizontal and declining vertical. The lines from the horizontal dial or the templates may then be directly transferred to the vertical dial. It really can't be much simpler than that! Using similar techniques it is possible to delineate a dial on virtually any surface, smooth or irregular.

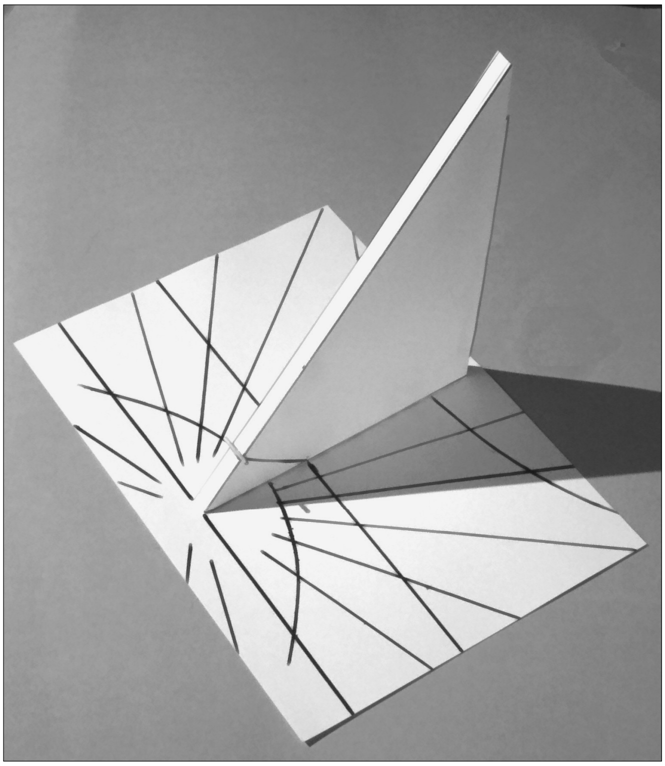

Fig. 5. The completed 'Cambridge' dial.

If we prefer to construct a vertical declining dial without making a horizontal dial this is also quite simple. First we need to know where the gnomon lies. Make a template for 90° minus the latitude, (38° for Cambridge), and fix it vertically on the dial plate, (actually along its noon line). Adhesive tape is quite useful because we want to hinge the gnomon from this vertical line. The gnomon should therefore be moved left or right by the number of degrees of declination of the wall. An easy way to set this is to produce a template at the correct angle and glue this to the dial plate and one side of the hinged gnomon.

On many dials there is some furniture in the form of equinox and solstice lines. These too can be added with absolute simplicity. To indicate the season on these lines we need a nodus on the dial gnomon. This can be a nick, a small ball or a short bar on its sloping edge - (my preference). To position the equinox line we need to construct a line at right angles from the sloping edge of the gnomon at the nodus to the dial plate at a reasonable position: Fig. 5. This will probably be quite close to the gnomon root. As a rough guide it should be about 15% up the gnomon for European latitudes. Where this point touches the dial plate draw a straight line right across the dial at right angles to the gnomon; this is the equinox line. The two solstices occur when the sun is 23½° degrees either side of the equator. Therefore a new template is made with two lines, ±23½° either side of a central, or equinox, line. In my example I made a double wedge with a gap between of the thickness of the gnomon: Fig. 6. The next step was to measure the distance of the nodus along the gnomon from its root. This length was marked on the template and the portion below was cut away. I also cut a small hole in the template so that the nodus point could be accurately seen at the centre of the two wedges; i.e., on the equinox line. Then the card was creased so that it would hinge on both sides of the gnomon. To start with I initially marked the position of the winter solstice line as this was already touching the dial plate. Then I sequentially cut small wedges off the card starting from the foot of the gnomon towards the outside. At each stage the template was folded back allowing me to make a series of marks where any of these three lines touched the dial plate. Eventually the template was cut away until it was folded fully back against the gnomon. Finally I had to join up the marks to form two

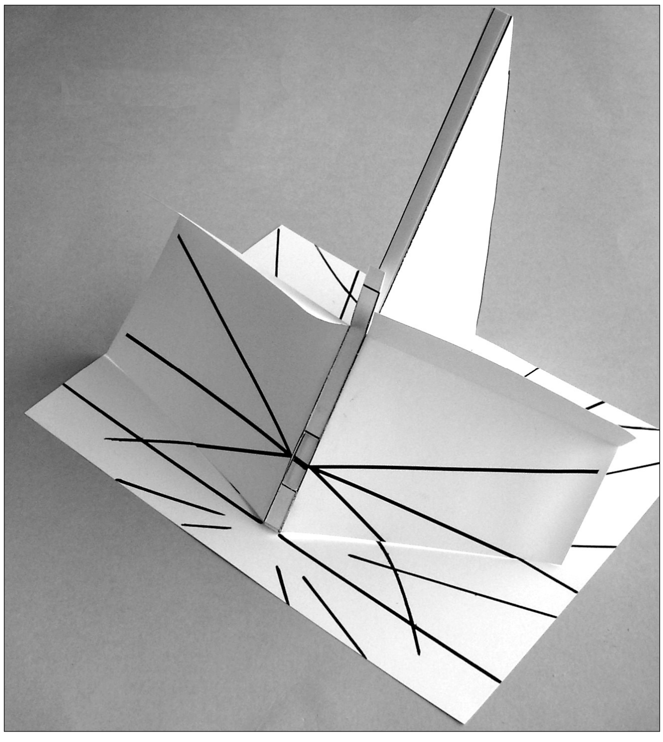

Fig. 6. The template used for marking the solstice lines.

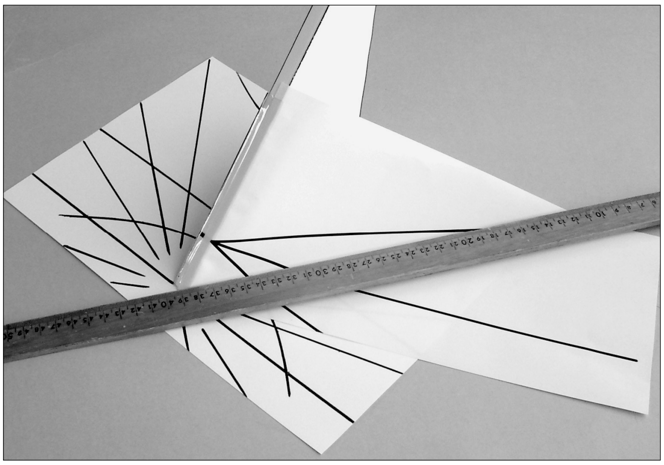

Fig. 7. An alternative method for marking the solstice lines.

continuous curves. Needless to say, I had to make sure that at all stages the equinox line on the dial plate followed the equinox line on the template. If it had not, then I would have done something wrong! As an alternative to the card template I could have used a flexible sheet of paper or even some cloth. This could be attached to the gnomon, perhaps by double-sided adhesive tape. Then, using a straight edge with one side against the gnomon root it could be moved across the dial plate in small steps and the three lines could be pricked through to mark the required lines: Fig. 7. A good method that may be used for this and several other applications is to make a relatively small template fixed to the gnomon edge and with some thread tied to the nodus, keeping this taut, extend the lines to meet the dial plate. This approach is particularly useful for larger dials. My finished horizontal dial is shown in Fig. 6.

If additional date lines are required, these are simply added to this template. The same applies to the original hour template for half-hours, and quarters if these are required on the dial.

A HEART SHAPED SCAPHE DIAL

We may now return to the vertical heart-shaped scaphe dial: Fig. 1. How can this technique of using templates be applied to that? Remember that we need to keep our hour template in the equatorial plane. The method that I used was to first mark the equinox and solstice points at noon. This was done directly from my equinox/solstice template: Fig. 8. This template also forms a temporary polar gnomon with its origin at the nodus. (Note that the heart's cusp was rather rounded and would have given a rather indefinite shadow, so I added a 'V' shaped nodus for more precise results.) The equinox/solstice template was then removed. Next, I cut my hour line template such that it fitted as snugly as possible into the heart along the equinox line with its centre at the nodus tip: Fig. 9. It was then possible with pencil to mark the points inside the heart along that line. For convenience I made the template slightly overhang so that it rested on both edges of the heart.

The first template was then reinstated and held in position with Blu-Tack™?: Fig 8. The problem now was how to mark each of the hour lines between the solstices. This is easily solved by using light; either sunlight or a spotlight. The heart was rotated such that its sloping gnomon's shadow passed exactly through each of the hours marked along the equinox line and the positions of the shadow were carefully pencilled in.

The two solstice lines were applied by using another template that 'hinged' on the sloping gnomon, being gradually cut away as it was moved towards the noon line, similar to that used on the 'Cambridge' dial.

With the various marks completed I joined up the points by hand, making sure that the pattern was as expected, then completed the dial with thin black drawing tape: Fig. 10. The results obtained are so different to those shown in Fig. 1 but this original dial is from Roman times and they probably did not know how to correctly delineate it. It may even be an attempt to show unequal hours.

There are other ways that my heart-shaped dial could have been completed using different combinations of templates, but I believe that the method that I used was fairly simple and foolproof.

As a final exercise to explore the limits of my technique I decided to make a declining heart-shaped scaphe dial that could be fitted inside a window. It actually turned out to be

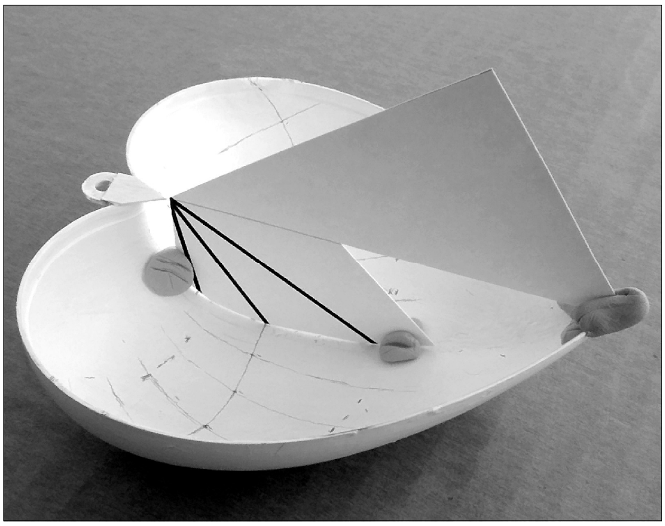

Fig. 8. Template used for marking equinox and solstices. It also includes a temporary gnomon.

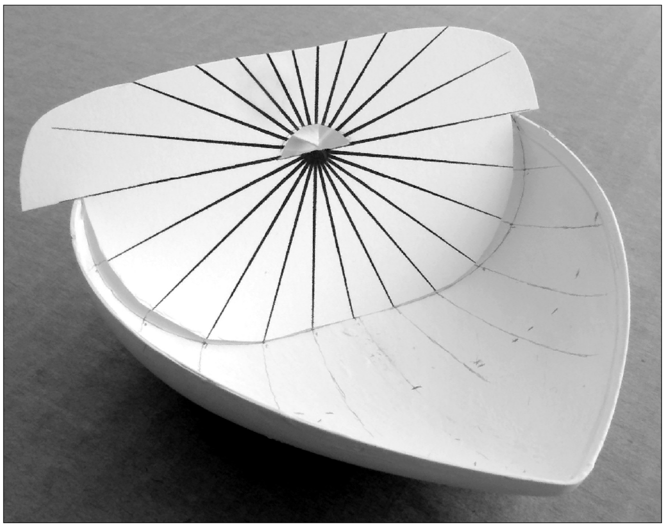

Fig. 9. Template used for marking the hour lines along the equinox.

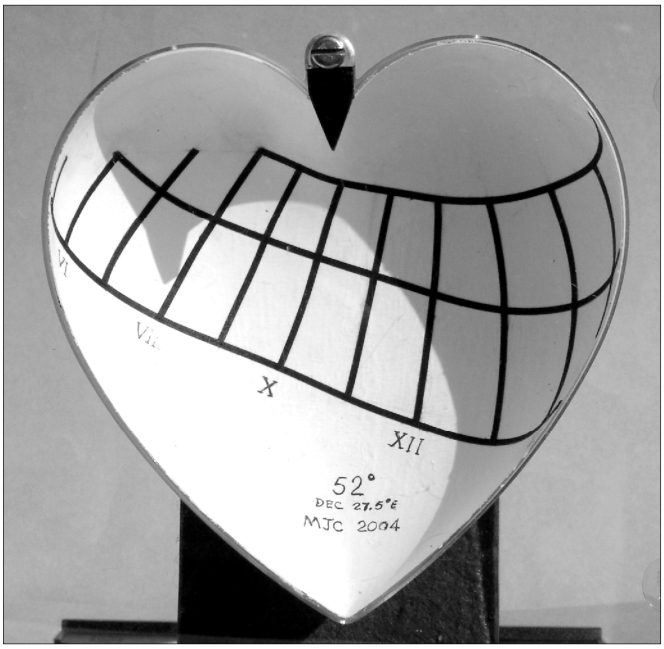

Fig. 11. The declining heart-shaped scaphe dial.

almost as simple as the south facing heart. It also helped me to refine my techniques yet again. The equinox/solstice template was fixed at the angle of my window, which declines towards the east by 27.5°, again using a template to support it. The same procedure was then adopted for marking out this new dial. For the positions of the various solstice/equinox lines I did not keep cutting off my template but just sighted along each of the three lines, marking the points where the lines would have met the heart's surface. When the dial was completed and fixed into a window I noticed that from inside my room the markings and shadows could be clearly seen, as my layer of white paint was quite thin. Therefore, with the choice of suitable materials the dial would function just as well inside or out - a very versatile time indicator.

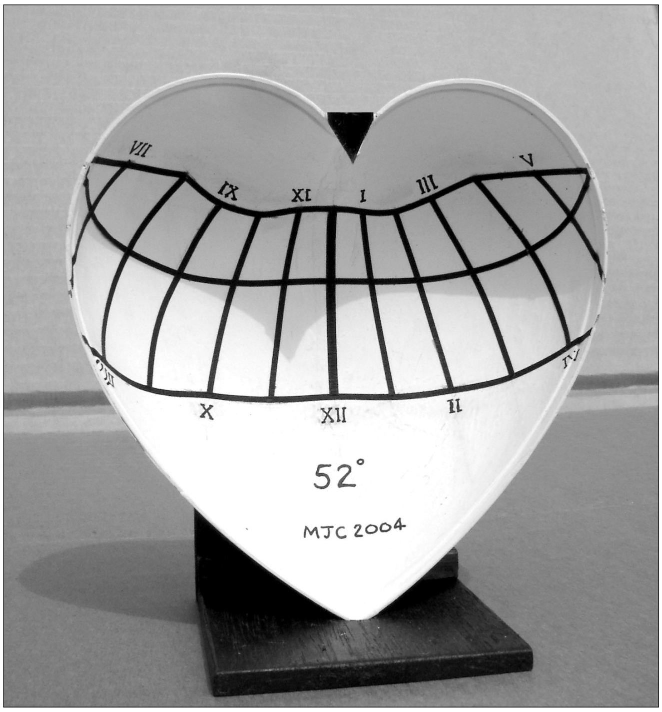

Fig. 10. The finished heart-shaped scaphe dial.

CONCLUSIONS

The various completed dials, that for Cambridge and the two heart-shaped scaphe dials were an interesting exercise. However, the method did show up a few weaknesses. The largest problems, and hence errors, were introduced by the thinness of the card used. It was not rigid enough, particularly on the 'Cambridge' dial. Some useful stiffening was achieved by folding the unused edges of the templates. With hindsight I should have used thicker card and could probably have braced it by gluing additional pieces on the reverse of each face. I could even have added thin sheets of hardboard, polystyrene or plywood. As it was, I found it necessary to glue some small spacers inside to assist with rigidity and squareness. Another problem encountered was working with a 'card' dial. This too was flexible. If I had been making a *real* dial it would have been quite solid. Another small thing to remember when using this (or any other) method is that the hour lines on a horizontal dial before 6 am and after 6 pm need to be extensions of the lines diametrically opposite and will be read from that same edge of the gnomon.

One of the most difficult processes on both dials was the method for marking the solstice lines. For each mark it was necessary to cut off a slice of the card trying to keep the new edge as close to the dial as possible. A better solution would have been to fit a fairly small card, still hinged to the gnomon, with the ±23.5° lines marked on it. These lines could then be 'projected' to the dial surface using an extension of thread, held tight and exactly across the template with its origin at the nodus. (This moves us into the realm of 'mechanical dialling', i.e. the use of the trigon and sciaterra.) I had virtually done this for my final dial by sighting along the lines.

The heart-shaped scaphe dials also showed me how difficult it is to get large fingers into the scaphe as the heart was only 10cm wide. I don't think that I would have made a good heart surgeon! It would have been much simpler if the dial have been at least 30cm wide.

Armed with simple templates such as have been described it should now be possible to construct dials almost anywhere without difficulty. The templates may be made by careful drawing onto the card at an appropriate scale but I have used a computer drawing package so that I can change the scale and cropping points quite simply. All that I need to do then is to print the scales on a piece of paper or card, cutting it as appropriate. Fig. 12 shows how the template for one half of the 'Cambridge' dial was laid out. Note that when using a computer it is essential that the printer used keeps the horizontal and vertical dimensions equal and that no distortion is thereby introduced. Also ensure that the paper or card does not stretch in one axis due to moisture or temperature. If in doubt, check with a ruler in both x and y directions against suitably placed scales.

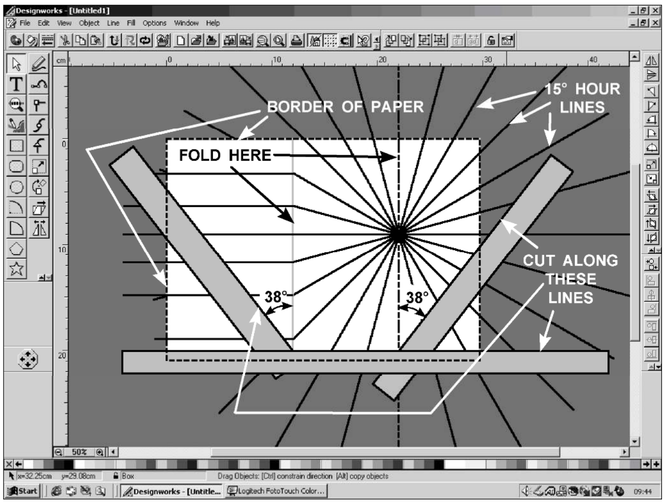

Fig. 12. The design for the half template on my computer.

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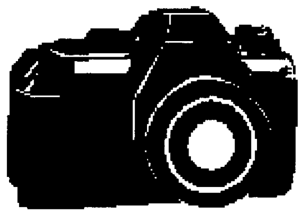
SUNDIAL AWARDS SCHEME 2005

The deadline for entries to arrive at the address below is now very near. If any entrant is having difficulty in meeting the deadline, please contact Nick Nicholls at this address. We may be able to help.

45 Hound Street, Sherborne, DT9 3AB
Tel: 01935 812544

BSS PHOTOGRAPHIC COMPETITION 2004



REMINDER

Entries are due no later than
31 January 2005

Entry forms were distributed with the March 2004 Bulletin. Additional forms may be obtained by sending an S.A.E. to

BSS Photographic Competition
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or on request (MS Word file) from
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TENTH ANNUAL NASS CONFERENCE
TENAFLY, NEW JERSEY, USA – 19-22 AUGUST 2004

MARTIN JENKINS

Tenafly, New Jersey was home to the 10th NASS Conference, an attractive little town only a forty-minute bus ride from New York City. The town centre is classic American by virtue of the railway passing along the main street, which also boasts a beautifully preserved Victorian train station. The conference was held in the Clinton Inn only a five-minute walk from the town centre, so was ideally placed for those delegates who opted to spend the Saturday evening dining with friends at one of the many restaurants.

The conference started with registration on the Thursday evening of the 19th August. There were approximately 40 people attending, which included spouses, not all of whom were attending the presentations on the Friday but preferring to go on a shopping trip into New York! America was represented by delegates who had travelled from as far away as Oregon, California, and Canada to attend, with the UK BSS contingent represented by Margaret Stanier, and by Janet and myself (who were combining the conference with the opportunity to visit family later in the week).

The conference proper commenced with an early start of 8:15 on the Friday when Fred Sawyer welcomed everybody and outlined the programme for the conference. The first presenter was Larry McDavid who has developed a PowerPoint presentation 'Sundials; Prehistory to the Digital Age', a sundial educational presentation for adult audiences. The presentation is to be made available for NASS members to use whenever they are called upon to give a talk about sundials.

Next Bob Kellogg gave a talk on 'Dialling for Students', using examples of dial construction to be contained on the NASS educational CD. Following on from these two 'educational' talks Bob Terwilliger enthralled the audience with a talk about his laser trigon that will 'draw a sundial on a Buick'. He then gave a hilarious tour of serendipitous design, construction, and ultimate destruction of his garden hot-tub dial, a bizarre but wonderful creation.

After coffee, Stephen Luecking demonstrated how 3D modelling programmes could be used to fully dimensionally replicate the apparent mechanics of dialling geometry. He also discussed how these CAD packages could then be used in the direct manufacture of dials.

Archaeological digs in Newfoundland then took us back in time from all these modern aspects of dialling. Sara Schechner gave a fascinating presentation about 17th century dial fragments found recently at Feryland in Newfoundland. The tale involves many tangled threads including ones about Lord Calvert who abandoned the site in favour of the Chesapeake Bay in 1620. Work is still continuing at the site and so it is hoped that more sundial history will come to light in due course.

John Carmichael finished the morning's presentations with a brief photo history of stained glass sundials followed by a discussion of current efforts to stimulate higher production levels of such sundials around the world, and some technical details of their design, manufacture and installation.

Fig. 1. Bill Gottesman and his Focusing Equatorial Sundial.

After a very delicious buffet lunch the afternoon's talks got underway with Bill Gottesman describing his spiral equatorial dial. The interesting aspect of the dial is that the focal length of the reflecting mirror changes as a function of the sun's right ascension resulting in a sharp image at all times, meaning that the dial could be read to about one minute of time. Bill had the dial on show in the car park, in glorious sunshine (see Figure 1).

Fig. 2. Robert Adzema and the 10th NASS Conference sundial cake.

Next, yours truly presented a talk 'Essential Science for New World Diallists', which outlined the horrendous difficulties facing anyone who is setting out to design, manufacture, and erect a dial.

Fred Sawyer returned to a more serious topic, constructing a cycloid gnomon for a polar dial. Thijs de Vries had devised a polar dial with a linear scale aligned along the meridian. The dial, using a helical gnomon, allows one to play with the definition and presentation of the equation of time.

Final talk for the day was by Paul Nibley who discussed his journey through the world of miniature noon canons in his search for alternative trigger mechanisms to the usual lens focussed image of the sun which can be very unreliable. At the closure of the day's talks Fred Sawyer presented, in absentia, the Sawyer Dialling Prize to Bill Nye and Woody Sullivan for their successful implementation of the Mars Dial and Earth Dial projects respectively. For more information about the earth dial project readers are encouraged to visit the web site www.planetary.org/earthdial.

The Conference Dinner, held at the Inn, featured entertainment of an unusual sort. Local performers Gina Ferrara and Steve Deats played a West African xylophone, and led an Afro-Caribbean drum ensemble (to which several NASS members belong) respectively. In addition the 10th Conference was commemorated with a beautiful cake in the form of a sundial, see Figure 2.

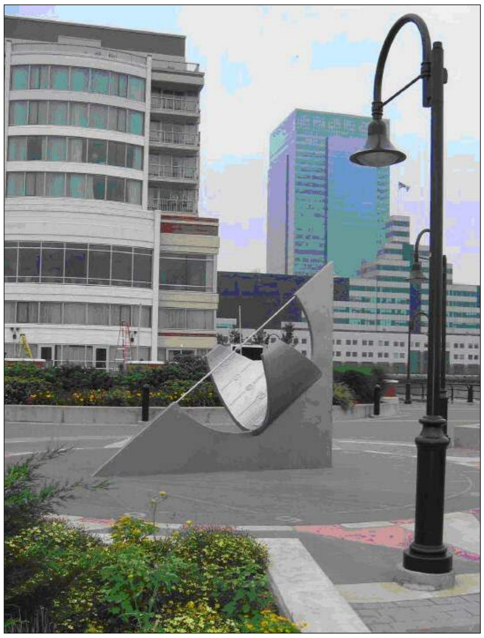

Fig. 3. The equatorial dial in front of the Hyatt Hotel, Jersey City.

Saturday was the day of the sundial tour. Unfortunately the weather was not the best. Under the guidance of Robert Adzema and Hal Brandmaier, the intrepid coach party set off. First stop was to visit an engineering fabrication shop constructing one of Robert's latest dials for a Long Island client. The dial was most impressive even in its unfinished state, standing approximately ten feet high and constructed from stainless steel.

Ever onward, the party next visited another of Robert's dials, this time in front of the Hyatt Hotel in Jersey City (see Figure 3). The view across the Hudson River to the skyline of New York was impressive but somewhat obscured by cloud and fog, which was also to the detriment of seeing the dial in action! However, the dial, again stainless

Fig. 4. Analemmatic dial at the Greater Newark Conservancy Urban Environment project.

steel, is very impressive and a credit to Robert's artistic skills. One unusual aspect for an equatorial dial is that it also carries hour markings along the top edge of the dial sector so that the time can be read from behind the dial as well as from in front. The dial also incorporates an analemma.

Fig. 5. George Washington Memorial Park Cemetery dial with incorrect gnomon.

Next on the itinerary was a bronze and concrete dial at the Greater Newark Conservancy's Urban Environmental and Ecological Centre located in the grounds of the 39th oldest synagogue in the USA. The dial is by Sara Schechner and Hal Brandmaier. It has a major axis of sixteen feet, and is at the centre of the Solar Pavilion where children will be taught about time and the sun (see Figure 4).

Ominous thunderclaps heralded our arrival at the Lamont-Doherty Earth Observatory in Palisades, just over the state line in New York. This estate is now part of Columbia University, and is a centre for research into seismology, paleomagnetics, tree-ring analysis, and marine and rock sciences and mechanics. In the grounds the party saw a charming equatorial dial by Robert Adzema set in a small pond. A beam of sunlight through an aperture on the style illuminates dates on an analemma that are important to the dial donors. Robert's home, adjacent to the Observatory grounds, contains his studio and his wife Jane's pottery workshop. A wonderful barbeque was set out for the party on the lawn. Just as everyone was about to begin lunch the heavens opened up. Though damp, the party's spirits were high, the food was superb, the company excellent, and everyone seemed to enjoy the visit in spite of the rain. Lunch over; it was back on the coach to visit the dial at Thorpe Village, a senior residence. Here the party were shown a vertical declining dial set high on a wall. The dial, again by Robert, was large and colourful, made from small mosaic tiles made by Jane Adzema in her pottery. The sun did manage to shine briefly, but unfortunately it had already passed behind the plane of the dial!

Returning to New Jersey, the next stop was to view a horizontal sundial in the centre of Midland Park. The dial plate is the millstone from a local 18th century gristmill, and boasts a gnomon commemorating the bicentennial of the American Revolution. The final dial on the tour was at the George Washington Memorial Park Cemetery in Paramus, New Jersey. The gnomon design is based on Washington's coat of arms. In the 1980s the gnomon was stolen but the replacement is incorrectly placed for the dial to be of any use (see Figure 5). The tour over, the party returned to Tenafly. There were no formal evening arrangements and so delegates retired to the various restaurants in the vicinity. Some of us, including Margaret Stanier, had a delicious Chinese meal to round off a very interesting and tiring day.

Sunday started bright and early, as usual! The morning comprised very informal talks. Ken Clark discussed the construction of the Mars and Earthdials, and how to see them, followed by Dudley Warner on 'Dials that Run Backwards' (after his visit to Australia and New Zealand). Stephen Luecking discussed Albrecht Durer, the Renaissance mathematician and artist, and his relationship to Regiomontanus and his improvements on the work of Ptolemy.

'How do you move an Obelisk?' by Hal Brandmaier, explained the history of the move of the Cleopatra's needle from Egypt to its present location in Central Park, New York City. Hal then went on to discuss recent attempts to move an obelisk from the Vatican to Ethiopia! The closing talk was an update on The Turtle Bay Sundial Bridge, California, given by Robert Adzema. The bridge was not designed to be a sundial, only later was this considered, and the attempts to date to make it into a dial are intriguing and still unfinished. In addition to the informal talks, John Carmichael provided a hands-on workshop for those interested in making their own stained glass sundial. John invited delegates to try their hand at glass cutting and soldering, in addition to demonstrating the methodology of pattern transfer.

The Conference finished at lunchtime with grateful thanks to all concerned, everyone enthused about dialling and its many facets, and the announcement that the 11th Conference in 2005 will be in Chicago.

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READERS' LETTERS

Finlay, Dial Maker

I saw with interest in the Bulletin for Sept 2004 on page 104 a reference to Ian Hamilton Finlay. The one you illustrate "(H)our lady" is one of six in his garden at Dunsyure, illustrated most conveniently in : Jessie Sheeler '*Little Spartan'* (London 2003). To these you can add the sundial on the wall at Inverleith House in the Botanical Gardens, Edinburgh. Others are reproduced in Zdeñek Felix and Pia Sdimig's '*Ian Hamilton Finlay*, *Works in Europe (1972-95)'* Ostfildern (1945): University of Canterbury at Kent, University of Liege, and British Embassy in Bonn. Finlay is rare among sculptors/garden designers/poets - he is all three - in his interest in sundials.

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Selling Sundials

I refer to the letter from Frank Coe in the September 2004 Issue. The Tompion sun-dial advertised by Sotheby's in the June issue and sold by them in their sale of Scientific Instruments, Clocks, Barometers and Mechanical Music on 15 June 2004 was not removed from its original location for the sale. It left its original home, Wrest Park, Bedfordshire well over half a century ago.

Mr Coe raises an interesting and important point about sundials being protected along with the building with which they are associated. As he says, this is simpler with vertical dials which are physically attached to the building to be listed. Separately mounted horizontal dials in the garden could be considered as independent items so perhaps they should be the subject of a separate protection listing as historical monuments. But if so on what grounds should this be based? That they are in their original position and therefore an integral part of the house and garden design? This was not the case with the dial from Wrest Park which, even while it was still there, was removed from its original position in the main drive to another position in the grounds.

We surely protect historical buildings and artefacts against thoughtless modification which destroys or alters their aesthetic quality or their value as historical evidence. Moving a garden sun-dial, even selling it, does not do this unless it is removed from an original location which itself has not been altered and in which the sun-dial plays an integral design role. Even then, the dial is still at risk from vandalistic defacement or theft. Perhaps more sun-dials have been saved by being traded than by being left in what might have been their original positions. If so, the history of the development of dials has probably benefited even if that of garden-design has not. To take up a general position 'that we should discourage the view that fixed horizontal dials are tradeable artifacts (sic)' seems to me unhelpful. Each individual case needs assessing in its own terms.

A final thought: the question of whether a detached fixed dial is in its original position or not is something which sundial recorders might well investigate - and record.

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Dial Vandalism

On a recent visit to the National Trust property, Anglesey Abbey, near Cambridge I noticed that the dial at the front of the house, SRNo.1778, had been badly damaged by vandals. Its gnomon was bent right over, also causing damage to the dial plate. This dial is on full view from the house and it is difficult to imaging how anyone would dare to do this.

The purpose of my visit that day was to photograph the large cube dial, SRNo.0588, in the gardens and I had to wait for a child to stop swinging on its south gnomon. The gnomon was clearly bending with this small child's weight. I barely had time to start photographing the dial when another child ran into the garden and went straight for the same gnomon. In both cases their parents did not even attempt to exercise any control. The dial with its gnomons at child height is obviously very attractive to children! Closer inspection revealed that the three extant gnomons had signs of previous repairs. The north gnomon was totally missing.

These two events lead me on to ask how can we protect such dials from visitors? Naturally horizontal dials can be removed and replicas put in their place, but these would also suffer at the hands of these people, probably requiring frequent and costly replacement. Another solution would be to place a fence around each dial (and each statue) to keep it just beyond arms length. This would be a terrible pity for people like us who want to study these objects. However, I am sure that an application to view could be made from the estate office, so maybe it is not such an imposition if it can save the dial from being stolen or damaged.

I feel that the BSS should contact owners of these dials and offer advice for their protection. Perhaps some of our Members would be prepared to help and set up a small group who are able to do this with the backing of our Society?

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Redacted

THE ANGLO-SAXON SUNDIAL ON ST. MAURICE'S CHURCH IN WINCHESTER

D. SCOTT

About twenty sundials in England have survived from the Anglo-Saxon period. They marked the third, sixth and ninth hours after sunrise for timing the monastic offices of Tierce, Sext and None[1]. In Hampshire there are four sundials of this type, three are very similar and now mounted on the parish churches at Corhampton, 16km south-east of Winchester (Fig. 1): Warnford, 3km north-north-east of Corhampton, (Fig. 2): and Winchester St. Michael's (Fig. 3). They were described by Haigh (1845)[2] & (1879)[3], Gatty (1900)[4], Green (1926)[5] & (1928)[6], and Green & Green (1951)[7]. The fourth sundial was discovered in 1970 on the parish church at Hannington, 25km north-north-east of Winchester (Fig. 4). In addition to Tierce, Sext and None, it marked the points midway between them and was described by Hare (1980)[8].

A sundial of Anglo-Saxon appearance, but of uncertain date, is mounted on the surviving west tower of St.Maurice's church in Winchester (Fig. 5). It was described by Page (1912)[9], Green (1943)[10], Cox & Jowitt (1949)[11], Green & Green (1951) and Tweddle (1995)[12]. When photographed in 1950 it was already weather-worn, but sufficient detail remained to show how it differed from the other Anglo-Saxon sundials in Hampshire. A photograph taken in c.1990 (Fig. 6), shows how atmospheric pollution in the city has now almost entirely destroyed the detail. The sundial has been dated as from the tenth or eleventh centuries[12]. It was carved on a rectangular stone block, cut back to form a projecting cylinder in the Anglo-Saxon manner. Around the perimeter acanthus leaf patterns were carved in relief, the predominant form of foliage decoration in Winchester during the tenth and eleventh centuries[12]. This detail can be seen more clearly on a sundial of about the same date at North Stoke in Oxfordshire, 17km downstream to the south-east from Abingdon-on-Thames shown in Fig. 7.

Over the top of the St Maurice's sundial was draped a slender serpent carved in bold relief, with open mouth on the left and forked tail on the right. The best known example of this feature is on the sundial at Escomb in County Durham, lkm north-west of Bishop Auckland, which was described by Beddow (1991)[13] in terms of Norse mythology. Scandinavian political influence was dominant in Winchester during the period 1016-1042.

The nine incised lines were grouped downwards towards the vertical, unlike those at Hannington which radiate from the horizontal, but probably still intended to mark the times for the canonical hours of Tierce, Sext and Nones and the points midway between them. The lines met in a small circle high up on the dial-face, instead of at the centre of the main circle as on most Anglo-Saxon dials. This arrangement suggests the use of a gnomon angled downwards towards the ground, but it is generally believed that the angled gnomon was unknown in England before the twelfth century[14]. So either the sundial should be given a later date o4 the angled-gnomon was known in England earlier than generally supposed.

Some idea of sundial design knowledge in late Anglo-Saxon Winchester can be gained from the drawing in an

Fig. 1. Corhampton Church sundial.

Fig. 2. Warnford Church sundial.

Fig.3. Winchester St Michael's Church sundial.

Fig. 4. Hannington Church sundial.

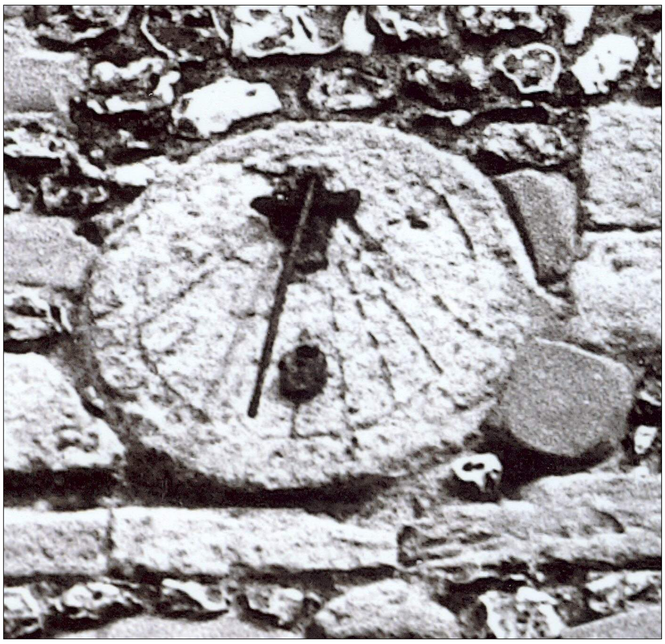

Fig. 5. Winchester St Maurice's Church sundial. Hampshire Record Office. Photo: P.M. Green.

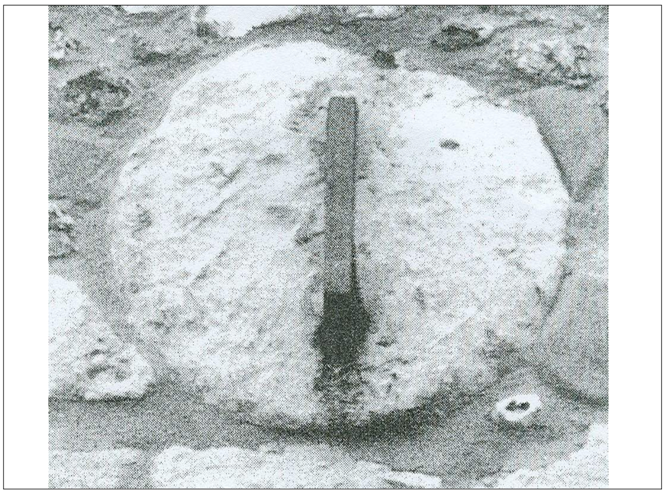

Fig. 6. Winchester St. Maurice's Church sundial. Photo: E. Tweddle.

eleventh-century Saxon psalter, (Fig. 8) believed[15] to have been made in the Winchester School of Manuscript Illumination around 1050[16]. The drawing is almost certainly a symbol for a time-measuring device, rather than a record of an eleventh-century Anglo-Saxon sundial. The artist seems to have combined features of ancient scaphe dials with those of Anglo-Saxon monastic sundials. The series of circles which form a background to the drawing are reminiscent of lidded scaphe dials, such as the one from Carthage, (Fig.9)[17] and the arrangement of the lines is similar to the view of a conical sundial as seen from the front. The short horizontal gnomon, and its position relative to the lines, would be appropriate for a sundial where the tip of the shadow indicates the hour. The illustration does confirm that the Church divided the daylight period in hours, which on the drawing are numbered from I to XII between the lines, and alongside them are the initial letters for the Latin words from first to twelfth. The ends of the third, sixth and ninth hours are marked with a cross as on Anglo-Saxon sundials, and the two isolated crosses at the top of the drawing probably represent Lauds at daybreak and Compline at night neither of which can be marked by a shadow.

Fig. 7. North Stoke Church sundial.

The first documentary evidence for St Maurice's church was in 1172[18]. It originated as a gate chapel which gave access to the precinct of the New Minster in Winchester and, although an important parish church in the medieval city, it was demolished in 1840 leaving only the twelfth-century west tower. Rebuilt on a larger scale in 1841 it was again demolished in 1957, once more leaving only the west tower intact[18]. The sundial was not designed for St Maurice's church which faces 17° west of south (Fig. 10), whereas the lines are symmetrical about the vertical as for a south-facing wall. The sundial design may have been influenced by the Winchester School and the ideas embodied in the psalter drawing and, if intended for use with an angled-gnomon, it must be one of the earliest examples in England. The modern gnomon in the 1950 photograph, with the rather untidy fittings, could be correct, but it is longer than necessary as shown by its shadow which extends over the large stone blocks below the sundial. The St. Maurice's sundial may have been a type, transitional between the old Anglo Saxon sundial with a horizontal gnomon, marking nominally the third, sixth and ninth hours after sunrise, and the later sundials with a gnomon angled downwards for the latitude of the location, marking correctly the hours between sunrise and sunset but from midnight according to the 2 x 12 equal hour system of the mechanical clock.

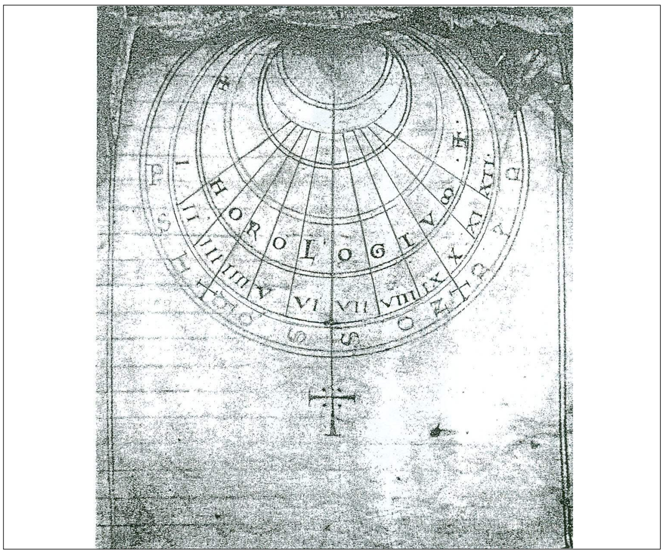

Fig. 8. Drawing of a sundial in a Saxon psalter of the eleventh century. British Library, Cotton Manuscripts, Tiberius CvI folio7.

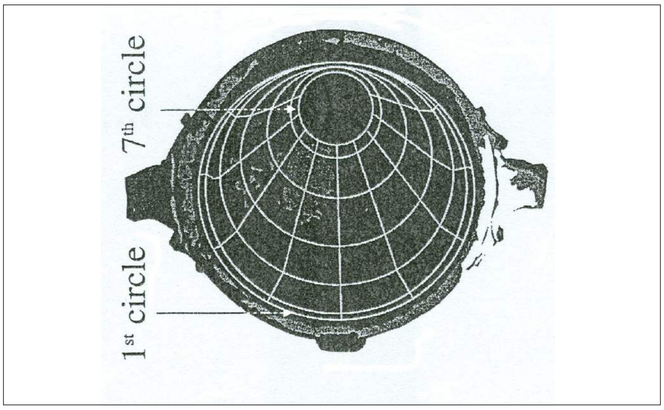

Fig. 9. The Scaphe of Carthage; Paul Gagnaire: (circles in the cavity of the scaphe shown in Fig. 4).

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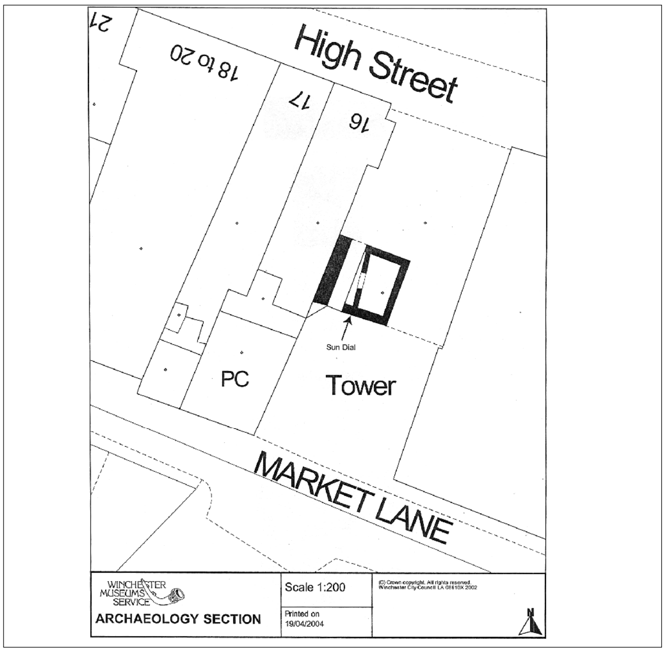

Fig. 10. Map to show the position of the surviving west tower of St. Maurice's Church; Winchester Museums Service, Archaeology Section.

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SUNDIAL FOR A GOLDEN WEDDING

JOHN WALL

Fig. 1. The Golden Wedding sundial window.

My wife Betty and I celebrated our Golden Wedding Anniversary on Saturday 7th August this year, 2004. (Our friends have been kind enough to remark that this is quite an achievement, given the current climate!) Well in advance we began to consider how best we might celebrate this landmark in our life together. As an enthusiastic member of the BSS, the commissioning of a sundial seemed highly appropriate. However, this special occasion clearly called for a special kind of sundial. For some years I have been keenly interested in the nature and distribution of stained glass window sundials in the United Kingdom. Our Chairman, Christopher St. J. Daniel, has identified 36 such sundials, of which four are in our native county, Yorkshire[1]. These are:

1. The earliest known example, a small glass roundel 2.75" (70mm) in diameter in the Great Hall of Gilling Castle, North Yorkshire, now occupied by a Roman Catholic boarding school. It was the work of Bernard Dickinkhoff and is dated to 1585.

2. Originally in Gray's Court College, in the City of York, now on display in the entrance hall of the City Art Gallery in Exhibition Square. and dated to the 17th century.

3. Tong Hall, near Bradford, West Yorkshire, the work of Henry Gyles – "The last and only glass painter left in York in the 17th century". It is dated c.1702.

4. Nun Appleton Hall, North Yorkshire, also the work of Henry Gyles, dated 1670.

Christopher Daniel has himself added to this tally of Yorkshire stained glass dials with a splendid modern version inserted in a south-facing window of the Merchant Adventurers Hall in Piccadilly in the City of York. He was also largely responsible for the restoration of an early stained glass dial originally sited in the Hall of the Worshipful Company of Weavers in the City of London, dated c.1669. It has been relocated to the Weavers House, New Wanstead[2].

The site for our proposed glass sundial effectively chose itself - a window overlooking the porch of our house that sheds light on an upper staircase landing. Its horizontal shape, and its size - 16.25" x 40.5" - provided the ground on which to sketch out a preliminary design consisting of seven principal elements, (Fig. 1):

1. The dial itself, in shape not unlike the outstretched wings of a bat in flight, with conventional hour lines, except that they are in reverse order to the norm since the whole is viewed from the inside. These are bounded at the top and bottom by two curved lines that represent the dates of the winter and summer solstices respectively and a straight line midway that represents the equinox.

2. An 'equation of time' graph headed 'minutes correction' to enable the apparent solar time recorded on the dial to be converted to 'clock time'.

3. Since every self-respecting classical sundial bears a Latin motto, ours has one of my own devising: LUX ET AMOR QUEMQUE DIEM REGUNT AB ORIENTE SOLE AD SOLIS OCCASUM, which being translated reads: 'Light and Love Rule Each Day from Sunrise to Sunset'.

4. The initials of our Christian names, J for John and B for Betty, intertwined, repeated twice, copied from a similar feature on the wrought-iron gates at the entrance to our garden.

5. Four flowers at the corners, namely Wallflower (for ob-

vious reasons); Morning Glory; Evening Primrose; and lastly Globe flower, representing the earth spinning on its axis, without which there would be no day and night, sunrise and sunset, light and dark, or indeed any sundial to record them.

6. The longitude and latitude of our house, 0°56' W and 54° 16' N.

7. The Anniversary dates: 1954 – 2004.

It would have been gratifying to have been able to commission our window from the world-renowned York Glaziers Trust, heirs to the tradition of that master glazier Henry Gyles. (Their most recent achievement has been the restoration of the magnificent Rose Window severely damaged in the fire that destroyed the roof of the south transept of York Minster in 1984.) That proved to be impractical and instead we turned to a more distant professional glass engraver, David Gulland, whose studio cum workshop is hard by the Museum in Dumfries. Readers of the Bulletin will be familiar with his work from David Young's account of the George Higgs memorial window, installed in the Tollbooth Arts Centre in Kirkcudbright[3]. (It was George Higgs, at that time the British Sundial Society's oldest member, who, together with his friend and neighbour David Gulland, developed the concept of the engraved glass sundial.) David Gulland's welcome acceptance of our commission involved a radical change of plan regarding the nature of our sundial, as we shall see.

The creation of a glass window sundial in modern conditions poses certain problems, all of which David Gulland's technique has successfully overcome. The first is how to deal with any marked declination from due south, as is the case with our home 'Drystones' in Kirkbymoorside, North Yorkshire. It was essential to determine the exact degree of declination, for which I called in the expertise of my friend and neighbour, sundial enthusiast and sundial maker D. Scott-Kestin. Not only did he work out the complicated mathematics that are involved in such an exercise, but he made a corresponding vertical dial that is now sited beside our front door. It invariably intrigues every visitor, since in common with the finished version in glass overhead, the combination of hour-lines and date-lines enables us to mark the precise date and time of each anniversary of our wedding - 7^{th} August at 12:00 noon - alongside our initials J B (Figure 2).

The second problem is how to incorporate a gnomon on an unleaded single pane of glass. As Christopher Daniel has

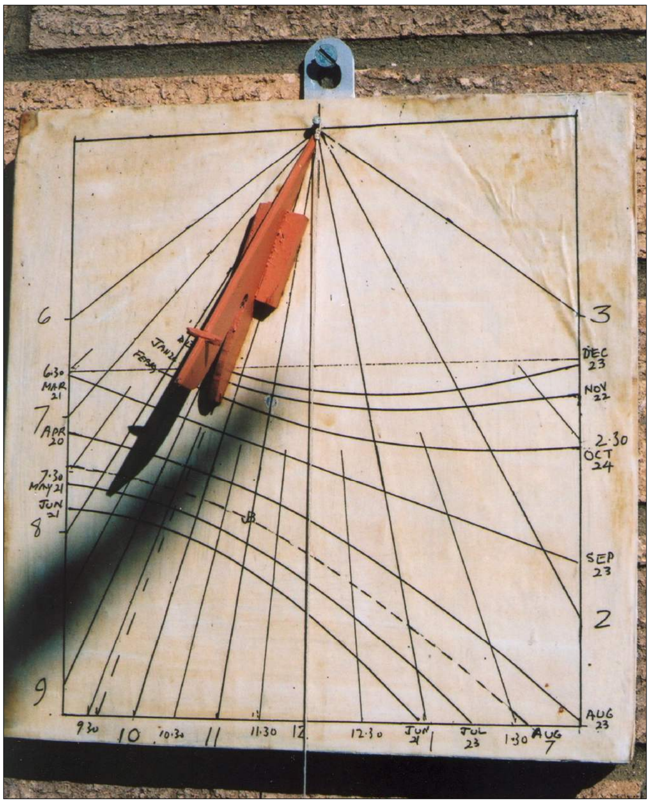

Fig. 2. Vertical dial, by D. Scott-Kestin, beside the Walls' front-door.

pointed out, the glass of all the recorded 17^{th} century stained glass windows was normally drilled with two or more holes to allow the heavy metal outside gnomon to be fastened in place. As this was usually made of brass, or sometimes of iron or lead, the strain on the glass was considerable and has contributed to much damage and loss. David Gulland's ingenious solution is to dispense with the conventional metal gnomon altogether and to substitute one of a radically different kind. The sundial and its furniture is engraved –'abraded' - on the light-facing surface of a second window pane positioned exactly one inch from the existing window pane which is retained *in situ* - a type of double-glazing. A small disc with a tiny pin-prick hole at its centre is precisely positioned on the inner surface of the pre-existing outer pane: it is the ray of sunlight that the pin hole projects onto the engraved glass that constitutes the 'gnomon'. (In David Gulland's phrase, this is an imaginary gnomon with the spot of light at its tip.) Indeed, it is evident that the terms we employ of a conventional gnomon are inappropriate here. The purist might object that since no shadow is cast (except the shadow of the disc), there is no gnomon. So be it!

Accomplished artist that he is, David Gulland set to work to polish and improve my primitive design and to add welcome features of his own devising. Since the distance between the two panes of glass has to be precisely one inch throughout, in order to ensure the time-keeping accuracy of the sundial, and since the existing wooden window frame was markedly less than one inch deep, it was necessary to call in a local joiner to fashion an extension of very precise dimensions, together with fillets that keep the engraved pane in its place without exerting such pressure as might cause it to crack. It was an anxious moment when the finished pane was married up to its housing, and what relief when it sweetly fell into place with not a fraction of an inch to spare!

The reader will have noticed that the overall 'bat's-wing' shape, and the delineation of the lines on the finished product, differ considerably from those on the prototype fixed alongside our front-door. This is something that in my ignorance I had not anticipated. It results from the entirely different nature of the gnomon in each case. Although David Gulland was furnished with a copy of the design on which D. Scott-Kestin based his conventional dial, this was not in itself sufficient to provide the co-ordinates that would determine the necessarily precise position of the disc with

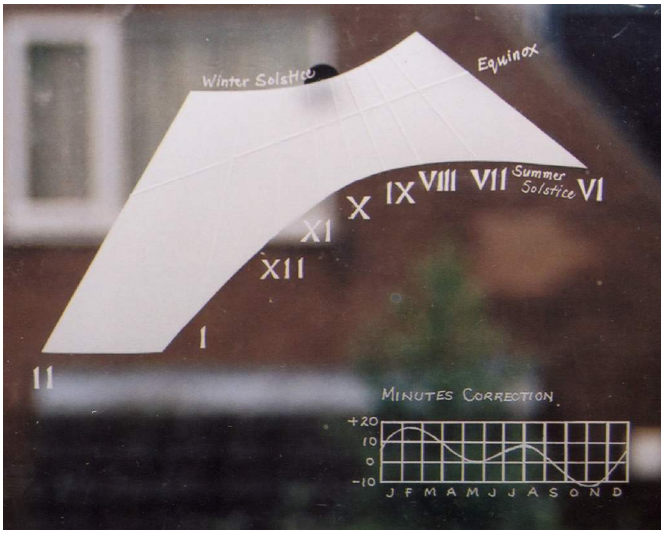

Fig. 3. Central portion of the engraved glass dial, with EoT/longitude correction graph.

its central pin-prick. Were it to be displaced by the smallest amount, then the sunbeam thus created would not with sufficient accuracy fall upon the appropriate hour lines at different times of day. Modern science came to the rescue, like a knight in shining armour, in the form of a computer programme that generated the required matrix once it had been fed with the parameters its diet demanded. Nevertheless, David Gulland took no chances, and on the date of the dial's installation he checked, in one of those 'brief, bright moments (of sunshine) fading fast' in our 'summer' of 2004, that the spot of light did indeed fall on the dial at its appointed place before the two panes were permanently joined in matrimony.

Of course, my wife and I are pleased that our commemorative glass window dial has added to the total of such time-tellers in God's own county, Yorkshire. In the event, in retrospect, we are glad that our sundial is on an engraved and not a stained glass window pane. We feel that the effect of stained glass, given its location, would have been rather obtrusive. The clear engraved design is very effective - a handsome addition to our home. It has been admired by all the guests who took time to visit us during our anniversary weekend. It was a real thrill for Betty and I to recall our wedding day half a century ago when on its anniversary the spot of light did indeed fall on the exact time and date as indicated on the dial. Naturally we will encourage our sundial to tell us the time every day, but it will be a very special reminder on the day of each anniversary in the years to come.

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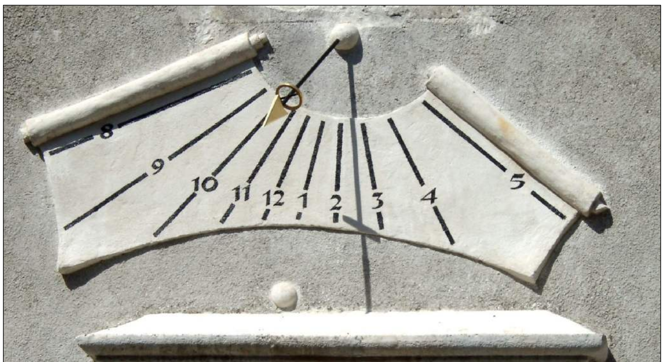

St Thome, Provence, France. *A neatly made dial using the edges of a ribbon scroll for the limits of the solstices. However, the equinox line has been omitted. Photo: Mike Cowham.*

FIVE SUNDIALS AT DUNMORE, Co. DONEGAL

MICHAEL J. HARLEY and HARRIET JAMES

Fig. 1. Dunmore House, with the 1935 heliochronometer in front.

The McClintock family lived at Dunmore (Fig.1) from about 1685 until 1940. Located about 5 miles south west of Londonderry, it was burned down by King James's retreating army after their unsuccessful siege of Derry in 1689, rebuilt in 1709 and further extended in 1742. Lt. Col. Robert Lyle McClintock was the last McClintock to live there, leaving in 1940 after a terrible family tragedy that left his wife, Margaret Jennie (known as Daisy), his only son William and his son's fiancée Helen, dead. In 1912 while he was serving in Bangalore, India, with the Bengal, Bombay and Madras Sappers and Miners, he invented the 'Bangalore Torpedo' used to explode booby traps and barbed wire entanglements. On his retirement to Dunmore he designed and made the moulds for the concrete fence posts, garden sheds, bowers and seats that are to be seen around the estate. He also designed and made at least five concrete sundials, four of which survive. One was stolen in 2002 from a nearby property.

Fig. 2. The 1934 multidial at Dunmore House.

It is not known to what extent his wife may have contributed to the calculations needed for these complex dials but we can assume that she did as "...William's mother, Daisy, was something of a mathematical genius. Her husband was a Sapper and they spent most of their service life in India where Daisy filled in her spare time by working out missile trajectories and other obscure problems for the army..."[1]. Fast and accurate calculations of missile trajectories were a major problem for the armed forces. It would take another ten years and the invention of one of the world's first computers before this problem was finally solved.

THE 1934 MULTIDIAL

On the terrace, at the south east corner of the house, is a concrete multidial (Fig. 2) comprising four distinct dials – equatorial, polar, direct east and direct west. All the gnomons, numerals and hour lines are made from brass and cast in the concrete. The multidial is 500mm long, 250mm wide and 150mm thick. The upper face is parallel to the equator and faces north. This has an equatorial dial with a brass gnomon perpendicular to the plate. The dial hour lines are equally spaced at 15º intervals around the gnomon and sunlight only falls on the plate from the Vernal equinox until the Autumnal equinox. It is marked "SUMMER TIME".

The polar dial is in a semi-circular cut-out at the northern end of the multidial. The gnomon is at 1:30p.m. as the layout has been adjusted to show B.S.T. and corrected for the 7½° of longitude between Greenwich and Dunmore. The hours, in Arabic numerals, read from 7a.m. to 6p.m.. The direct east and west dials are both in semi-circular cut-outs at the sides of the multidial with the brass bound edges of the cut-outs acting as the gnomons. The east dial reads hours from VI to XII in Roman numerals and the west reads from XII to VI, again in Roman numerals. These times are "A.S.T." Apparent Solar Time. Cast in the concrete on the east side is "LAT 55 N", a swastika and "R.L.McC". On the west side is the date "1934", "LNG $7^{1}/_{2}$ W" and a swastika. The swastika symbol is thousands of years old. Among other things, it can represent the rays of sun or the four directions of the wind. The motto "NO DAY OUTLIVES ITS NIGHT" is cast in the pedestal top that sits on a low brick base.

Fig. 3. The 1935 heliochronometer.

THE 1935 HELIOCHRONOMETER

In 1905, George James Gibbs designed and patented a heliochronometer, a precision sundial using an Equation of Time cam mechanism, that was accurate to one minute[2]. On the front lawn of Dunmore is a sundial that was designed by R. L. McClintock using an Equation of Time cam mechanism (Fig. 3). It is now damaged but when new it gave a direct reading of Solar Time (Local Sun Time), Greenwich Mean Time (clock time - based on a mean 24 hour day) and Summer Time (when clocks are set one hour ahead of G.M.T.). It consists of a large brass dial plate 330mm diameter with a small brass date disc 125mm diameter and a brass alidade that had two brass sights originally, both of which are now missing. The support bracket of the back sight is still in place but the foresight bracket is broken off and missing.

The dial plate is inscribed "Robert Lyle McClintock", "Dunmore", "1935" and "Long $7^1/_2{}^{\circ}$ W", "Lat 55°N", (Fig. 3a). The hours and half-hours are marked by brass strips embedded in the concrete base surrounding the dial plate and show times from 3:30 a.m. to 9:30 p.m. The hours, identified by Arabic numerals cast in the concrete, are almost eroded away and difficult to see. The dial is mounted on a pre-cast concrete inclined octagonal base, which is connected to the octagonal top of a pre-cast concrete pedestal by a concrete bracket. The date "1935" appears twice on this bracket. The vernier scale on the edge of the dial plate (Fig.3b) is inscribed "Solar", "Greenwich" and "Summer Time". The spacing is to the same scale as the hour and half-hour lines on the base with the correct half-hour gap between Solar and Greenwich to compensate for longitude difference of $7^1/_2{}^{\circ}$. There is a one-hour gap between Greenwich and Summer Time. The vernier is calibrated to an accuracy of 5 minutes.

The date disc (Fig. 3c) has month marks, each identified "JAN", "FEB" etc.. There are five spaced day marks on the dial plate which coincide with the edge of the calendar

Figs. 3a,b,c. Details of the 1935 heliochronometer showing (left to right): a) the cast hour numerals; b) the vernier scale on the edge and c) the date disk.

plate marked "1", "7", "15", "22", and "30". Rotating the date disc to indicate the current date turns a concealed cam that moves the alidade left or right by the correct amount to compensate for the Equation of Time.

The mechanisms for controlling the rotation of the dial and date disc and setting the device at the correct inclination (same as latitude i.e. 55 degrees) and orientation (true south) are concealed in the concrete base and bracket which connects the base to the pedestal. There are four mottos cast in the concrete. One on the underside of the inclined base reads in French "QUI A TEMPS A VIE" (who has time has life). Two are in Latin, one word per flat, around the octagonal top of the pedestal "NEQUE UMBRA SINE LUCE" (there can be no shadow without light) and "QUASI UMBRA TRANSIT VITA" (as a shadow goes life). One is in Urdu, one word per riser of the square top step, (translation unavailable). To use the lawn heliochronometer sundial when it was in working order one would have:

1) Turned the small date disc until it indicated the date.
2) Rotated the large dial plate until the sun shone through the pinhole on the upper sight of the alidade, and lined up this spot of sunlight on the vertical centre line of the lower sight.
3) Standing facing the upper edge of the dial one would

have read the hour from the brass numerals and the minutes from the vernier time scale on the dial plate.

THE 1936 VERTICAL SUNDIAL

Four metres up on the south face of the north wall of the walled garden is a 675mm high by 530mm wide by 50mm thick concrete direct south vertical dial (Fig. 4). Longitude

Fig. 4. The vertical dial in the walled garden.

corrected, it shows the time from 7 a.m. to 6 p.m. in Arabic numerals cast in the concrete. Each hour is sub-divided into 15-minute divisions using brass strips cast in the concrete. It has a simple but massive brass gnomon held in place by a base flange bolted to the concrete plate. Cast in the concrete is “R L Mc C” “DUNMORE” “1936” “GMT” and the final verse from Matthew Arnold’s ‘Consolation’ (Fig. 4a):

TIME SO COMPLAIN’D OF
WHO TO NO ONE MAN
SHEWS PARTIALITY
BRINGS ROUND TO ALL MEN
SOME UNDIM’D HOURS

Nearby is an Equation of Time Graph on a concrete plaque (Fig.5) 530mm wide by 400mm high dated 1935.

Fig. 4a. The dialface and inscription of the vertical dial.

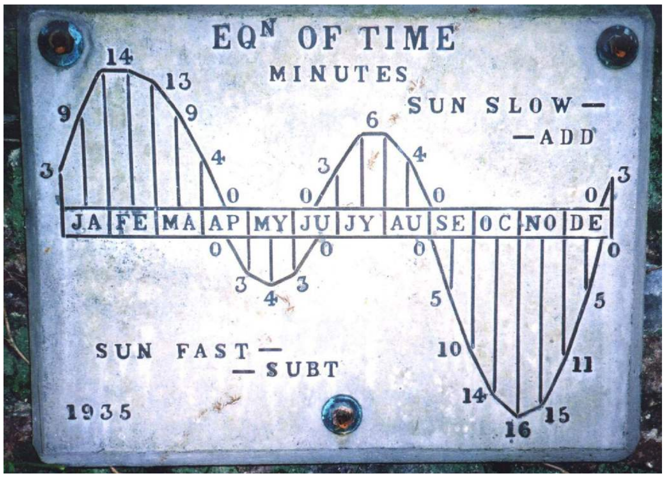

Fig. 5. The Equation of Time plaque for the vertical dial.

THE 1939 HELIOCHRONOMETER

In the walled garden of Dunmore there is a second heliochronometer sundial (Fig. 6) that uses a spot of sunlight projected onto an analemma to compensate for the Equation of Time instead of a cam[3]. It gives a direct reading of Solar Time (Local Sun Time), Greenwich Mean Time (clock time - based on a mean 24 hour day) and Summer Time (when clocks are set one hour ahead of GMT). It consists of a brass alidade (Fig. 6a) with two brass sights mounted on a pre-cast concrete inclined octagonal dial plate, 630mm across the flats, that is connected to the octagonal top of a pre-cast concrete pedestal by a concrete bracket. The date “1939” and the initials “R L McC” are cast into this bracket.

The 970mm high pedestal sits on two steps, the top one square, the bottom one octagonal. There are four mottoes, one on the underside of the inclined base in Urdu (translation unavailable) one in English on top of the pedestal “SOON COMES NIGHT”, one in German, one word per flat, around the edge of the octagonal top of the pedestal

Fig. 6. The 1939 heliochronometer.

Figs. 6a, b. Details of the 1939 heliochronometer showing: a) left, the two sighting arms of the alidade and b) right, the time scale vernier on its end.

"SOLL MAN DEN TAG OBEN AUF DEN ABEND" (thought to be a version of the phrase: "SOLL MAN DEN TAG NICHT VOR DEM ABEND LOBEN" (one should not praise the day before evening) and one in Latin, one word on the riser each side of the square top step "OMNES VULVERANT ULTIMA NECAT" (all *{hours}* wound, the last kills).

To tell the time one rotates the alidade until the sun shines through the pinhole of the upper sight. Next line up this spot of sunlight on the current month mark of the analemma on the lower sight. Then read the hour from the brass numeral on the concrete dial plate and the minutes from the vernier time scale on the end of the alidade (Fig. 6b). The hours and half hours are marked by brass strips cast in the concrete dial plate. The hours are identified by brass Arabic numerals and show times from "5"(a.m.) to "9"(p.m.).

THE 1843 MELVILLE SLATE SUNDIAL

In the rose garden at Dunmore, within the walled garden, there is a horizontal slate dial 530mm deep by 500mm wide, (Figs. 7 & 7a). When found, it was badly cracked with only two of its five gnomons in place. The central gnomon was in the owners' possession but two of the subsidiary gnomons were missing. A triangular spall, where the central gnomon had been wrenched out, was missing but a diligent search of the surrounding area recovered it from where it had been tramped into the nearby mud, many, many, years before. The entire dial was heavily lichened

Fig. 7. The Melville dial, as discovered on its pedestal.

and the engraving difficult to make out. Clean water, a soft brush and ten minutes later the sharp engraving emerged and revealed that it was made for "ROBERT McCLINTOCK Dunmore", "Latitude 55° 7' North" by "RICARDUS MELVILLE"[4], "Fecit AD 1843" and with the Latin mottoes "Tempus Fugit" and "Memento Aeternitatis" (Time flies - remember eternity). There is a central compass rose and, in addition to the central dial, there are four small subsidiary dials.

There are 64 names of distant cities and countries on the dial plate from Nanking in the east to Queen Charlotte Sound in the west (Table 1). The four subsidiary dials, one

Fig. 7a. The Melville dialplate in its unrestored state.

at each corner of the plate, indicate local time at: NEW YORK, *N. America*; ALEXANDRIA *Egypt Africa;* SYDNEY *Australia* and BENGAL *Asia*. There is an Equation of Time table in two parts, one each side of the plate. There is a large abstract trefoil design centred on the north side of the plate and smaller four leaf designs fill otherwise blank spaces all over the slate.

The earliest known Richard Melville dial, dated 1832, was made for Downpatrick, Co. Down; his last was made in Dublin in 1871. In the intervening period of almost forty years he travelled extensively throughout Ireland, Scotland and England and more than twenty examples of his work have survived, some still in their original settings. Curiously, he sometimes signed his uniquely styled dials 'Richard Melvin'. Why he did this is the subject of conjecture.

The dial sits on a concrete pillar made by R.L. McClintock, grandson of the Robert McClintock for whom the dial was made. Around the four edges of the supporting concrete top is the motto " WORK" "WHILE IT IS DAY" "FOR NIGHT COMETH" "WHEN NO MAN CAN" and underneath the top, on its splayed support there is an Urdu word or words not yet translated, "DUNMORE", "RLMcC" and "1934", the date the pillar was made. Sir John and Lady McFarland, the present owners of Dunmore, readily agreed to have this important dial restored and this was entrusted to Harriet James.

THE 2003 MELVILLE RESTORATION

When removed from its pillar, the sundial was in poor condition (Fig. 7a). The slate was cracked right through across the centre. There were other cracks on the slate surface and some missing sections. The remaining three gnomons appeared to be replacements of the originals. They were made of brass and bolted through the stone to brass plates on the back of the slate. An extra hole in the slate seems to have been added to the two original fixing holes on each dial to attach the brass plates.

Some crude attempts had been made to repair the cracks in the slate and to glue the central gnomon in position. The slate was cleaned and glued back together. The cracks and missing sections were repaired with an epoxy stone glue loaded with slate dust. The purple slate from which this and all Melville's other dials are made is probably from North Wales. Any missing detail on the dial was recarved or scribed. Most of the lettering on the dial had been carved with a chisel, but the circles, lines and some other lettering seem to have been scribed with a steel point or file. The

Fig. 7b. The Melville dial after its restoration.

	Melville Dial		M. J. Harley calculations using modern longitude			
Place on Dial	Modern Name	At time on dial	Dial should read	Longitude correction.	Time arc	Longitude
Q^n Ch^t Sou	Queen Charlotte Sound, Can.	3:45 AM	3:57 AM	8:02:20	8:32:00	128° 00’ W
Q^n Ch^t Isle	Queen Charlotte Isle, Canada	4:00 AM	3:41 AM	8:18:40	8:48:20	132° 05’ W
Nootka S^d	Nootka Sound, Canada	4:15 AM	4:17 AM	7:42:48	8:12:28	123° 07’ W
C.S.Francisco	San Francisco, U.S.A.	4:45 AM	4:20 AM	7:40:00	8:09:40	122° 25’ W
Deige	San Diego, U.S.A.	4:55 AM	4:41 AM	7:18:56	7:48:36	117° 09’ W
Californi	California, U.S.A.	5:10 AM	4:47 AM	7:12:28	7:42:08	115° 32’ W
Guatalara	Guadalajara, Mexico	5:30 AM	5:36 AM	6:23:40	6:53:20	103° 20’ W
Peru	Peru (Lima?)	5:45 AM	7:21 AM	4:38:32	5:08:12	77° 03’ W
Mexico	Mexico City, Mexico	6:00 AM	5:53 AM	6:06:56	6:36:36	99° 09’ W
Vera Cruz	Veracruz, Mexico	6:15 AM	6:05 AM	5:54:52	6:24:32	96° 08’ W
N. Orlean	New Orleans, U.S.A.	6:30 AM	6:29 AM	5:30:46	6:00:26	90° 05’ W
Nashville	Nashville, U.S.A.	6:40 AM	6:56 AM	5:03:32	5:33:12	83° 15’ W
Havanah	Havana, Cuba	7:00 AM	7:00 AM	4:59:48	5:29:28	82° 22’ W
Quito	Quito, Ecuador	7:10 AM	7:15 AM	4:44:20	5:14:00	78° 30’ W
Wash'ton	Washington D.C., U.S.A.	7:15 AM	7:21 AM	4:38:28	5:08:08	77° 02’ W
Philadelphia	Philadelphia, U.S.A.	7:30 AM	7:29 AM	4:30:44	5:00:24	75° 06’ W
Quebec	Quebec, Canada	7:40 AM	7:44 AM	4:15:16	4:44:56	71° 14’ W
Puerto Rico	Puerto Rico, Bolivia	8:05 AM	7:59 AM	4:00:52	4:30:32	67° 38’ W
Trinidad	Trinidad	8:25 AM	8:10 AM	3:49:28	4:19:08	64° 47’ W
Bueneos Aries	Bueneos Aries, Argentina	8:50 AM	8:35 AM	3:24:08	3:53:48	58° 27’ W
Cayenne	Cayenne, French Guiana	9:00 AM	9:00 AM	2:59:40	3:29:20	52° 20’ W
Surinam	Suriname, S. America	9:20 AM	8:42 AM	3:17:04	3:46:44	56° 41’ W
Rio Janerio	Rio de Janerio, Brazil	9:40 AM	9:36 AM	2:23:08	2:52:48	43° 12’ W
S. Salvador	Salvador, Brazil	10:00 AM	9:55 AM	2:04:20	2:34:00	38° 30’ W
Olinda	Olinda, Brazil	10:20 AM	10:10 AM	1:49:44	2:19:24	34° 51’ W
Azores	Azores, Portugal	10:40 AM	10:48 AM	1:11:40	1:41:20	25° 30’ W
C.de Verde	Cape Verde, S. America	11:00 AM	10:55 AM	1:04:24	1:34:04	23° 31’ W
Teneriff	Teneriffe, Spain	11:15 AM	11:23 AM	0:36:20	1:06:00	16° 30' W
Maderia	Madeira, Portugal	11:35 AM	11:22 AM	0:37:56	1:07:36	16° 54' W
Lisbon	Lisbon, Portugal	11:50 AM	11:53 AM	1:06:12	0:36:32	09° 08' W
Local noon at Dunmore		12:00 AM	12:00 AM	0:00:00	0:29:40	7° 25' W
Dublin	Dublin, Ireland	12:05 PM	12:04 PM	0:04:40	0:25:00	6° 15' W
Madrid	Madrid, Spain	12:15 PM	12:14 PM	0:44:24	0:14:44	03° 41' W
Edinburgh	Edinburgh, Scotland	12:25 PM	12:17 PM	0:17:00	0:12:40	03° 10' W
London	London, England	12:30 PM	12:29 PM	0:29:40	0:00:00	00° 00' E
Paris	Paris, France	12:40 PM	12:39 PM	0:39:00	0:09:20	2° 20' E
Amsterdam	Amsterdam, Holland	12:50 PM	12:49 PM	0:49:20	0:19:40	4° 55' E
Hamburgh	Hamburgh, Germany	1:10 PM	1:09 PM	1:09:40	0:40:00	10° 00' E
Rome	Rome, Italy	1:25 PM	1:19 PM	1:19:36	0:49:56	12° 29' E
Vienna	Vienna, Austria	1:40 PM	1:35 PM	1:35:08	1:05:28	16° 22' E
Stockholm	Stockholm, Denmark	1:50 PM	1:41 PM	1:41:52	1:12:12	18° 03' E
Riga	Riga, Latvia	2:05 PM	1:50 PM	1:50:04	1:20:24	20° 06' E
Con'nople	Istanbul, Turkey	2:25 PM	2:25 PM	2:25:32	1:55:52	28° 58' E
Petersburgh	St. Petersburgh, Russia	2:35 PM	2:29 PM	2:29:40	2:00:00	30° 15' E
Jerusalem	Jerusalem, Israel	3:00 PM	2:50 PM	2:50:36	2:20:56	35° 14' E
Moscow	Moscow, Russia	3:05 PM	3:00 PM	3:00:00	2:30:20	37° 35' E
Bagdad	Bagdad, Iraq	3:25 PM	3:27 PM	3:27:20	2:57:40	44° 25' E
Teheran	Teheran, Iraq	3:50 PM	3:55 PM	3:55:20	3:25:40	51° 26' E
Mauritus	Mauritius, S.Africa	4:15 PM	4:19 PM	4:19:52	3:50:12	57° 33' E
Herat	Herat, Afganistan	4:30 PM	4:38 PM	4:38:28	4:08:48	62° 12' E
Samarcan	Samarkand, Uzbekistan	4:50 PM	4:56 PM	4:56:52	4:27:12	66° 48' E
Cabul	Kabul, Afganistan	5:05 PM	5:06 PM	5:06:28	4:36:48	69° 12' E
Bombay	Mumbai, India	5:20 PM	5:21 PM	5:21:00	4:51:20	72° 50' E
Delhi	Delhi, India	5:30 PM	5:38 PM	5:38:12	5:08:32	77° 08' E
Madras	Madras, India	5:50 PM	5:50 PM	5:50:48	5:21:08	80° 17' E
Benares	Beneras, India	6:00 PM	6:01 PM	6:01:40	5:32:00	83° 00' E
Calcutta	Calcutta, India	6:20 PM	6:22 PM	6:22:40	5:53:00	88° 22' E
Aracan	Arakan, Burma	6:35 PM	6:45 PM	6:45:40	6:16:00	94° 00' E
Ava	Inwa, Burma	6:50 PM	6:57 PM	6:57:52	6:28:12	97° 03' E
Siam	Thailand, (Bangkok ?)	7:05 PM	7:11 PM	7:11:44	6:42:04	100° 31' E
Ceylon	Sri Lanka, (Colombo ?)	7:30 PM	5:49 PM	5:49:04	5:19:24	79° 51' E
Batavia	Jakarta, Indonesia	7:45 PM	7:36 PM	7:36:52	7:07:12	106° 48' E
Canton	Canton, China	8:00 PM	8:02 PM	8:02:44	7:33:04	113° 06' E
Pekin	Peking, China	8:15 PM	8:05 PM	8:05:20	7:35:40	116° 25' E
Nankin	Nanking, China	8:30 PM	8:24 PM	8:24:48	7:55:08	118° 47' E

Table 1. Place names on the Dunmore Melville dial. NOTE : Locating the names of distant places around the Chapter Ring to show that place's local noon had been a feature of some dials since the 18th century[7]. Instead of showing the place's local noon, Melville placed the 64 names so as to show the time difference between Dunmore and the distant place or, as he put it himself on another of his dials: "To find the time of the several places named in this circle: add the time past the meridian & subt the time wanting". Times on dial read visually by M.J.Harley to nearest 5 minutes.

only detail not legible was one of the 64 place names written in copperplate.

Once restored (Fig.7b) the whole sundial was mounted on a piece of reclaimed purple slate to strengthen it as the original slate had a variable thickness of only about ½". Copies of the existing subsidiary gnomons were made by John Davis[5] to replace the two missing ones, and these were patinated to match the existing ones. All the gnomons were reset, bolted right through the slate using the two original fixing holes for each. The third, apparently later, hole for each was filled. New vandal-proof fixing screws were made for the four original holes through which the sundial had been attached to the plinth.

By an amazing co-incidence Harriet James's mother has a photograph album which belonged to a cousin who used to stay with the McClintocks at Dunmore in the 1920s. The album reveals a photograph (Fig. 8) of what appears to be the Melville sundial on a pillar surrounded by children and with pet rabbits sitting on it! As the photographs in the album were taken in the 1920s this is probably the original pillar made for the Melville sundial before it was replaced by R.L. McClintock in 1934.

DUNMORE JULY 2004

To discover a Melville dial in its original setting was a find indeed and we can only conjecture about how this dial must have inspired the young Robert McClintock to become a sundial maker in later life. That his son and his childhood friends also played around this dial can be clearly seen in Fig. 8. It was also the silent witness to the triple tragedy that occurred on Saturday 24th September 1938[6].

William, Col. Robert's son, had followed the family tradition and joined the Royal Artillery. At the age of 24 Lieutenant McClintock, engaged to Miss Helen Mackworth of Sidmouth, Devon, fell from his horse at a point to point meeting and was paralysed from the neck down. Their June wedding was postponed and after several months in an English hospital, William was brought back to Dunmore in the care of two full time nurses. His fiancée accompanied him and a new date was set for the wedding, Monday 26th September. His mother vehemently opposed this and despite all her protestations the wedding was to proceed.

On the Saturday prior to the wedding day the Colonel retired to his study after lunch, William was wheeled out into the rose garden and Miss Mackworth went to her room. A short time later the Colonel heard two shots and on going into the garden found his son dead from a shotgun blast to the head, a short distance away his wife lay dead with a shotgun pointing towards her head. William's body was taken inside the house and his fiancée informed. While the Colonel and the two nurses were back in the garden attending to his wife's remains they heard another shot from inside the house and on returning found Miss Mackworth dead beside William with a revolver close by. Instead of the wedding three burials took place the following Monday. The Colonel died within two years from natural causes.

The restored Melville is now back at Dunmore (Fig. 9) and the grandchildren of the present owners, Sir John and Lady Maryette McFarland, play happily around it in the rose garden oblivious to the terrible events of 66 years ago.

Fig. 8. The Melville dial on its original pedestal, as photographed in the 1920s. Photo courtesy Mrs. D. Huxley.

Fig. 9. The restored Melville dial on its McClintock concrete pedestal, with its present owners Sir John and Lady McFarland.

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ACKNOWLEDGEMENTS

Dunmore has been the residence of Sir John and Lady McFarland since 1958 and the authors are indebted to them for allowing them unrestricted access to their estate and for their assistance in surveying these important and historic dials.

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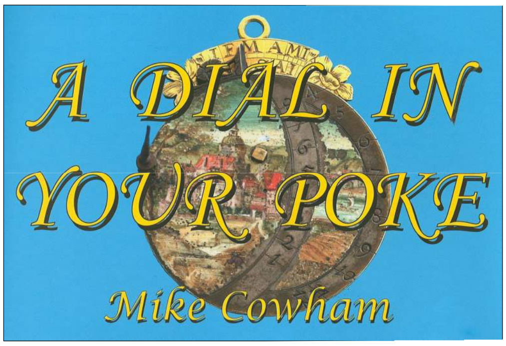
BOOK REVIEW

A Dial in your Poke: a book of portable sundials by Mike Cowham. Published by the author, 2004, xii + 212 pages, colour illustrations throughout. Price £29.50



In *A dial in your poke*, Mike Cowham has produced a wide-ranging and interesting general book on portable sundials, aimed at the interested public and at sundial collectors in particular. The book is divided into twenty-four chapters covering the numerous different types of portable dial, with five appendices addressing other pertinent subjects such as saints' days and magnetic declination.

In the first five chapters, Cowham covers the earliest history of portable dials and the various forms of altitude dial. From sticks in the ground and simple Egyptian and Roman time-keepers in chapter 1 ('The first portable dials'), we move to a chapter on 'Altitude dials' which discusses pillar dials, vertical disc dials, Regiomontanus dials, Capucine dials, little ships of Venice, scaphe dials and (very briefly) astrolabes. Chapter 3 is devoted to 'simple ring dials' and Chapter 4 to 'Equinoctial ring dials'. I had a couple of queries here. Although the latter do certainly work by measuring the sun's altitude, I am not convinced that they should simply be called altitude dials without further explanation, given their resemblance to equinoctial dials, a form of directional dial. Cowham also fails to note that the first universal equinoctial ring dials were manufactured by Elias Allen *before* Oughtred published his treatise on them, seeming to claim that it was the published description that came first. Chapter 5 moves on to another form of altitude dial – the quadrant – covering not only the Gunter quadrant but also the many other variations of this instrument, such as the horodictical quadrant, Islamic quadrants and the Sutton quadrant.

In chapter 6, Cowham turns his attention to the first of numerous forms of directional dial – the ivory diptych dials that were produced in Nuremberg from the sixteenth to the eighteenth centuries. Other diptych dials appear in the following chapter – 'French ivory dials' – with examples from both the Dieppe and the Parisian workshops. This leads neatly into a consideration of other French dials in chapter 8 and a major discussion of French 'Butterfield' dials in chapter 9, perhaps the best-known of all forms of portable dial. 'Butterfield' dials were, of course, not exclusively made in France and Cowham considers examples from England and Russia in chapter 10.

In chapter 11 his focus returns to 'English portable dials', with discussion of the important developments in the seventeenth, eighteenth and nineteenth centuries. After a general chapter on 'universal equinoctial dials', our attention is turned to another important German sundial-producing city – Augsburg – and the many forms of Augsburg dials, crescent dials and Augsburg string-gnomon dials.

Chapters 14 to 17 are each devoted to a single type of dial –

inclining dials, analemmatic dials, magnetic compass dials and string gnomon dials. These are followed by 'Towards precision', a chapter looking at the ways in which dial makers attempted to make it possible to read portable dials to single minutes, by the use of transversal scales or mechanical minute dials, for instance. Chapter 19 bundles together a number of miscellaneous dials, such as cannon dials and polyhedral dials. I wondered whether the dials of China and Japan might have been given slightly more prominence here, given that they do turn up relatively often in collections and sales. It would also have been a sensible place to make mention of the astronomical compendia that frequently included portable dials.

The last few chapters address different issues. Chapter 20 introduces nocturnals, dials for telling the time from the motion of the stars rather than the sun. Chapter 21 deals with perpetual calendars, which are so common on portable sundials that the explanation of their use and the common types is an eminently useful addition. The next chapter, 'Caring for a collection', struck me as being one of the most useful in the book, giving very helpful advice on cleaning and protecting dials, and providing important warnings against the all too common use of abrasive cleaners and varnishes. 'Reproduction & modern dials' brings up the issues surrounding forgeries and modern copies and how to distinguish them from the real thing. Lastly, in 'A final glance', Cowham takes the opportunity to highlight a few items of particular interest that did not find a place in other parts of the work. He clearly has an eye for curious and attractive details.

There are five appendices. The first covers the different styles of numerals, letters and sigils on portable dials, including Arabic and Far Eastern numbering. The second lists the saints' days commonly found on perpetual calendars, with identifications of the majority of the abbreviations. The bibliography constitutes appendix 3. Appendix 4 provides a chart of magnetic declination, useful for helping to date dials with compasses where the contemporary declination is marked in the compass bowl. Finally, appendix 5 gives details of the most important portable dial collections held in museums, with footnotes to the relevant museum catalogues. (I was surprised and disappointed to find that my recent catalogue of the important collection at the National Maritime Museum was omitted here, even though it is listed in the bibliography.)

Although there were one or two occasions when I missed an illustration that would have been helpful (there is, for instance, no image of the Augsburg crescent dials), the book is otherwise extremely well illustrated throughout, with many fine colour photographs and some beautiful close-up shots.

Cowham is on firmest ground when describing the types of dial and the ways in which they work, even if some of his explanations might be too brief for someone not acquainted with the basic principles of dialling. I was particularly impressed with Cowham's evident familiarity with examples of many of the dials: he writes with authority as someone who knows the problems and possibilities involved in using them regularly.

He does, unfortunately, make rather too many slips when he moves into the areas of social and cultural history. To take a couple of examples: he wrongly states that guild control of sundial production was strong in England and weak in France (it was quite the other way about), and that the craftsmen of London only formed guilds in the seventeenth century, when, in fact, all the major companies came into existence during the fourteenth and fifteenth centuries, and instrument makers appear in guilds such as the goldsmiths and the grocers from the mid-sixteenth century. In another instance, he lists the old style year as beginning on 1 March, when the date should be 25 March, Lady Day. Also, while the appendix of saints' days was very useful for providing the listings from the original perpetual calendars, I was surprised by the number of items that Cowham is unable to identify, when access to a standard dictionary of saints would easily provide the necessary information. For instance, Gregory on 12 March is easily identified as Gregory the Great, and 'Carolu' on a German dial on 28 January as Charlemagne.

My other major concern with the book was the level of proof-reading. There are far too many grammatical errors, poor hyphenations and incorrect uses of punctuation, particularly commas and apostrophes. These do tend to bring the reader up short and disturb the concentration. Unfortunately, they are all too common in self-published books, which lack the checks and balances provided by professional copy-editing and proofreading.

All that having been said, this is an entertaining introduction to the world of portable sundials, which will aid the collector and the general reader alike, and the fine-quality pictures are a beautiful substitute when it isn't possible to have 'a dial in your poke'.

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CHURCH TOWER HORIZONTAL SUNDIALS

JOHN FOAD

A couple of months ago, a helpful tip-off from Tony Wood led me to the church of St. Michael and St. George at Benenden in Kent. There I found an excellent ten inch horizontal bronze sunial, with Equation of Time, made by W & S Jones of Holborn. The inscription reads:

This Dial was given by
THO^{S} LAW HODGES Esq
Anno Domini 1819 for the Regulation
of the clock in the Parish Church of
BENENDEN Lat 51° 3' 54"

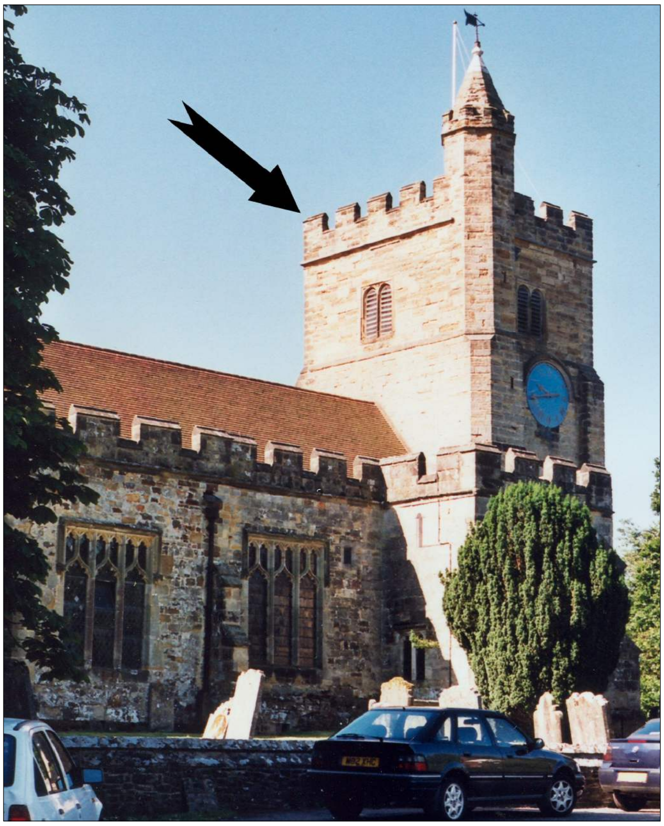

Fig. 1. The church of St. Michael and St. George at Benenden, Kent. The position of the dial is arrowed.

Looking into the history of the dial I found that Hodges was the Patron of the parish, and lived at Henstead, the estate now occupied by Benenden Girls' School. In 1819 he presented to the parish a clock for the church tower, made by Thwaites and Reed, and this dial for its regulation. Unlike many horizontal church dials, this one has escaped the notice of thieves, and indeed of myself on a previous visit, and for one very good reason. It was installed, not in the churchyard, but at the top of the tower, inside the battlements. In this position, it is only a few precarious steps down the stone spiral stairway to the clock room, a very convenient location for the Keeper of the Clock, and also a very secure location, as the tower is always kept safely locked, and the dial is in any case out of the sight of visitors.

Fig. 2. The dial in the corner of the tower.

Fig. 3. The dial by W&S Jones of Holborn.

I wonder how many other churches have a dial tucked away like this. One at Southwell Minster was described in Bulletin 12(i) of February 2000. It is just outside the window of the clock chamber, 70 feet above ground level. I hoped that the Day Books of Thwaites and Reed, which are preserved at the Guildhall Library in London, might show that they supplied a dial with the clock, and thus that their records might lead to other finds, but this was not the case. I would be very interested to hear of any other dials similarly located. Perhaps it is worth checking on any church with a clock but no known dial.

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IN SPITE OF THE WEATHER – NEWBURY 2004

JANE WALKER

The assembled BSS members after the rain had stopped. Photo: Peter Ransom

Forty-one B.S.S. members attended the one-day meeting at Mary Hare School, Newbury on Saturday 25th September 2004. This was the 4th 'Newbury' in this venue and David Pawley and Peter Ransom had once again worked very hard to provide an interesting day with a wide variety of dialling topics in pleasant surroundings.

This year the Highways and Byways Department had joined in by setting up a maze of cones and diversions through which we had to find our way. It was a relief to be led out of the labyrinth by David's yellow B.S.S. stickers pointing the way to Mary Hare School.

The Lords of the Weather had mistaken the date and allowed a steady downpour over Berkshire on Newbury day! Inside, however, the atmosphere was sunny and warm. The day followed the well-established and successful format of earlier years, short talks and slide shows or power point demonstrations, coffee and a packed lunch with friends and expositions on members' static displays. Which is not to say that the day was in any way 'run of the mill'. Talks, presentations and exhibitions were both challenging and fascinating.

After registration and the meeting and greeting of friends over an early cup of coffee, the day started with a welcome by Peter Ransom leading into a light hearted presentation by Martin Jenkins who had attended the Tenth Annual Conference of N.A.S.S. at Tenafly, New Jersey, U.S.A. Some of the shots – sundials in the rain for example – were familiar to regular attendees at B.S.S. conferences.

Mike Shaw then gave a presentation on using the Universal Diallist's Companion, based on a diagram in *The Art of Sundial Construction* by Drinkwater, which facilitates the laying out of any dial without the use of equations.

Peter Ransom's presentation came as a result of his holiday in Prague where he had found and photographed dials on walls all over the city. Perhaps a B.S.S. trip to Prague is indicated to check out these attractive murals.

John Davis gave us a preview of an educational CD presentation devised by Larry McDavid of NASS to which several members of B.S.S. and N.A.S.S. have contributed. The C D covers a great deal of material on dialling with lots of photographs of different types of dial and will be a valuable resource to all those who give talks on sundials. Anyone interested in obtaining a copy should contact John Davis.

Whatever your 'angle' on sundials there'll be something for you at Newbury. The exhibition was, as usual, a feast of fascinating displays and we divided into groups to be treated to short explanatory talks by exhibitors.

Mike Cowham introduced us to *A Dial In Your Poke,* a hardback book full of colour photographs together with the history and descriptions of portable sundials and related topics, which he has written and published. A delightful book which will surely be on any dialler's 'wish list' this Christmas. Available from Mike Cowham (address on the back cover of the Bulletin) at a special price, for members, of £25 + p&p. Mike also demonstrated a set of templates

Photo: Mike Cowham

The back of David Brown's noon mark.

which can be used for laying out dials. These are described in this edition of the Bulletin. Additionally, Mike had information about the B.S.S. 2004 Photographic Competition for which the closing date is 31st January 2005.

Sue Manston brought a display of very colourful dials painted on glass. A technique which, she assured us, is easy as well as being effective. Also some Shepherds' dials which she had made using Pringle packets etc. as cylinders.

John Davis, as Flowton Dials, showed his large and incredibly detailed double horizontal dials.

Bill May, a welcome newcomer to Newbury, uses the techniques and expertise of a precision engineer in his retirement hobby of dialling. He showed an equatorial dial which used two car flywheel starter rings and had a mechanism to adjust for the equation of time.

David Brown had a working model and photographs of The Aularian Noon Dial which he has recently installed on the William R. Miller Building in Oxford. He also showed his work on the restoration of a stained glass dial and a scaphe dial which he has made. David's talk included a discussion of Bailey points which can be used to show the position of sunrise and sunset on an analemmatic dial.

Heiner Theisen brought the dial together with documents and drawings which were the source of his article on the Vial Dial in September's Bulletin.

Tony Wood had a paper on Mass Dials in Museums and photographing scratch dials.

Mike Shaw had a customised astrolabe from *Janus*, an American company and a 'moon stick' which was designed to give the state of the moon at any date from pre-history into the future. Mike also had a chalice dial made from a stainless steel salad bowl.

Peter Ransom had been shopping on e-bay and showed a horizontal dial by Thomas Jones for lat 52° 45' as well as a set of attractive, silver teaspoons with sundial motifs. He distributed photo-copies of *Hobbies* magazine (May 1931) and of *Woodworker* (Feb 1950) both of which carried articles on making sundials.

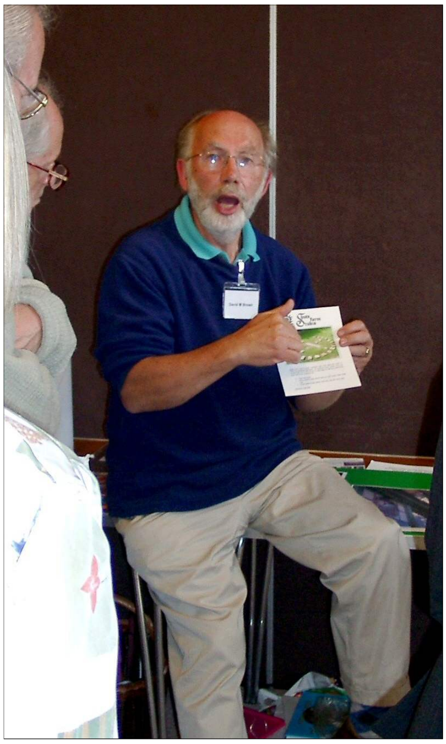
Photo: Mike Cowham

David Brown explaining the 'Bailey points' on an analemmatic dial.

John Foad brought an Ecliptic Date Dial, the subject of a future article in the Bulletin.

David Pawley announced himself as the sole member of the British Hearing Aid Collectors Society. David has worn a hearing aid for most of his life and has amassed a collection of aids ranging from the speaking tube used for communication between two people in a noisy room to today's digital instruments.

Patrick Powers had furnished an exhibition showing the progress of the new Fixed Dial Register.

The day ended with a vote of thanks to the organisers and their helpers by Tony Wood, a cup of tea and a final chat and then back through the labyrinth and home; perhaps to start on a new dialling project sparked off by something we had seen or heard.

The next 'Newbury' will be on 24th September 2005 – when the sun is expected to shine all day.

GUIDELINES FOR CONTRIBUTORS

1. The editor welcomes contributions to the Bulletin on the subject of sundials and gnomonics; and by extension, of sun calendars, sun compasses and sun cannons. Contributions may be articles, photographs, drawings, designs, poems, stories, comments, notes, reports, reviews. Material which has already been published elsewhere in the English language, or which has been submitted for publication, will not normally be accepted. Articles may vary in length, but text should not exceed 4500 words, about three-and-a-half pages in the Bulletin.

2. Format: The preferred format for text is typescript, single-spaced or double-spaced, A4 paper, or on disc, 'Microsoft Word' or ASCII, with one printout. Authors are asked <u>not</u> to submit any material by e-mail or e-mail attachments.

3. Figures: For photographs, black-and-white prints as large as possible. Colour prints are also acceptable if they show sufficient contrast. Slides and transparencies are also acceptable. Please do NOT send photographs or drawings as e-mails or e-mail-attachments. Drawings and diagrams should be in clear black lines on white paper. Each figure illustrating an article should carry on the back the author's name, and a number indicating its relative position in the text (Fig.1, Fig.2 etc…). Captions for the Figures should be written on a separate sheet in numerical order. They should be sufficiently informative to allow the reader to understand the figure without reference to the text.

4. Notes are best avoided: it should be possible in a short article to incorporate into the text all the background information which the reader needs, to understand the article. If notes are used, they may be referred to, in the text, as (Note 1), (Note 2) in brackets; then listed at the end of the article, after the 'Acknowledgements' and before the 'References'.

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

6. References: Sources are referred to in a text by a superscript number. They are listed in numerical order under the heading 'References' at the end of the article. If the same source is cited several times in the article, use a superscript number and complete reference on the *first* occasion only. On subsequent occasions, simply insert the author's name in brackets in the text of your article, adding *(if necessary)* the date or page or figure number. Avoid further superscript numbers, and do not write *loc.cit.* or *ibid.* in the reference list.

   The Bulletin's convention is as follows:
   For books: Author's name; Title of book, in italics; Name of publisher, Place and date of publication.
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   Examples:
   A.E. Waugh: *Sundials, their theory and construction.* Dover, New York, 1973.
   D. Colchester: 'A Polarized Light Sundial', *Bull. BSS.* 96.2, 13-15 (1996)
   A.A. Mills: 'Seasonal Hour Sundials', *Antiquarian Horol.* 19, 142-170 (1990)
   W.S. Maddux: 'The Meridian on the Shortest Day', *Compendium, Journ. NASS.* <u>4</u>, 23-27 (1997).

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

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

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