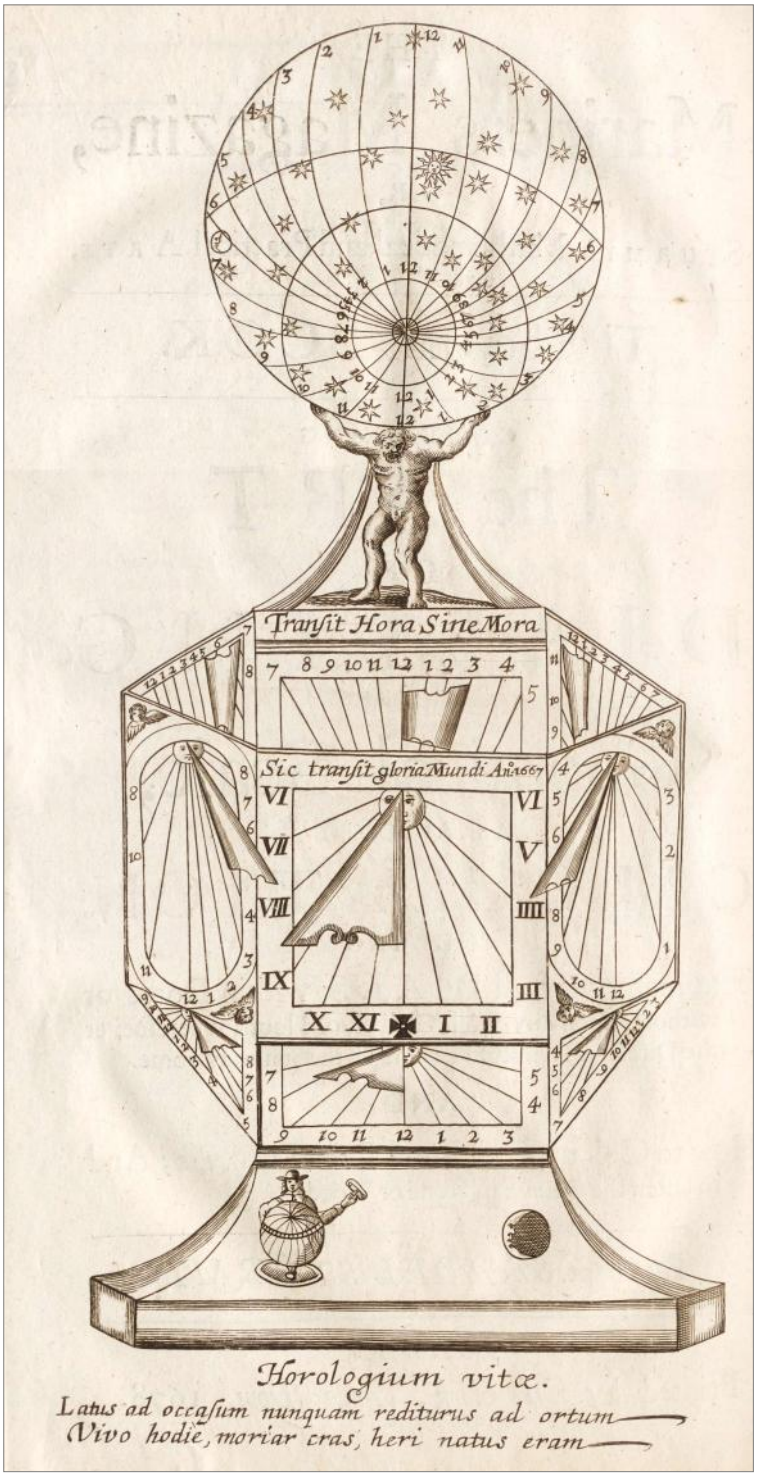
The British Sundial Society

BULLETIN

VOLUME 30(iv)
December 2018



The attractive multiple dial shown here is a full-page illustration taken from a book of 1679 entitled

The Mariners Magazine
or
Sturmys Mathematicall
and
Practicall Arts

At its top is a spherical dial supported by the figure of a man. Beneath is a polyhedral dial with its due south face at the front.

On its base is an interesting figure of a man behind a sphere and he is supporting something with his left arm.

The book itself was mostly written by Captain Samuel Sturmy. It is basically a book of navigation but it includes sketches and descriptions of many interesting instruments, including a chapter about sundials and their construction.

The whole work is over 400 pages long but 'The Seventh Book' is entitled 'The Art of Dialling by the Gnomonical Scale as also by Calculation.' This section covers just 42 pages and is dated 1678. The book also includes tables of logarithms, sines and tangents.

Mike Cowham

Details of this, and many more old books, can be found on the BSS website at http://sundialsoc.org.uk/publications/old sundial books/

***Front cover**: Slate double horizontal sundial by David Brown, who describes its construction on pages 14–17.*

***Back cover**: Two new vertical dials by Ben Jones, who discusses their design, implementation and method of attachment to their respective walls on pages 11–13.*

Editorial team: John Davis, Frank King,
Christine Northeast and David Brown

Printed by The Lavenham Press Ltd, Lavenham
01787 247436

BULLETIN
OF THE BRITISH SUNDIAL SOCIETY

ISSN 0958-4315

VOLUME 30(iv) - December 2018

CONTENTS

EDITORIAL

We are pleased to offer this bumper Christmas issue of the *Bulletin* and are most grateful to all the authors who have written articles for us. Please keep up this good work! Perhaps appropriately for this time of year, the first article is a heart-warming tale of a sundial which disappeared many years ago but has now safely returned home.

Once again we have an article by a new author, Graham Parks, who has designed an outdoor reflection sundial which he spoke about at the Newbury Meeting. Summaries of this and other Newbury talks are included in this issue.

It is good to see Ian Butson back in print after a spell away. Characteristically, he tells us about his findings in a local cemetery. These include a cross dial and a modern mass dial. Ian's account also describes an interesting solar instrument designed as an aid for navigators.

Two of our best-known makers of stone sundials, Ben Jones and David Brown, describe some of their wares which are, as ever, a feast for the eye.

The Editorial Team would like to thank all those who help in the preparation of the *Bulletin*. In addition to the authors we especially thank Fiona Vincent for final proof-reading and Bill Visick for producing the cover and for liaising with the printers.

A very Happy Christmas to you all.

Frank King

A LONG ABSENCE
The Return of St Michael-on-Wyre's Churchyard Dial

JOHN DAVIS

Recovering stolen sundials is one of the services by which the BSS justifies its charitable status. Sometimes a stolen dial can be returned to its rightful owner within a few weeks of the theft but, in the case of the dial reported here, it was lost well before the Society was even founded.

The dial shown in Fig. 1 was advertised (as a wall-mounted Georgian sundial!) on eBay in May 2018. It immediately looked suspicious to me as it was engraved with the name of a vicar and churchwardens for 1796 and also still had the remnants of the fixings that would have held it to a pedestal. Of course, churches do sometimes become redundant and their artefacts sold off but all too often dials are stolen from churchyards. In this case, it did not take much online research to identify the church as St Michael's in St Michael-on-Wyre, Lancashire: the fact that the latitude engraved on the dial in the auction listing was 53° 49′ which is very close to the actual latitude of St Michael of 53° 52.7′ confirmed this was correct.

Fig. 1. General view of the original St Michael-on-Wyre sundial.

Fig. 2. The dial plate from above.

I quickly made contact with the current churchwardens and, although a younger one did not know whether the church even had a sundial, his long-serving colleague immediately knew that a dial had been stolen between 30 and 40 years ago. Attempts to locate it in the area at the time had failed and so a replica had been made to fill the empty pedestal. The current vicar, the Rev. Andrew Wilkinson, had been in post for 'only' 19 years but was aware of the loss and the importance of the dial so he authorised attempts to recover it. These were duly successful and the dial is now back in St Michael-on-Wyre, where it will be kept secure in the future.

It later transpired that the dial had been discovered abandoned in the undergrowth of a house which had recently been bought by a relative of the seller and was being cleared. The house had previously been owned by an elderly lady so it is possible that the dial had been discarded by the original thief. As found, it was heavily patinated and the engravings were illegible so the finder had "cleaned it up" to give the current appearance.

The Original Dial

The dial plate, shown in Fig. 2, is a nominal 13¼″ square (actually 335 × 337 mm) and has a thickness varying between 3.87 mm (centre) and 4.70 mm (edge). The whole dial weighs a substantial 5.13 kg and it is significantly larger than the majority of churchyard dials. The basic dial is very well delineated, showing the hours between III:30 and VIII:30 with Roman numerals drawn to be read from the inside, an arrangement which in 1796 was outdated for London makers but still common in provincial centres. This hour span would have covered the maximum period of sunlight at the design latitude with about 3 minutes' margin. The inside chapter ring is divided to quarter hours but, most unusually, the outside one has a set of transversals, allowing the time to be read with ease to 1-minute intervals. They are labelled 10, 20, 30, 40, 50, 60. This feature lifts the whole dial well above the average standard for a churchyard dial and shows the influence of the very best London mathematical instrument makers much earlier in the century. It is not the only late use of the feature by a provincial maker, with Henry Sefton of Liverpool also making use of transversals, so it is just possible there was some form of a connection.[1] The major engraving is to the south of the gnomon (Fig. 3) and reads:

Lat 53° 49′
The Rev^{d} Hugh Hornby MA
VICAR

James Bains
James Lewtas
Rich^{d} Hornby } CHURCH-WARDENS
John Croft
John Miller

1796

Not all of this is easy to read now but a full and accurate transcription was published in an article about the church in 1914.[2] The article also helpfully gives the names of the designer and maker of the dial, engraved just outside the SW and SE segments of the chapter ring but now very difficult to read:

John Baines, del't [delineavit]
and
Ja's Dawson, sculpt [sculpsit]

Fig. 3. The signature panel at the south edge.

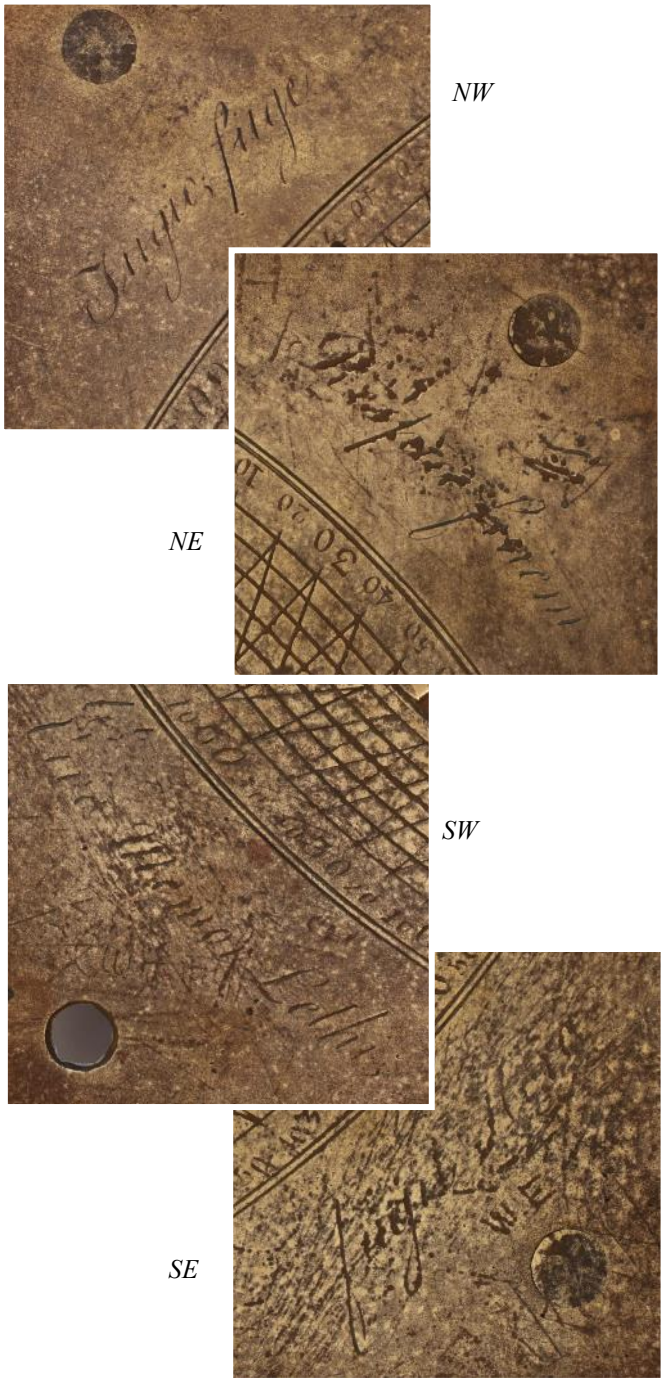


Fig. 4. The mottoes in the corners.

Note here the similarity of the designer's name and the first of the churchwardens – a family link seems likely despite the slight spelling difference. Although the dial is obviously very well-made by a professional engraver, James Dawson has not been traced in any of the usual sources.

The dial has mottoes in each of the spandrels, shown in Fig. 4, reading:

NW: *Fugio fuge*
NE: *Respice finem*
SW: *Vive Memor Lethi*
SE: *Fugit Hora*

These are not particularly common but they can be found, in variant forms, in Mrs Gatty. In particular, she lists the

Fig. 5. Gnomon profile.

combination '*Vive Memor Lethi, Fugit Hora*' (Live mindful of death, the hour flies) for Makerston House, Kelso. *Fugio Fuge* (I fly – fly) appears in Charles Leadbetter's 'Mechanick Dialling'[3] as well as in Gatty.[4] In addition, *Respice finem* (have regard for the end) is a not uncommon *memento mori* and is part of a motto reading *In Omnibus Rebus Respice Finem* (in all things look to the end).

There is another motto engraved around the central circle reading "*Our days upon Earth are a Shadow. Job*". This is a Bible quotation (Job 8:9) as might be expected for a dial in this location.

The description of the parish of St Michael-on-Wyre in the Victoria County History of Lancaster also gives the basic details of the original churchyard sundial though these would be insufficient to allow the design of the replica.[5]

The gnomon (Fig. 5) is a substantial casting with a blade thickness varying between 8.30 mm (base) and 7.97 mm (tip). Its angle to the dial plate alongside it was measured as 53.85°, a very good match to the actual latitude of 53.87°, just 2 arc-minutes different from the engraved latitude. It features an integral foot (supporter) which extends around three sides of the base of the gnomon, being cut back at the south so that it does not obstruct the shadows when the sun is very low in the sky – a thoughtful touch. It is attached to the dial plate by the usual pair of tenons (see Fig. 6) but, rather unusually, these have been split by lengthwise and angled chisel cuts to spread them tightly into the mortise slots. In addition, there is an iron fixture into the centre of the gnomon. These methods have certainly worked as the gnomon is still extremely firm despite the rough treatment that the dial has received. Fig. 6 also shows that a pair of small blow-holes in the casting of the dial plate have been repaired by hammering in small pieces of brass – on the front surface, these are almost invisible.

Three of the four original corner fixings holding the dial to the pedestal are still present, though the fourth was evidently pulled through the plate, bending it slightly in the process, when the dial was ripped from the pedestal. As can be seen in Fig. 4, the fixings were designed to be flush with the plate surface and almost hidden. They were – and still are – screwed to blocks of metal which were cemented into holes in the pedestal capital. If these had had a reverse taper or grooved sides, they would have resisted removal rather better but then the determined thief would just have done more damage to the dial plate.

Metallurgy

The composition of the copper-alloys used were analysed by X-ray fluorescence in the usual manner[6] and the results are shown in Table 1. They show that the dial plate is a fairly typical lightly-leaded brass of medium zinc concentration, probably made with the standard cementation technique rather than Champion's improved method. The gnomon, complete with its foot, is a casting and heavily leaded with a significant amount of variability due to the slow rate of cooling from the melt. The pedestal fixings, although they seem to match the dial plate well for

Fig. 6. Back of dial with, inset right, the gnomon tenons and left, the filled blow-holes (circled in the main picture). Note the rectangular cement-covered blocks in the corners.

Area	Cu	Zn	Sn	Pb	Ag	Ni	Fe	As	Sb	Bi	Comments/Others
Dial plate (back)	77.6	18.9	0.57	1.52	0.07	0.05	0.53	0.62	0.07	0.02	cleaned spot
Dial plate (back)	81.7	15.2	0.55	0.84	0.06	0.04	0.76	0.76	0.06	0.06	adjacent uncleaned
Dial plate (front)	81.6	13.0	0.84	2.93	0.11	0.03	0.45	0.81	0.10	0.06	partially cleaned
Gnomon (east)	71.7	14.7	2.08	8.87	0.15	0.03	1.81	0.81	0.15	0.06	uncleaned
Gnomon (west)	76.0	12.6	1.70	6.10	0.12	0.02	2.15	0.97	0.12	0.07	uncleaned
Gnomon foot (average)	66.0	15.6	2.40	9.7	0.14	0.04	2.54	0.80	0.14	0.04	uncleaned
Pedestal fixing	83.5	9.2	0.03	6.20	0.07	nd	0.09	0.71	0.07	0.08	partially cleaned

Table 1. Composition of the 1796 St Michael-on-Wyre dial in wt% as measured by X-ray fluorescence (XRF). nd = not detected. (Details as per ref. 6.)

colour, are actually a rather different low-zinc leaded brass. With its very low tin (Sn) and iron (Fe) concentrations it may well be a later addition from a rather more modern source.

The Hornby Connection

The Rev. Hugh Hornby (1765–1847), named as vicar on the dial plate, was not the first or the last Hornby to hold that post. He was presented to the living by his eldest brother, Joseph Hornby of Ribby Hall, after graduating from Christ's College, Cambridge in 1787. After 57 years of service he handed the post to his son the Rev. William Hornby (1810–99) who served until 1885 when he resigned the living in favour of his second surviving son, the Rev. Phipps John Hornby (1853–1936), Archdeacon of Lancaster. In 1919 the living passed to his son the Rev. Hugh Leycester Hornby (who had been awarded the Military Cross in 1916).[7] In total, the Hornby dynasty were vicars at St Michael-on-Wyre (which appears in the Domesday Book) for 140 years.

The family continues to live in the village and Richard Phipps Hornby (1922–2007), the eldest son of the Rev. Hugh Leycester Hornby, actually presented the current vicar to the living; he was Private Parliamentary Secretary to Duncan Sandys (1959–63) and later Under-Secretary of State for the Commonwealth Relations Office before becoming Chairman of the Halifax Building Society (1983–90).[8] Current members of the family still hold the patronage of the church and are prominent in the village with another Hugh Hornby being the Squire so it is not surprising that the sundial is held in such high regard by the villagers.[9]

The Replica Dial

When the original sundial was stolen and not immediately recovered, the parishioners commissioned a replica dial to be made and placed on the pedestal. It was this dial which was first recorded for the BSS Register of Fixed Dials as SRN 1630 in 1992, with later details and photographs

Fig. 7. The replica dial. Photo: John Lester.

Fig. 8. The original pedestal with the replica dial (2007). Photo: John Lester.

provided by John Lester and the sadly-missed Margaret Ribchester. It is shown in Figs 7 & 8, now looking quite at home in the surroundings. It is clear that a detailed description of the dial engravings, perhaps that given in ref. 2, was available for the construction of the replica as all these details are included, though not in exactly the same positions. It is a very well-engineered dial which seems to

have been made by someone who knew what they were doing but it lacks the important transversals and gnomon foot which make the original rather special. The fact that the names of the maker and designer of the original dial are included on the replica was somewhat of a confusion to the modern reporters as the name of the maker of the replica seems to have been lost.

Conclusions

It is always good to recover a stolen dial and return it to its rightful home. This was especially true in this case where the dial had been missing for so long and might easily have been melted down as scrap. Such a fate would have been very sad as it is an exceptional dial of its type.

ACKNOWLEDGEMENTS

It is a pleasure to acknowledge the help provided by the Rev. Andrew Wilkinson and churchwardens Michael Fleet and Tony Ball of St Michael's church for their help, and paul*1963 for placing the dial on eBay. John Foad and John Lester kindly provided details of the replica dial.

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Postcard Potpourri 45 — Port Sunlight

Peter Ransom

Two sundials this time!

The cross dial (SRN 2419) at 11 Bath Street, Port Sunlight, is probably the better-known dial, owing to Mike Shaw's involvement in getting the broken cross replaced by a wooden one in recent years. The postcard of this dial seems to be available from time to time. I have four copies of it, of which only one has been through the post; it is dated March 10, 1907. Printed and published by Lever Brothers Limited, it forms part of the 'Pictorial Post Cards of Port Sunlight' series, all of which have a green border.

Port Sunlight, on the Wirral peninsula, is a model village built by Lever Brothers to accommodate workers in its soap factory and dates from 1888. It consists of 800 different houses built for a population of 3500 people. The backs of none of the houses are visible.

The other postcard is of the dial on the Dell Bridge (SRN 2420). The bridge, built of sandstone in 1894, has a parabolic arch that spans a former tidal inlet. The dial declines to the west, the earliest morning hour line being 9 am, and the 8 pm hour line is nearly horizontal. Currently it lacks its gnomon and pictures of the dial can be found on the Internet.

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AN IRREDEEMABLE TOY?

GRAHAM STAPLETON

A search online of sundials to buy will quickly return a vast quantity of brass objects which purport to be some kind of dial, but are clearly of recent manufacture and designed by someone with no inclination or ability to produce a working instrument. One might hope that in buying something that is actually antique – more than 100 years old – this kind of imposture can be avoided; sadly this is not always so.

In this context, 'toy' does not refer to a plaything for children, but to inexpensive small decorative personal accessories that were produced in volume, particularly in Birmingham.[1] The term arose in the eighteenth century, originally for metal goods, but swiftly expanded to cover items incorporating other materials.

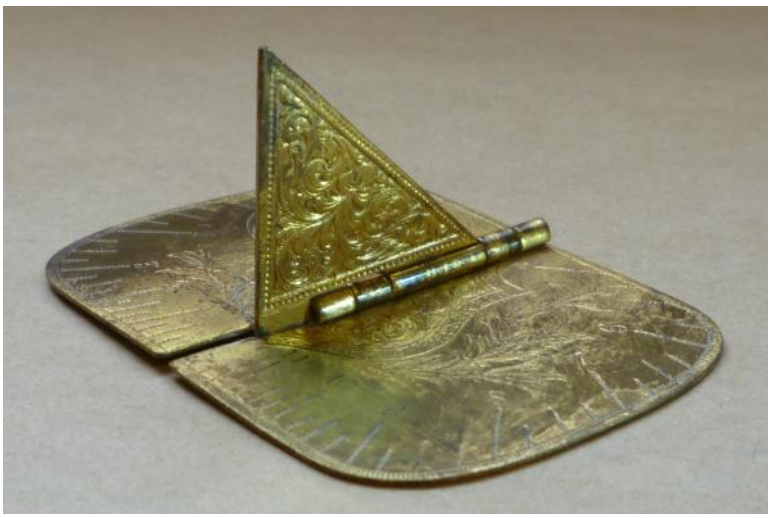

Fig. 1. The appearance of the dial when unfolded.

This folding horizontal dial, just 2½ inches across, is to be found not only in the possession of amateurs, but also in significant collections such as the British Museum[2] and the Whipple Museum of the History of Science, Cambridge. Made of brass, the gnomon and two halves of the dial plate are held together by a single hinge (Fig. 1). This example has lost the magnetic compass used (optimistically) to orientate the dial.

Tracing the origin of these dials has proved beyond me. Around the edge of the shield shape divided by the hinge is the wording 'Birmingham Patent 1875'. On the underside of the leaf without the compass aperture – but not on all examples – is crudely stamped 'J. Baum & Co Birmingham'. Searches of some business directories did not find the company, and the absence of a patent number, or even a registered design mark, suggests to me an insubstantial business operation.

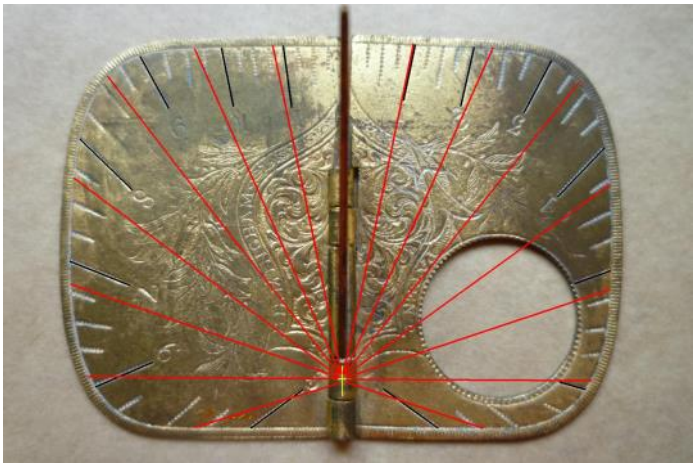

Fig. 2. The engraved hour lines, compared with ones calculated for latitude 52°.

The nature of Birmingham's industry was very much of separated trade specialisms and batches of piecework, so it is plausible that the stamping-out, etching, engraving and assembly could all have been done by different workshops.[3] The magnetic compasses were probably bought in – seemingly from wherever was cheapest – since among the examples of this dial to be seen on the Internet are some with an O rather than an E for East, suggesting a German manufacture.

Simply by eye, it is quite clear that the gnomon angle is 45°, and measurement confirmed it to be so. However, I wondered if there might be some redemption through the delineation being correct. There were two difficulties in establishing this: firstly, the engraved hour lines do not converge at one point and secondly, the centre of the dial lies inaccessibly in the centre of the hinge. Taking a photograph, I drew in the maker's hour lines (in black) and approximated the centre (with a yellow cross) (Fig. 2). Then with a set of hour-line angles calculated for latitude 52° (approximately the latitude of Birmingham) and a protractor, I set out (in red) the correct positions for the hours and was disappointed, but not surprised to see how woefully different they were.

So an antique, an interesting object – yes, but one of scant merit. One thing I did notice about the examples seen on the Internet was that, like this one, the majority did not have a compass. Whether they fell out owing to shoddy

manufacture, or whether people salvaged them from an otherwise useless article, I cannot say. But with certainty I can declare it an irredeemable toy, though sadly one that with almost no extra material or effort could have been good and useful.

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TWO UNUSUAL SUNDIALS AT TOLLESBURY

IAN BUTSON

The article by Frank King "Introducing a New Mass Dial" in the March 2018 edition of the *Bulletin* described a mass dial which had recently been cut on the 'west face' of a memorial gravestone.[1]

This mass dial was additionally inscribed SUNRISE and SUNSET adjacent to the horizontal lines, and NOON below the central vertical line of the dial. Below the dial, sentimental thoughts were also inscribed.

Figs 1a and 1b. Two views of the grave of Martin Roy Moss Dunn, with its cross sundial.

Fig. 2. Close-up view of cross sundial.

Although this dial was not provided with a gnomon, the author explained that one could hold up a knitting-needle with one end at the dial centre and note its shadow. If the knitting-needle were horizontal and aligned north–south its shadow would correctly indicate noon and sunset but would be of limited use at other times.

This depiction of a sundial reminded me of another gravestone with a symbolic vertical sundial on its west face, in the village cemetery at Tollesbury in Essex.

Tollesbury is a small coastal village situated on the north side of the mouth of the River Blackwater, between Colchester and Maldon. Largely a farming area, it is also famous for its oyster fisheries. With these local sea fishing activities, a thriving sailing community has also developed over the years.

In the village cemetery at Tollesbury two unusual sundials are to be found.

Close to the eastern boundary of the cemetery a polar cross sundial has been placed on the grave in memory of a local

Fig. 3. Memorial plate.

Fig. 4. Memorial cross, showing the morning hours, 3 am to 9 am.

Fig. 5. View of the two graves.

Fig. 6. Memorial to Gerald and Maureen Dunn.

man, Martin Roy Moss Dunn, who died in March 1974 at the young age of 26, as a result of a motoring accident (Figs 1a, 1b and 2).

The memorial plate (Fig. 3), fitted to the stone supporting the cross, also carries the inscription,

"Remembered every hour through the eternal shadow-play enacted on this Sun Dial by the passage of APPARENT TIME"

The white marble sundial is inscribed with Roman numerals on its vertical side faces, recording the hours from 3 am to 9 pm, in 10-minute intervals (Fig. 4).

Although this cruciform type of equatorial sundial is well documented, it is rarely to be found. To date only 22 examples are recorded within the records of the British Sundial Society, and it would appear that this particular sundial is the most recent example to have been installed.

Next to the grave of Martin Dunn is that of his parents, Gerald (1917–2002) and Maureen Dunn (1920–2005) (Fig. 5).

On their memorial stone (Fig. 6) Gerald is described as a Polymath. Indeed he was, having had many varied interests, which included sailing, navigation and sundials. He had constructed a number of different types of sundials, even making some to commission.

In the early 1970s Gerald had devised a simple low-cost navigation device which would allow one to determine the local latitude and longitude anywhere in the world, to within a few miles. It could also be used as an elementary navigation teaching aid.

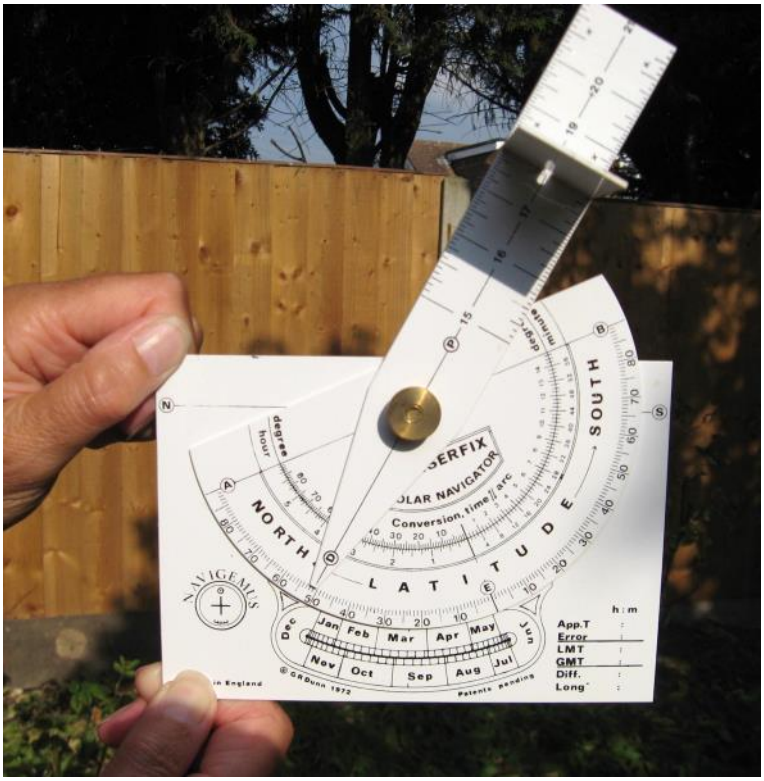

Fig. 7. "Cruiserfix" Solar Navigator.

Fig. 8. West face of Gerald and Maureen Dunn's gravestone.

In 1976 a patent was granted for the device. An example of the device is currently held in the National Maritime Museum at Greenwich.

Marketed as the "Cruiserfix" Solar Navigator, the key component of the device is a polar sundial, in the form of a cross (Fig. 7).

By measuring one's local apparent time and comparing with GMT, local mean time can be determined. Using the provided time-to-angle conversion scale, this time difference will then allow the longitude to be determined. Correction arrangements are also included to take into account the daily time difference with an equation-of-time graph.

At local noon, and with the aid of the sun shining through a small aperture, the cross dial may be aligned directly with the sun. Having previously set the adjustable latitude scale to take into account the appropriate day and month of the year on the included analemma, the latitude may then be read directly from the latitude scale.

Martin Dunn was an active member of the sailing community and when he died in 1974 the polar cross sundial and associated inscription were placed as an appropriate memorial on his grave.

On the west (rear) face of his parents' gravestone is engraved a symbol suggesting the notion of a vertical sundial, but without its gnomon (Fig. 8).

This design is simply intended to allude to a sundial and give the impression of passing time. Nevertheless it is very much like the headstone dial described in Frank King's article. The main difference is that the outer ends of the hour lines fall on an implicit semi-ellipse rather a semi-circle. These lines are at 15° intervals as was common on medieval scratch dials that were intended to indicate unequal hours. With this dial too, one could hold up a knitting-needle with one end at the dial centre and note its shadow. If the knitting-needle were appropriately oriented, its shadow would again correctly indicate noon and sunset but would be of limited use at other times.

With the inscription "*Until Apparent Time Shall Cease*", this would seem to be a fitting sentiment for the memorial of Gerald and Maureen Dunn.

The author would be pleased to hear from members of any other similarly depicted 'sundials' that are known on gravestones.

ACKNOWLEDGEMENTS

I am grateful to Greg and Juliet Dunn for providing background details of their family for this article, and also for their support for the article. Thanks are also due to them for the loan of the "Cruiserfix" Navigator for illustration purposes.

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TWO NEW VERTICAL DIALS IN STONE AND SLATE

BEN JONES

Last summer I made two vertical wall dials. Both were commissioned as 60th birthday presents and both have phosphor bronze rod gnomons but apart from that they are quite different sundials.

One is a Portland stone declining dial 27″ square, carved in relief with a quotation from Copernicus as the motto (Fig. 1). The other dial is slate measuring 19″ by 18″; it faces due south and shows longitude-adjusted common hours along with Babylonian and Italian hours. The Italian hours were numbered to count *to* sunset rather than *from* sunset.

The slate dial has V-incised lines and letters that are gilded (Fig. 2). The Latin motto is a quote from Horace which can be translated as: 'Now is the time for drinking, now is the time to dance footloose upon the Earth'. Classical scholars will know that this was considered by some Romans to be the appropriate response to the news of Cleopatra's death; the rest of us can just take it as an injunction to boogie.

The Portland stone dial was fixed on a rough stone wall at first-floor height on a house in Wiltshire. The slate dial was fixed to a cob wall just above head height in a garden in Devon.

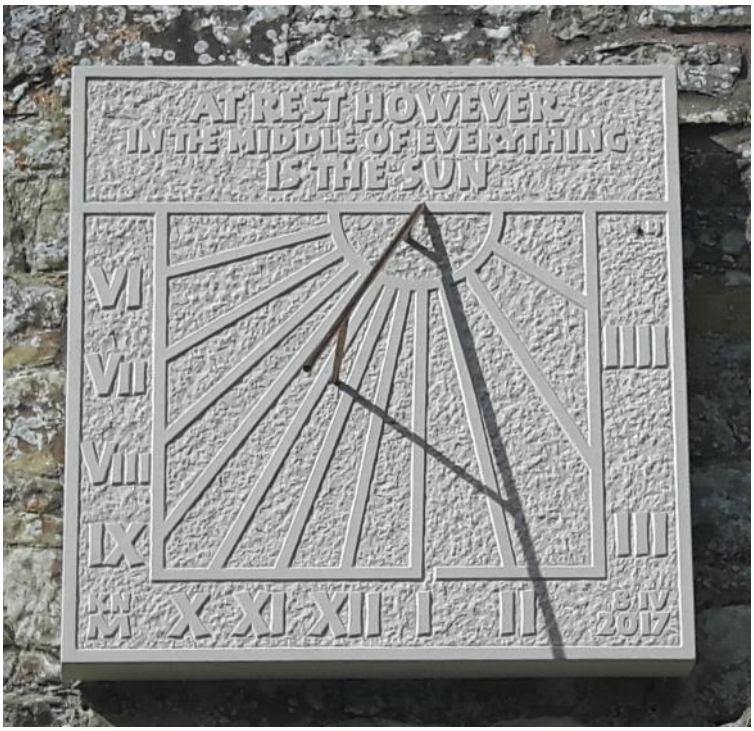

Fig. 1. The Portland stone dial.

Fig. 2. The finished slate dial with gold and aluminium leaf.

Finding the right size and position for the Portland stone dial was very much a matter of judgement as there was nothing symmetrical about the house. The client and I stuck paper templates in various places on the wall until size and position looked right or at least 'not wrong'.

Working out the hour angles for a straightforward dial is a reasonably straightforward task but working out how to measure the wall for declination and a method of hauling the stone to the right spot and then fixing it in place is a much trickier job.

To find the declination of the uneven wall I fixed three screws into the wall in an L shape and measured the declination (34° 48′ E) off the lower pair of screws. The top screw was wound in or out until it was plumb above one of the lower declination screws. This meant that later on, when the finished dial was held against these three screws, the dial would be pretty well both plumb and correctly aligned. This method might allow a dial to be installed even on a cloudy day although it is very much nicer to have some sun, just to check everything is as right as possible.

If you use this three-screw method to fix a dial and then find that there is an odd bump sticking out further than

you thought, it should be possible to wind each screw out a quarter turn at a time until the dial plate clears the offending bump and still keep the declination the same. There was an offending bump behind this dial but I took a hammer and chisel to it.

A horizontal wooden batten fixed temporarily to the wall on which the dial could stand helped enormously by taking the weight of the stone while all the necessary adjustments were being made and the resin in the dowel holes set.

The Portland stone dial was fixed in place with four stainless steel dowels and P38 resin filler.[1] This is a strong and reliable but crude method of fixing. The final result is either right or forever wrong because once the resin has set there is no further adjustment possible. I have used specialist resins, the sort that need mastic guns and mixing nozzles, but have been scared by the speed with which the resin can harden. The idea of a dial being only half in when the stuff sets rock hard is unsettling.

The end of the bronze gnomon that meets the dial plate is sharpened to a point like a pencil. This allows the actual centre of the gnomon to rest on the exact spot that marks the gnomonic centre of the dial. I find this helps with fixing the gnomon correctly by reducing the number of things that need to be checked and adjusted before the resin goes off (Fig. 3).

Fixing the Portland stone dial was completed just before the gnomon's shadow arrived on time at the 4 pm line and about five minutes before the sun moved off that side of the house entirely (Fig. 4).

Making the slate sundial was a more complicated affair. It had to be made a particular shape and size to suit the site, have a long motto and show longitude-adjusted common hours plus Babylonian and Italian hours. Local Apparent Time hours and half hours are indicated by the crossing

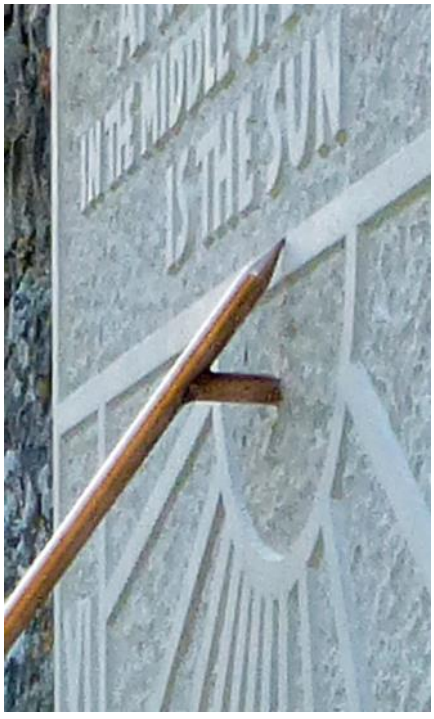

Fig. 3. The 'sharpened pencil' gnomon.

Fig. 4. The Portland stone dial and house.

points of the Babylonian and Italian hour lines. Carving in the LAT lines would have made this part of the dial horribly cluttered so I chose to leave it to the gnomon's shadow to join up these points. My clients decided they really must have the Babylonian and Italian hours after reading an article by Frank King about his Selwyn College dial.[2,3] This article they found on their smart phones one evening down the pub.

At first glance it looked like it would be a struggle to get everything to sit neatly together in the required size and shape, but a few sketches soon revealed that the whole lot actually fitted together surprisingly neatly. It required the letters to be very carefully spaced and drawn and the use of two ligatures. Once it was found that the second half of the motto sat almost perfectly under the summer solstice curve, I could not think of a better way of making this sundial.

The top line of the motto is divided by the gnomon. This is a slight pity but the geometry of the dial and the height of the lettering fixed the root of the gnomon there. As the dial has a rod gnomon rather than a solid triangular one, splitting the motto was considered acceptable.

For his Selwyn College dial Frank used a disk parallel to the dial plate for his nodus. My plan was to pinch this idea as it produces a clear circular shadow that is simple to read. Unfortunately the solution to combining this disk with a common hours' rod gnomon proved elusive. Either the disk was too big or the rod was too spindly. In some ways it might have been simpler to have decoupled the common hours from the Babylonian and Italian hours but doing so just produced a less attractive set of complications and

Fig. 5. The slate dial in position, but still supported by a batten.

compromises. In the end the nodus was made by a notch in the rod gnomon.

Owing to cost and time considerations I used the Shadows software package[4] to calculate the dial but next time I would like to use Frank's method to set out Babylonian and Italian hours which is based on the crossing points of the various hour lines. This method has the benefit of producing lots of points to set out which means an error in calculation or measuring will show up clearly against all the many other points.

Cob walls are built from mud and then rendered (Fig. 5). Resin fixings do not hold very well in the crumbly cob. The traditional method for fixing into cob is to hammer square oak wedges into round holes drilled into the wall. The wedges can then be drilled to receive fixings, in this case stainless steel dowels set into the back of the dial with resin.

To align the dial I again used an L shape of adjusting screws anchored to the wall using Rawlplugs, but instead of measuring the declination (whatever it might be) and making the dial to suit, as I did for the Portland stone dial, this time I adjusted the screws until they were correctly aligned to hold the dial plate facing due south.

To do this an edge of a horizontal board was held against the pair of 'declination screws'. On this board was stood a vertical pin. The angle between the pin's shadow and the edge of the board was measured. The 'declination screws' were wound in or out until the shadow-to-wall angle suggested that the screws were suitably aligned. I used a laptop and the SAZ program[5] to find what the shadow to wall angles should be at any one time throughout the day.

It took a while to adjust the declination screws for the slate dial but the clouds helped enormously by vacating the sky for the whole day so the dial could also be checked with its own shadow.

REFERENCES and NOTES

1. Davids Isopon P38 filler is a car body filler and is readily available from most car accessory shops.
2. Frank H. King: 'New Babylonian and Italian hours sundial for Selwyn College, Cambridge, 1. Design & construction, *BSS Bulletin*, 22(iii), 2-8 (September 2010).
3. Frank H. King: 'New Babylonian and Italian hours sundial for Selwyn College, Cambridge, 2. Numerical insights, *BSS Bulletin*, 22(iv) 9-11 (December 2010).
4. Shadows is a software package for the calculation and drawing of sundials and astrolabes. It has been developed by François Blateyron, a software developer and amateur astronomer, and it is available as freeware in its base level. *www.shadowspro.com*
5. Written a long time ago by BSS member Gordon E. Taylor, SAZ shows the sun's azimuth and EoT. It is clear and simple to use, though it does not print on later versions of Windows. The Shadows program can also be used to find the sun's azimuth.

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THE MAKING OF THE SLATE DOUBLE HORIZONTAL SUNDIAL KNOWN AS M-29

DAVID BROWN

This article is based on a presentation I made at the September 2013 Newbury meeting in which I gave an account of the process leading to the completion of M-29 (Fig. 1).

Fig. 1. The completed double horizontal sundial M-29 (photo: Derek Richards).

About ten years ago, John Davis mentioned that he and Michael Lowne were compiling a monograph for the BSS on the Double Horizontal sundial.[1] He had noted that whereas most of the extant instruments were made of brass, only one was known to exist that was made of slate[2] and the whereabouts of that one were not now known, it having been sold at auction in 1988 to an unknown bidder. Would I therefore be interested in making a slate double horizontal dial? The seed was sown, and it took some time to germinate because I knew that my understanding of both the content and geometry of these intricate instruments were then at best rudimentary.

Double horizontal dials had often been the subject of articles in the *Bulletin* and elsewhere.[3] I had also seen, and been inspired by, the naval brass double horizontal dial made by Joanna Migdal in 2008/9 when it was on display in the Museum of the History of Science, Oxford, prior to its installation nearby at St Hugh's College.[4] Sundials that I had made up to that time had been mostly in slate but limited to single gnomons, often carrying a nodus on the gnomon and seasonal and anniversary date curves on the plate. The intricacy and detail of the double horizontal dial would require a step change in my thinking and would challenge my manual skills. Research was needed.

Help came in abundance from a book published by the late Jim Morrison in which there is an excellent section on the double horizontal sundial.[5]

John Davis was generous in his help and advice and Tony Moss was another guru who willingly shared his expertise. Time rolled on and John Davis pressed me for at least a specification of the dial so that it could be included in the BSS Monograph. This was the spur that was needed to get me to focus on the essential details. I provided the specification of the intended dial and its size[6] which John was happy to include in the monograph without a photograph because the dial did not at that stage exist, but hopefully would by the time the monograph went to press. It was given the identification code of M-29, the M representing its inclusion in that section of the monograph which lists modern instruments.

The first task was to work out the geometry. It was a great help to have an illustration and description in Jim Morrison's book of a double horizontal dial delineated for almost the same latitude as M-29.[7] With John Davis's help, I created spreadsheets of data which became the go-to source for the laying-out of the details on the dial surface.

I had already prepared a piece of 3 cm thick Welsh slate with the help of my bench-mounted water-fed diamond

Fig. 2. Cutting the shape on the wet circular saw bench.

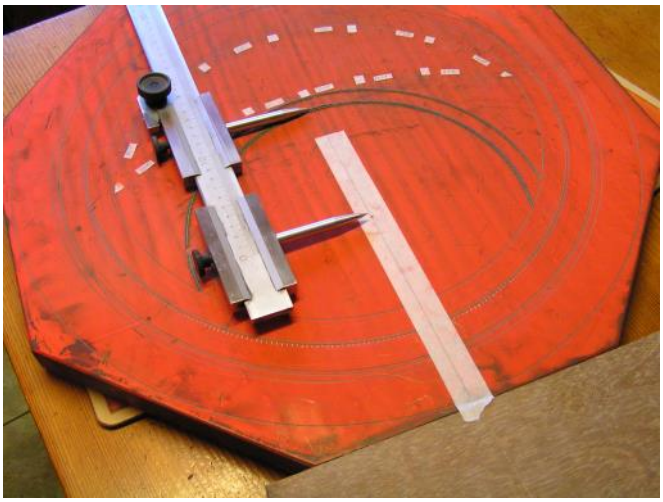

Fig. 3. Inscribing circular arcs with a beam compass.

circular saw (Fig. 2). The shaped and edge-chamfered surfaces were rubbed down with 400-grit diamond pads and water. I needed to lay out the dial details on the face without making any lasting marks in case corrections or rubbings-out were necessary. I used a standard technique of painting the dial surface with a light-red coat of artists' gouache. This meant that lead pencil marks which could not have been seen easily on a bare slate surface could now be seen clearly and could be erased with either a little wet brushing or over-painting. When I was satisfied that a certain section was what I wanted, then incisions could be made.

Two types of incision were used: one was quick and easy graffito, scribing with a hard steel point; the other was V-cutting with a chisel. Graffito markings could be done very lightly to produce guide lines, for instance, which could be rubbed out later with diamond pads or wet and dry papers. Permanent markings could be made by heavier and repeated application of the scribe, until lines of the required weight were created. Straight lines were the easiest because a straight-edge could be clamped to the dial plate (safe and sure method) or held firmly by hand (more risky, because of possible accidental slips of the hand holding the straight-edge). All the curved lines on the double-horizontal dial are complete circles or circular arcs. Scribing compasses were used for arcs of modest radius, such as for the circles centred on the geometric centre of the dial, but when the radii exceeded that of even a very large pair of scribing compasses, it was necessary to use a beam compass (Fig. 3). This in turn was limited to radii of 50 cm whereas radii of arcs on the stereographic projection area increased to well over a metre, with some curves to be scribed which were almost straight lines. I extended the beam compass using wooden laths and a steel metre rule, an almost perfect (if somewhat Heath Robinson) solution. I needed a work surface larger than my kitchen table, so a full 2.4 metre length of thick marine plywood was employed – necessitating the complete take-over of the kitchen to provide me with a big enough work area (Fig. 4). I say 'almost' because with radii larger than the span of my outstretched arms I was unable to hold firmly both the anchored end-point of the much-extended beam compass as well as control the scribing end. Accidents were bound to happen – and they did on two occasions, resulting in parts of lines scribed in the wrong position owing to movement of the anchor-point. The accidental lines were too deep to rub out without removal of adjacent correct lines, so I decided to leave them on the dial – we can't all be perfect all the time! Later, finishing paint was carefully scraped out of these erroneous markings. They can still be seen in the right light but do not detract from the correct functioning and appearance of the completed work. For the day points on the ecliptic curves, I first plotted their positions to full scale on graph paper then pricked through the positions onto the slate with a steel point before marking more permanently with a diamond burr in a dentist's drill (Fig. 5).

The larger V-cut incisions were done in the traditional way with sharpened tungsten carbide-tipped lettering chisels in one hand and 'dummy' mallet in the other. The small letters and numerals were shaped with a very small chisel used two-handed more like an engraver's burin (Fig. 6).

Fig. 4. Extended beam compass on wooden board. The red-painted sundial plate is at the far end.

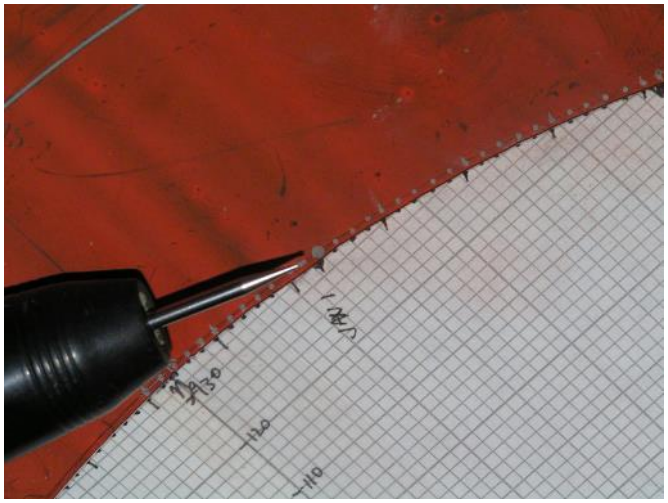

Fig. 5. Using a diamond burr to engrave the date marks on the ecliptic.

Fig. 6. Using an engraving technique for small numerals.

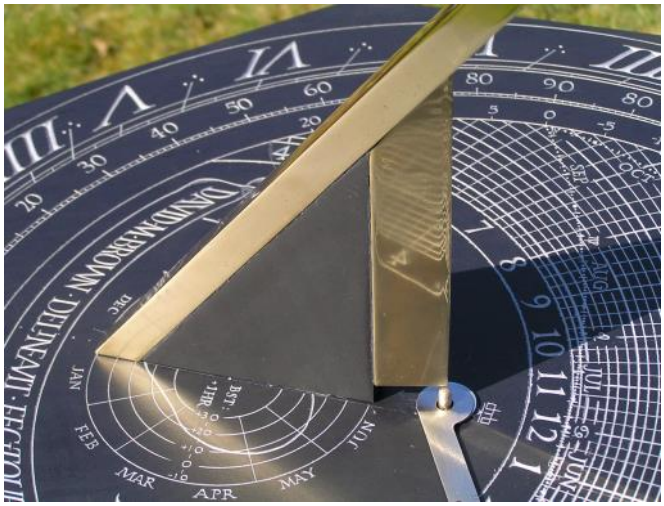

Fig. 7. The attachment of the cursor.

I had found over the years that by scribing the centre-line first with a steel point, the V-cutting of these small letters and numerals could be better controlled. I changed my initial plan of marking solar azimuths 0° to 360° from North to one of four sectors 0° to 90°. Changed numerals can be seen in Fig. 6.

The cursor which carries the altitude scale (made by Precision Waterjet[8]) pivots on a short stainless steel pin set into the centre of the dial plate. The bottom of the vertical gnomon was cut away slightly to accommodate it (Fig. 7). The outer end of the cursor has a self-adhesive felt pad attached underneath it to prevent the cursor from scratching the dial plate.

When all the inscribing had been done, a process that took two or three weeks of intense and often-interrupted work, I needed to turn my attention to the gnomon.

My metal-working skills are rudimentary. It would have been possible to have a solid brass gnomon cut by waterjet. I would have preferred to have had a gnomon made only of slate but the requirement for a narrow, extended arm on the polar gnomon and a sharp edge for the vertical central gnomon meant that slate alone, at 13 mm thick, would be too fragile. I opted for a combination of slate and brass. The brass elements were made by Precision Waterjet and I shaped the triangular slate infill (Fig. 8). I inserted short stainless steel pins between the slate and brass for added strength. The components were bonded with careful

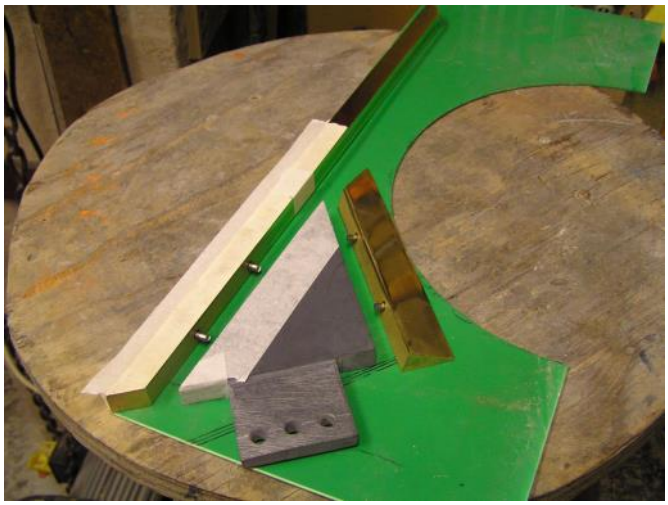

Fig. 8. Components of the gnomon.

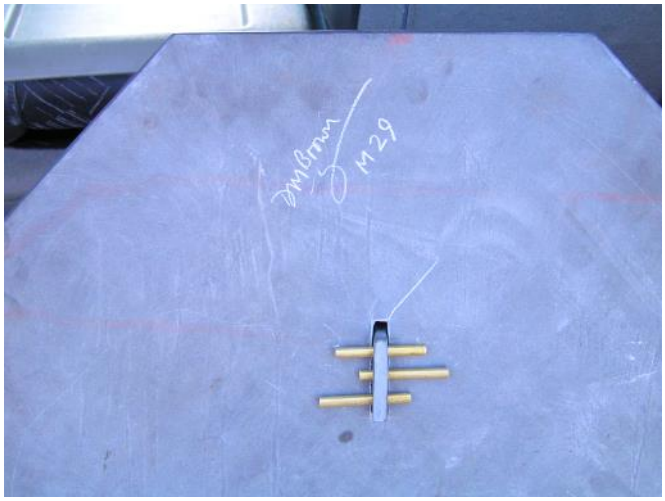

Fig. 9. Taper pin attachment of the gnomon and chinagraph signature under the plate.

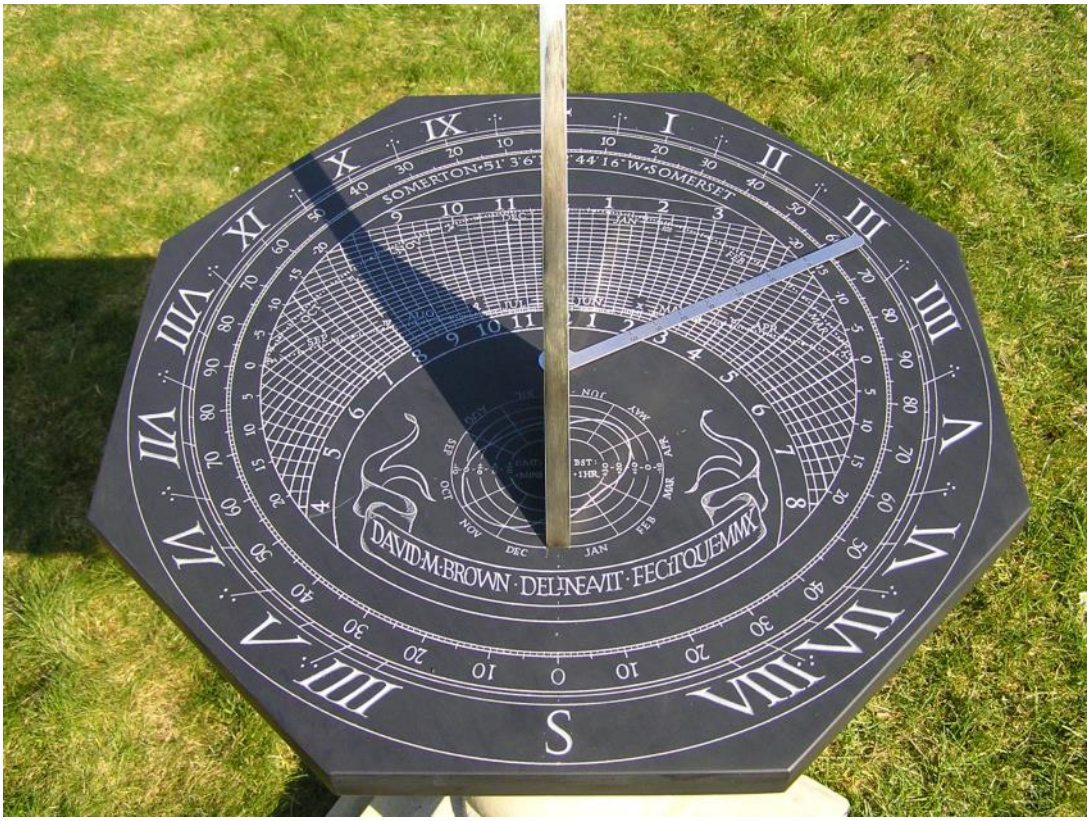

Fig. 10. The dial in a garden setting.

application of epoxy Stonefil adhesive.[9] I had decided early on in the delineation stage what the thickness of the gnomon would be so that appropriate allowance could be made for the noon gap and the alignment of the hour lines to the appropriate centre at the root of the polar gnomon. The tenon of the slate part of the gnomon was intentionally made thinner (8 mm) than the visible body so that when the gnomon is in place it is not possible to see the edges of the mortise slot in the dial plate. This rectangular slot was cut out first by a series of closely-spaced holes made with a masonry bit on my pillar drill, then fine-trimmed by filing with stonework rasps. The gnomon is retained by three transverse stainless steel taper pins under the dial plate engaging with corresponding holes in the gnomon tenon (Fig. 9). The tenon protrudes about 10 mm below the dial plate so for display purposes the whole dial is raised on two wooden strips.

When all the inscriptional work had been done, the details were given two coats of light grey matt Humbrol enamel. The paint inevitably went over the edges of the incisions, but when it was dry, rubbing the surfaces with diamond pads with 400-grit then 800 removed the excess paint as well as the red gouache and any lightly-scribed guide markings to leave the required gnomonic details.

Included in the furniture were the details of the designed location of the dial (Somerton, Somerset), my mason's mark (my stylised initials above a scratch dial), a circular format equation of time correction curve around the foot of the gnomon, and a banner proclaiming DAVID M BROWN DELINEAVIT FECITQUE MMX.

I suppose that it would be right and proper to mount the sundial appropriately outdoors (Fig. 10) but partly because I feel somewhat 'precious' about this dial which had taken three months of intense but frequently interrupted work, and partly because I display it from time to time at events such as BSS conferences and the Somerset Guild of Craftsmen gallery, as well as take it with me when I give sundial talks, it remains indoors where it can be aligned correctly near to a sun-filled window. It also serves as an illustration of manual dexterity and gnomonic complexity for visitors. It is now, I understand, the only slate double horizontal sundial known to exist and whose whereabouts are known.

REFERENCES

1. J. Davis and M. Lowne: *The Double Horizontal Dial,* BSS Monograph No. 5 (2009).
2. *Ibid.,* p.193, Record No. DH-45.
3. For example: F. Sawyer: 'William Oughtred's double horizontal dial', *NASS Compendium,* 4(1), 16 (March 1997) and Lowne: 'The design and characteristics of the double-horizontal sundial', *BSS Bulletin*, 13(iv), 138–146 (December 2001). These and other examples are included in Ref. 1.
4. Listed as M-23 in Ref. 1, p. 226.
5. J.E. Morrison: *The Astrolabe,* Janus, Reheboth Beach, USA, (2007), pp. 267–279.
6. See Ref. 1, p. 229.
7. See Ref. 5, p. 276.
8. Precision Waterjet Limited, 1 Uplyme Road Business Park, Lyme Regis, Dorset, DT7 3LS *sales@precisionwaterjet.co.uk*
9. Tetrion Stonefil adhesive, available from Crawshaws *info@crawshaws.co.uk* for example.

david@davidbrownsundials.com

A SALVAGED PEDESTAL

SUE MANSTON

The BSS Help and Advice Service was recently contacted by Mark Findlay, a brick and stone merchant from Edinburgh. He had acquired an ornate, but broken, pedestal (Fig. 1) from a developer for only £50. There just happened to be a sundial on the top, but no value had been attached to that!

Mark asked if we could give him any information about the dial (Fig. 2). It was recovered from the garden of a house in Inverleith Terrace, Edinburgh, directly opposite the Botanic Gardens. The house, previously converted into two flats, is being restored to a single dwelling. Inverleith Terrace is on the 1835 map of Edinburgh, but the house is not.

The dial is brass, 147 mm square. The Roman numerals are read from the inside, and IIII is used for 4 am and 4 pm. There are divisions for half- and quarter-hours. A cross pattée at noon and lack of a noon gap both suggest an early date. The dial is very simple and unlikely to have been made by a major mathematical instrument maker.

Fig. 2. The dial plate.

Fig. 1. The ornate pedestal.

The thick-and-thin piercing of the attractive gnomon (Fig. 3) is typical of the 17th century. The angle of the gnomon is about 51°, meaning that the dial was made for a latitude around London, certainly not for Edinburgh. It probably found its way to Edinburgh well after it was originally made.

Fig. 3. The thick-and-thin pierced gnomon.

The date on the dial appears to be 1675 and there may be a maker's name — Thomas N? — but this is difficult to see (Fig. 4). It is almost certain that the date of the dial is genuine, though the pedestal is probably later, perhaps Georgian.

Mark has decided to keep the dial and has placed the restored pedestal in his recently reconstructed garden. A happy ending for a £50 bargain!

ACKNOWLEDGEMENTS

Thanks to John Davis for his advice. All photographs courtesy of Mark Findlay.

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Fig. 4. A rubbing of the dial's inscription.

FUN DIAL FOR THE VISUALLY IMPAIRED

JOHN MOIR

As a sufferer from advanced age-related macular degeneration, I have had to abandon my many lifetime hobbies, making time weigh heavily on my hands. Recently I joined a clay modelling class for the visually impaired, run by local artist Brenda Coyle. Most of the class chose to make bowls or candle holders, but being a loyal BSS member, I had no option but to make a sundial. Brenda was most enthusiastic and offered to help me with the more difficult bits. The result of our joint endeavours is shown in the photographs.

As can be seen, I have used boundary lines between contrasting colours to mark the hours 6 am, 9 am, 12 noon, 3 pm and 6 pm. Such divisions are much easier to pick out than the more usual fine incised lines.

For visual variety I have placed four obliging ladybirds to split the dial's time span into eight 1.5-hour periods instead of twelve 1-hour periods.

In the interest of simplicity I decided not to number the hours as the only users of the dial are myself, family and friends who are all well versed in reading this dial without numbers!

This may not be the most accurate of sundials but it has certainly provided much fun for those involved in its creation.

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A SUNDIAL FOR A NORTH WALL

GRAHAM PARKS

In the autumn of 2012 my wife and I retired to a small Victorian cottage in Wiltshire. We spent the winter working on the house and it was not until the following spring that our attention turned to the small front and rear gardens. Prominent on one of the side boundaries at the back was the gable end of our neighbours' brick shed (Fig. 1) which needed something to soften it or make it more interesting and it struck me that what would look good would be a sundial. So, thinking about it a little more, I realised that about all I knew of sundials was that they were often very elegant, seldom seemed to tell the right time and had to face more or less due south. And it was then that I realised my idea had a serious flaw. The wall faced north.

Fig. 1. The wall as it existed in 2014.

The front garden needed far more work than the rear one so we spent the summer working on that and I put the issue to the back of my mind. But the idea would never quite go away and the following winter I came up with a cunning plan. If I mounted a mirror up near the apex of the gable, I could project a spot of light onto the wall and use that to tell the time. A few experiments on a sunny day with my wife's hand mirror on the end of a long stick convinced me it should be possible and I decided to make a project of it. I mean, how difficult could it be?

The State of the Existing Wall and Roof

It should be noted here that the wall and roof do not lend themselves to what I was proposing. Half way up the wall there is the remains of an old timber wall plate with newer much rougher brickwork on top of it, whilst the roof has clearly spread outwards. This means that the pitches of the two roof sides now differ and the centre of the gable is no longer centred on the wall. Also, whilst vertical below the plate, above it the wall leans backwards by about 65 mm or three degrees. Without a major rebuild I could do nothing about the state of the roof or the inclination of the upper part of the wall, but before I started I did clean off much of the old paint, repaint the barge board and repoint the wall.

Precedents

Having conceived the idea, it seemed obvious to me that someone would have done it before and I could get clues from that. However, a major Internet trawl produced nothing helpful. I soon learned that both Christopher Wren and Isaac Newton[1] had each created dials by putting a mirror on a window sill and projecting a spot of light onto the ceiling of their bedrooms, which meant that I was in good company, but gave me no clue as to how I might set about my task.

I also found references to a most interesting dial made by Tom Egan in California[2] in which an image of the sky, created by a circular convex mirror mounted on a frame at the top of an outside wall, is projected via further flat mirrors and a pin-hole into the interior of a room. The projected image then forms the basis of a small internal sundial. Fascinating, but again of little help to me.

In 2015, much later in the process and well after my project was underway, the BSS issued the UK Fixed Dial Register on DVD which I obtained and searched but I still could find nothing like my idea. There are a couple of examples following the Wren/Newton model,[3] but I am still unable to find references to existing dials where light is projected onto an external wall.

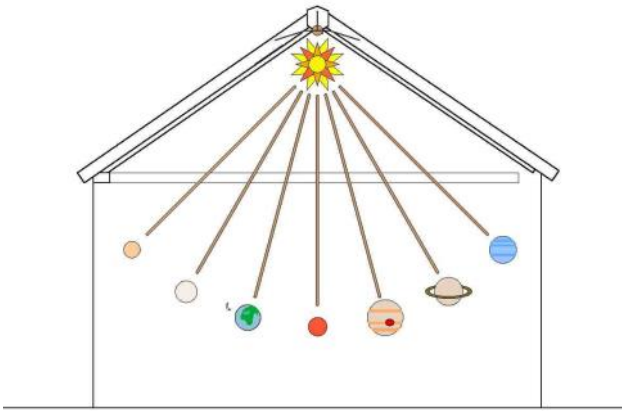

Fig. 2. My first idea of what the dial might look like (unfortunately demonstrating my complete naivety regarding sundials).

Early Designs

Given that my proposal would provide an idea of both time and date and given that I wanted something decorative, I thought it would be interesting to theme the dial on the solar system, with the light landing on a fused coloured glass symbol of the sun at noon on the winter solstice. I could then have hour lines formed with brass rods projecting from the sun to more glass symbols of the planets at their extremities. The planets would then be illuminated on the hours (GMT) at the summer solstice (Fig. 2). As can be seen from that design I really had very little idea of what I was doing. I also had no idea where the early morning and late afternoon planets would be placed in mid-summer. I had drawn them forming a circle round the sun but I had no idea if that would actually be the shape and, for all I knew, I could easily have ended up with Mercury and Uranus in the flower bed. I had briefly looked up the mathematics involved in sundials and ruled out that approach to solving the problem in seconds, so it was clear that the final design would have to be determined by experimentation, not calculation. I therefore decided to create an initial temporary mount for the mirror and see what happened over the next six months.

I knew that the mirror had to be positioned so that the incident rays coming from the sun in the middle of winter would clear the ridge of the roof and so that the reflected rays would clear the projecting wooden barge board on the verge of the roof sufficiently to enable me to get a reasonable-sized 'sun' at the apex. So I did some initial drawings of the geometry at mid-day at various times of the year and decided to mount the mirror 800 mm off the wall and 250 mm below the ridge. In addition, the structure supporting it would need to be designed such that it did not get in the way of either the incident or the reflected rays. With this in mind I stuck a mirror to half a wooden ball and mounted it on the wall via a plywood frame and two sticks. This was a flimsy design and needed to be stopped from wobbling by fixing and tightening a wire from the top of the frame to the apex of the gable. Then in early spring 2014 I adjusted the ball until the spot of light ('sunspot') shone where I thought it should and started to plot its progress (Fig. 3).

All went well for about four months and, on sunny days, I plotted the position of the sunspot with Blu-tack at every GMT hour to see what would happen. I had by this time at last realised that I really needed to know a lot more about what I was doing and started to read more widely on the subject. I therefore knew enough about the equation of time not to be surprised when my Blu-tack blobs did not form a straight line and I was feeling quite pleased with the results when the first disaster struck. The tension I had put on the wire had clearly been too great and pulled the frame apart. This also resulted in a partial collapse of the whole thing which rendered it all useless before I had reached the critical summer solstice.

Fig. 3. The temporary mirror holder, whilst it was still functional.

The Final Design

I was now back at square one but I wanted to put up the final mirror holder by the winter solstice, so finding a different design approach was essential. I decided the way forward was to build a 3D computer model. The software I had left over from my previous life as an architect was quite capable of the modelling task, but was not sufficiently sophisticated to do reflections. It was, however, able to do shadows at different times of the day and year so I built the model, including the mirror, and then rotated it through 180 degrees so that the wall faced south. This meant I could plot where the shadow of the mirror fell, giving me a much better idea of what the final thing would look like and ensuring that the mirror positioning was satisfactory.

It was at this point that I realised that what I was trying to create would be very similar to a vertical sundial whose face was part of an obscured glass window, and that my spot of light would follow the same path as the shadow of the tip (nodus) of the gnomon when viewed from inside the building. I later discovered that such dials do exist[4] and that my preliminary investigations would have been better directed towards similar dials and those with pierced nodus plates that tell both time and date such as the beautiful example on the Duomo di Como (Fig. 4).

The computer model worked well but it did bring all the major errors of my first thoughts to light. I wasn't going to

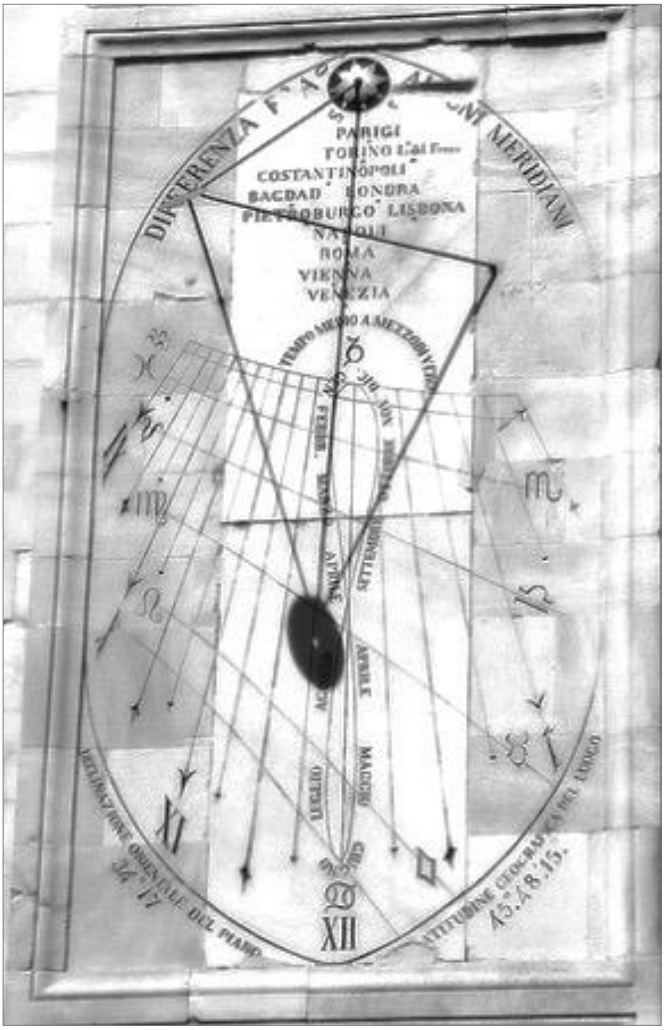

Fig. 4. Meridiana Duomo di Como (copyright Michele Faienza).

be able to have lines going from 9 am to 3 pm but would be restricted to 10 am to 2 pm. This meant that I had lost that most iconic of planets Saturn to the flower bed, but did bring Earth into the visually most significant 12 noon position. By way of compensation I also introduced a belt of 'asteroids' marking the spring and autumn equinoxes. The number of visible hours could have been increased by moving the mirror closer to the wall, but this was restricted by the issue of the incident and reflecting rays having to miss the projecting barge board in mid-winter. The final mirror position chosen was 900 mm away from the barge board and 220 mm below the ridge.

The dial I was proposing was a hybrid, with the main hour lines being set in the manner of a vertical sundial set to Greenwich Local Time and radiating from the root of a virtual gnomon located on the plane of the wall approximately 1100 mm above the mirror. However, the individual planets and asteroids were to be placed on analemmas so that they were illuminated exactly on clock time (GMT). This meant that whilst there were only five planets there were ten asteroids as the EoT is positive in spring and negative in autumn. I also decided to abandon the idea of using fused glass for the images and instead

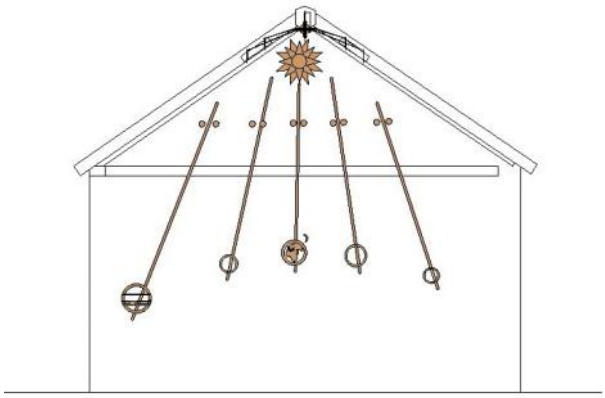

Fig. 5. The final design, showing five planets and ten asteroids.

produce the whole thing in brass. This made it less garish and also meant that I could do much more of the work myself. The resulting design is shown in Fig. 5.

Fabrication and Erection

The first issue to be solved was how to hold up the mirror in a way that could be made by one man in his garage with not much more equipment than a drill, a jigsaw and a blow torch. My early experiment had put me off anything involving tensioned wires so I came up with the idea of having two brass rods on each side of the barge board, spaced sufficiently far apart so as to produce two triangles that would hold the mirror rigidly in the middle. This later evolved into constructing the main frame in just two continuous rods that looped behind the mirror to which the mirror could be bolted and held on its horizontal axis. A further two much shorter curved rods at right angles to the main rods would then provide a similar fixing for the vertical axis.

I felt this was a good design, but it was clearly going to be difficult to construct. There were a lot of complex curves involved and they would need to be pretty accurately formed. I found that I could, after heating the rods with a blow torch, bend the small curves that occurred at the

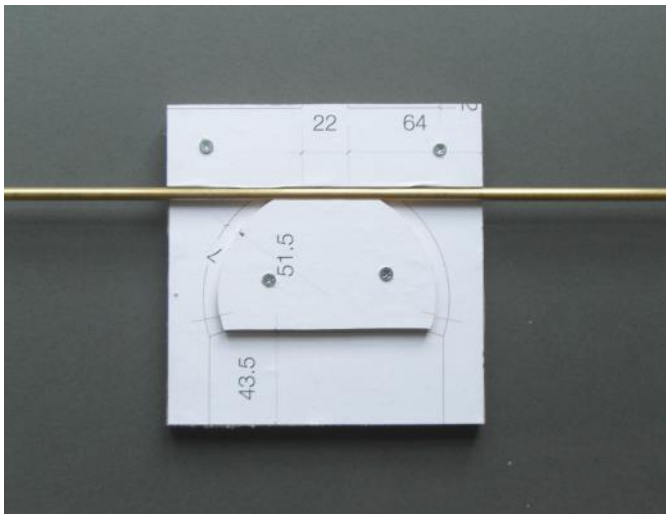

Fig. 6. One of the plywood formers used to form the mirror holder.

Fig. 7. The mock-up of the gable in my garage.

mirror around plywood formers cut by sticking full-size computer drawings to the plywood and then cutting them with a jigsaw (Fig. 6). This resulted in a lot of burnt plywood, but it worked. However, the larger curves were more difficult. Eventually I built a full size mock-up of the gable end in my garage with slots cut in it. This meant that after I had formed the tight curves I could clamp both rods in place and by heating the appropriate bits of the rods bend them, fairly consistently, into the shapes required (Fig. 7). I finally erected the mirror on 20 December 2014 just in time for the solstice and started to try and align the mirror so that the reflection at noon was pointing at the preferred position for what would be the centre of my brass sun. This proved to be far from easy. There were of course issues with clouds, but I was actually fairly lucky with the weather. However, the principal problem lay in physically adjusting the mirror. Despite my best efforts the curved rods did not form perfect semi-circles and so moving the mirror within them was a rather jerky affair meaning that getting it right on one axis usually resulted in it being wrong on the other. And all this had to be done with my arms above my head, whilst I was standing on a ladder and with a spot of light that, even at that time of year, moved surprisingly fast. I persisted and, with much help from my wife, over the next few days got the sunspot to within about 50 mm of where I had hoped it would be. The erected mirror is shown in Figs 8 and 9.

By comparison with the mirror holder, the construction of the sun and planets was fairly easy. I originally tried to get everything laser cut, but the local companies with the necessary equipment were not interested. So I spent much of 2015 cutting out bits of brass with a jigsaw whilst sticking bits of Blu-tack to the wall. In early January 2016 I was finally in a position to screw everything to the wall.

At first all seemed well. The hour lines were a little bit curved, but I put that down to the inclined nature of the upper part of the wall and generally speaking the sundial was telling the right time. The first indication of problems came at the spring equinox when the light spot was slightly lower on the wall than it should have been. This had become even worse by the time of the solstice and it was clear by then that the mirror had somehow dropped. This was a huge disappointment and not one I wanted to leave unrepaired. The mirror itself still seemed to be clamped tight as was the connection to the barge board, so I concluded that the problem must have been the support frame sagging. I waited until the equinox, when I could measure the problem against the noon 'asteroid' and decided I needed to raise the mirror by about 30 mm. The frame had been very securely clamped to the barge board by hardwood strips that were screwed through to the underlying structure and then also glued in position. This meant that removing the frame would be difficult and damaging so I elected to stiffen and raise the frame *in situ* by fixing an extra strut on each side. This required some very careful drilling into a round rod with the drill held above my head whilst standing on steps. Luckily it went quite well and by the winter solstice I was ready to realign the mirror once more and start the whole marking out procedure all over again.

Fig. 8. The mirror holder once erected.

Fig. 9. The mirror frame before strengthening.

Fig. 10. Some of the over 100 pieces of Blu-tack that were stuck to the wall. Those used for the GMT analemma were left blank. Those for the Greenwich Local Time hour lines were marked with a row of dots and the ones marked VA and VP were the actual and predicted vertical local time noon positions used to check the mirror alignment.

Design Improvements

Given the way in which the dial works it would always have been possible to omit the hour lines altogether and instead erect a series of figure of eight analemmas thus overcoming the issue of the equation of time. This was tempting but would have been very difficult to fabricate and would have rather gone against the original design concept. So instead I decided to plot the curved lines of the various analemmas and then provide a series of brass screws screwed directly into the centre of each of the bricks that those lines passed through. This would therefore provide an indication of the EoT correction to anyone who knew how to read it. I also added a small washer to the centre of the mirror which made the centre of the sunspot easier to see.

When it came to realigning the mirror I decided on a slightly different approach. Instead of aiming for a single spot I checked that it was vertical with a spirit level and then tried to align it horizontally with a vertical line formed by a piece of string positioned where I calculated the light spot should be at local noon. I felt that if I had got the mirror aligned to face exactly south, then the noon light position, adjusted for EoT and longitude, would follow down the piece of string. The difficulties with the final adjustment again occurred and the closest I could point the centre of the light to the piece of string was about 25 mm. But I figured this was close enough and was pleased when the local noon line followed parallel to the string.

These variations meant that as I progressed there were a very large number of pieces of Blu-tack on the wall (Fig. 10), but things went well until the period around the summer solstice in 2017, which was totally lacking in sun. I had become quite adept at interpolating to cope with passing clouds, but this was a different problem. Extrapolating a moving target that was slowing to zero and then returning on a slightly different course was very hit and miss to say the least, and at that time of year small movements of the sun give rise to large movements of the sunspot. I did my best but was very unsure of the result, so I decided to carry on with the marking out for another full year. This not only allowed me to check that the problem with the sagging mirror structure had not recurred but also meant that with luck I would get a better fix on the solstice positions for the planets. Fortunately the glorious summer of 2018 followed and I had no problems with lack of sun. So finally in July 2018 I was able to put up the hour lines, the sun, the asteroids, all the planets and the screws marking the analemma (Figs 11–16).

Fig. 11. The completed dial on a very early morning in July 2018.

Fig. 12. The 'Sun', the 'Asteroids' and 'Gemini', also showing the additional struts added to the mirror frame.

Fig. 13. 'Earth' and 'Mars'.

Fig. 14. 'Venus' taken a few days after the solstice. At the extremities of the dial the sunspot's elliptical nature becomes very apparent.

Fig. 15. 'Jupiter'.

Fig. 16. The 'Moon' and the screws marking out the analemma.

Fig. 17. 'Comet Reid' on the date and time of Reid's birthday.

Some Embellishments

In 2014 our first grandson Charlie was born and I thought it would be nice to move the small brass symbol depicting the moon away from its earth orbit to a point that would mark his birthday. He had been born in the night so I put it onto the dial at noon in place of the screw marking the analemma (Fig. 16). I also quietly made a star so that I was prepared should another grandchild come along, not thinking it might be twins. So when in early 2016 Fred and Tom arrived I was only partly prepared. Fortunately a second star could quickly be made and I now have the twin stars of Gemini at noon on their birthday (Fig. 12). This worked well, but when Reid the fourth grandchild came along I was a bit stuck for a symbol. However, an Internet search revealed that there was a prolific comet finding astronomer called William Reid working in South Africa in the early part of the twentieth century and so, as my fourth grandson was the only one to co-operate with my idea and be born in the hours of daylight, I now have a Comet Reid symbol marking both the date and time of his birth (Fig. 17). Fig. 18 shows the four grandchildren in front of their sundial.

Fig. 18. The grandsons in front of their sundial.

Fig. 19. An idea for an improved mirror holder based on the head of a surveyor's level.

Appraisal

So the dial is now complete and as far as I know there is nothing else similar. Its accuracy varies depending on the part of the wall I am looking at, but so far the largest inaccuracy I have noticed is about two minutes, which I don't find surprising given the state of the wall. The hour lines are not quite straight and the 'asteroids' that mark the equinoxes form a curve rather a straight line, but again I think both of these issues are due to the irregularities in the top part of the wall and I am, as I write, waiting nervously for the autumn equinox to see if the sagging mirror support issue re-emerges. But so far so good.

Given the five-year saga involved in creating this I do not propose to do a new improved version, but if anyone were to try it I would make the following suggestions. Only use a flat wall and preferably one that doesn't have anything projecting from its top. Triangulate the mirror support frame as much as possible and move the mirror closer to eliminate all possibility of sagging. And, finally, find a better way of mounting and adjusting the mirror. My initial thoughts on that would be to mount the mirror on something similar to the three-point screw adjustable head of a surveyor's level (Fig. 19). Such a device would need to be made by someone with much more sophisticated metalworking equipment than I have, but would give the accuracy necessary to create what would be in effect a scientific instrument.

The dial is not currently on the BSS Sundial Register, so if anyone would like to come down to see it and record it please contact me via the email address below. My wife and I would be very happy to see you for tea and cakes. You may also be able to see the beginnings of my next project as I have had this idea for a minimalist equatorial dial that would look good in an herbaceous border. The concept is to make it from a single curved brass rod. I mean how difficult could it be….

ACKNOWLEDGEMENTS

With thanks to my neighbours for letting me screw things to their wall and to Michele Faienza for letting me use his image of the Duomo di Como dial.

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4. For example the stained glass dial at Buckland Abbey, Yelverton, Devon (SRN 3801).

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READERS' LETTERS (1)

Gouda Sundial

The article by Doug Bateman and Frank King on the enigmatic east-facing dial on the Gouda town hall (Fig. 1)[1] prompted me also to pay attention to this dial after I visited Gouda recently. This led to a short article in our journal *Zon & Tijd*.[2]

In order to find out whether this is "a bad case of restoration drift", I scaled a photo of the dial so that the 6 hour and presumed equinox lines were at right angles, and projected a correct dial pattern on the result, scaled so that the 6 and 8 hour lines coincided.

My conclusion is that the hour lines are flawed: they are not symmetrical around the 6 hour line, and the 9 hour and the (not numbered) 4 hour lines are too close to the gnomon as compared to the lines for 5 to 8 hours. In addition, there appears to be no relationship whatsoever between the lines parallel to the equinox line and the date lines of a correct east dial.

Fig. 1. The east-facing dial on Gouda town hall (photo: Doug Bateman).

Fig. 2. Gouda treacle waffles – stroopwafels (photo: Christine Northeast).

So my tongue-in-cheek conclusion is that the painter copied the pattern from the famous Gouda treacle waffles (Fig. 2).

I hope you like this addition.

Frans Maes

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MEDIEVAL SUNDIALS: AN OVERVIEW OF 150 YEARS OF RESEARCH AND THE MOST IMPORTANT WRITINGS OF THE FIRST 100 YEARS

KARLHEINZ SCHALDACH

George Victor Du Noyer (1817–69), an Irish painter and illustrator, discovered medieval sundials as a subject of research before 1868 and presented an article about them to Albert Way (1805–74). He wrote (on 5 December 1868) in a letter to the editor of the *Archaelogia Cambrensis* (3rd series, no. 15, 1869, p. 88) that he hoped that his work would soon be published. Albert Way was the founder of the Royal Archaeological Institute. He published the contribution and drawings only after his friend's death and under his own name, adding his own findings and ideas.[1]

Way's fortune allowed him to travel extensively abroad. In the British Isles he knew of relics at Bishopstone, Kirkdale, Great Edstone, Bewcastle, Corhampton, Warnford, Winchester, Barnack, Swillington and Old Byland in England, and Inishcaltra, Kilmalkedar, Clone, Kells and Saulin in Ireland. To these he added just one more early dial from Continental Europe: the one which the sundial-bearer at Freiburg Cathedral holds in his hands (Fig. 1). Way wrote that there might possibly be more examples, but no French, German or other researchers from the Continent who had studied medieval church buildings gave any indication of further medieval sundials.[2]

In terms of time, there was little written in manuscript form before Du Noyer (apart from scattered references), because it needed a stimulus to deal with the Middle Ages. This took place in the Romantic Movement when around 1800 art historians were especially interested in the Christian or national roots of a culture. But research on medieval sundials remained sporadic throughout the 19th century. Greater attention was paid to the great works of art and sculpture during this period so that only a few connoisseurs devoted themselves to sundials.

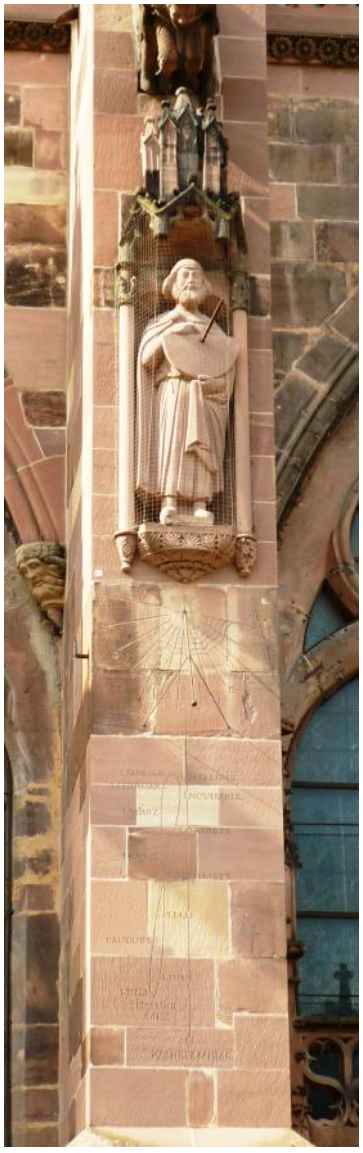

Fig. 1. Sundials on the cathedral of Freiburg (Germany): figure with sundial from about 1230 (modern replica) and a modern variant with an analemma from 1979.

It was left to a woman, Margaret Gatty (1809–73), to communicate the subject to a wider audience. In 1872 she published, under the name of Mrs Alfred Gatty, a compilation of 377 mottoes that she had found in connection with sundials.[3] The sundials themselves are only briefly described, but under "Further notes on Remarkable Sun-Dials" she listed the examples that Way already knew (but not that at Bewcastle) and described in detail the dial in Kirkdale.

In 1877, Daniel Henry Haigh (1819–79), a clergyman and leading expert on Anglo-Saxon runes, who previously had occasionally dealt with sundials, wrote extensively on the Anglo-Saxon dials in Yorkshire.[4]

Four books illustrate the state of research at the turn of the century: the work of the American Henry Spencer Spackman of 1895,[5] that of Eleanor Lloyd and Horatia Katherine Frances Eden (1846–1945; daughter of Margaret Gatty) which was the 4th edition of Gatty's 1900 book,[6] that of Hans Löschner (1874–1956), who was a professor at the German Technical University in Brno and whose gravestone in Graz is decorated with a sundial,[7] and that of the sundial collector and secondary school teacher Joseph Drecker (1856–1931).[8]

Spackman only summarised what he found in articles and books. According to him, nothing happened between the time of the Anglo-Saxon dials, which – as he said – were made in the 10th and 11th centuries, until the 16th century; at least, no writings or sundials from that time seemed to have been preserved.[9] An advance, however, was the book by Lloyd and Eden, which

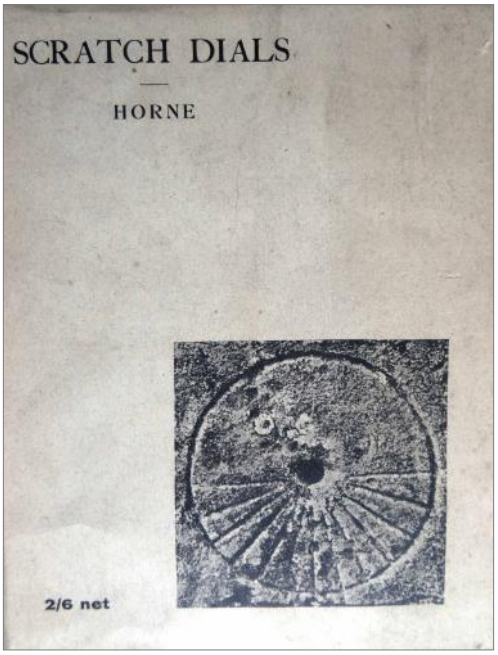

Fig. 2. Cover of Horne's book showing the dial of Baltonsborough Church, Somerset.

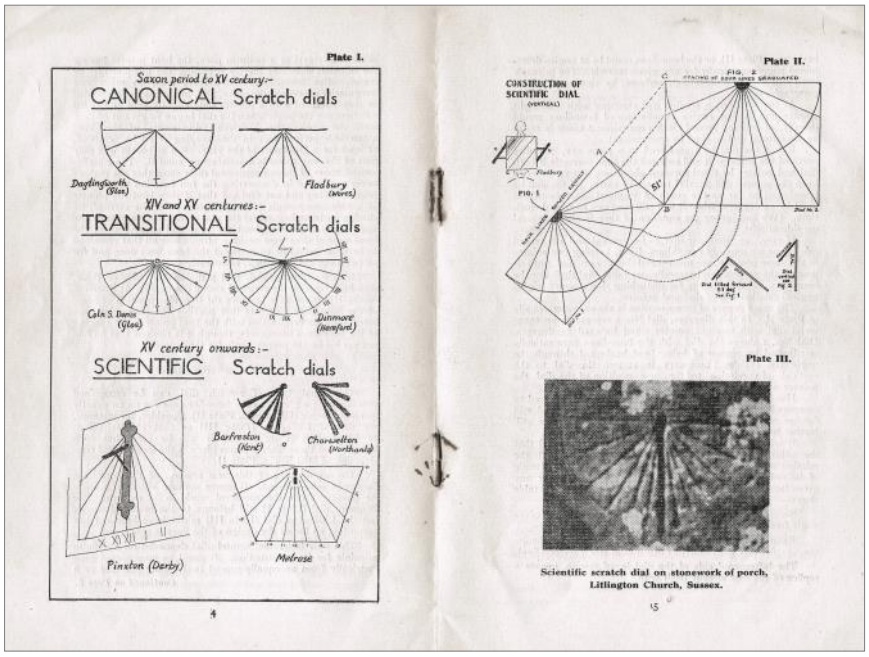

Fig. 3. Excerpt from Cole's Classification of Church Scratch-Dials.

presented the whole range of medieval sundials, including simple scratch dials.[10]

Löschner referred to Spackman in his statements about medieval sundials and to the art historian Josef Strzygowski (1862–1941)[11] in his statements about the two Byzantine sundials of Orchomenos and Thebes. Drecker noted in 1909 (my translation): "In Germany, as far as I can tell, we do not have a single sundial that can certainly be attributed to the Middle Ages. I was told of only one of the 12th century: remnants are to be found on the old St Peter's Church in Erfurt".[12] However, Drecker corrected himself in a lecture given in 1927 when he named two sundials in Germany, those at Freiburg Cathedral and in Otterberg.[13]

Further research in England was influenced above all by the contributions of the priest Dom Ethelbert Horne (1858-1952),[14] the physician Arthur Robert Green (1865-1955),[15] and the priest T.W. Cole,[16] since they were the first to recognise the wealth and variety of medieval sundials (Figs 2 and 3).

Along with Ernst Zinner (1886–1970), the director of the observatory in Bamberg, handwritten sources were included in the research for the first time. Excerpts from his manuscript's findings together with a directory of German places with remarkable sundials, which were mainly created before 1500, were published in 1939.[17] Significantly, he attempted a comprehensive inventory of all historical European sundials, for which he travelled throughout many European countries along with his wife who drove the car.[18]

The establishment of national sundial associations, which also dedicated themselves to the medieval sundials, put the research on a broader basis. Since then, especially in the *Bulletin* of the British Sundial Society, new posts on the subject can be found.

ACKNOWLEDGEMENTS

This article was first printed in German in *DGC-Mitteilungen* 153, 24–26 (spring 2018). I am grateful to Nigel Jones for pointing out some mistakes in my translation.

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For a portrait and CV of the author, see *Bulletin* 25(iii), September 2013. He can be contacted at *karlheinz_schaldach@t-online.de*

AN OCULUS DIAL FOR NORTHERN LATITUDES

Simple Interactive Bowl and Strap Dials in Pottery

MALCOLM BISHOP

This piece describes a form of dial (Fig. 1) answering some of the problems of preparing a dial in pottery, in miniature, and made suitable for a northern latitude, while perhaps taking a fresh approach to dial construction and practical use.

At least in part, inspiration came from the multiple scaphe dials described in the 2011 account of the Great Amwell dial boss[1] (all of whose gnomons had been lost), from the roofed spherical dials of antiquity, from the oculus of the

Fig. 1. Three prototype miniature oculus dials.

Fig. 2. A young person 'reading' the dial for 10:00 am. Above: oculus spot on datum line; below: finger obscuring oculus.

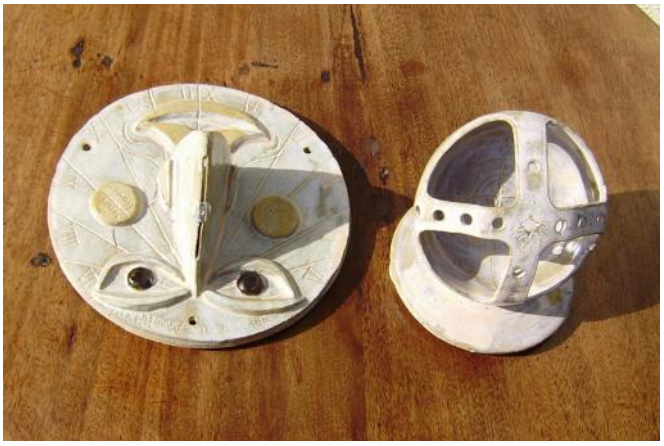

Fig. 3. The gnomon shadow of the more conventional parlour dial (left) indicating 4:15 pm GMT (LAT, EoT) on 6 August 2018 (51° 49′ N, 5°40′ W). The rim shadow of the oculus dial (right) indicating approx. 4:00 pm GMT (intersecting the horizontal and vertical datum lines where they cross). Dials aligned N–S (central joint of table top aligned N–S).

Pantheon[2] and from the oculus of Francesco Bianchini's great *meridiana* at Santa Maria degli Angeli e dei Martiri, Rome.

The current prototype parlour or conservatory oculus dials can also be described as 'finger' dials, as they have been designed to be interactive, and are to be read by blocking the sun holes in the band or strap with a finger (Fig. 2) in order to identify which time spot was on the median vertical datum line in the centre of the scaphe or bowl. This removes the need to peer closely at the dial to make out the time. The smallest of the three prototype dials has elaborate markings for the solstices etc. But these are seen, and then indistinctly, only by looking closely at the dial, whereupon as likely as not the head of the observer blocks out the sun.

The secondary supporting band lends essential strength and also allows for further sun holes to mark the solstices, which are read from the single central crossing point in the bowl.

From 5 am until 8 am and after 4 pm (Fig. 3), the rim of the bowl takes over to show times inscribed in the bowl on the horizontal datum line, and at 7 pm the shadow reaches the opposite rim.

In clay, slightly varying the shapes for the sun holes to be triangles, rectangles, or stars would do away with the interactive finger blocking. In a larger model, the sun holes or oculi can enclose numerals and the time be read directly from the datum line. Scaled-up versions in metal or other materials could indeed be both imaginative and decorative.

Accuracy at this scale, and in this material, is not the primary aim, so the fairly long 'dwell' of something like five minutes for each sun spot on the vertical datum line is not significant. The larger the dial, the smaller the oculus can be, and so the dial becomes more accurate as the dwell is proportionately reduced.

As an introduction to dialling for children, a dial of this sort can be made very easily from card strips and a convenient household bowl, making both construction and interaction a useful addition to the enjoyment of the dials in their educational function.

If, as here, clay is to be used, the challenge of construction when the band or straps are wet and weak may be best approached by first turning a double bowl and joining the two halves, allowing the whole to dry to leather hardness, and then carving away the unwanted clay. An exact sphere is not required as the positions for the sun holes can be established empirically over the course of a lazy sunlit day – pottery being a pursuit requiring considerable patience at all times! (Also required is a certain tolerance of shrinkage and distortion on firing which can upset the finest of calculations – see the variations in Fig. 1.)

The intended result, and certainly one to be aimed for with more accurate materials, is based on an equatorial design, with the holes at 15-degree spacing and ±23.5 deg for the solstices.

In the most successful, third, prototype the datum lines are reduced to their most basic, a vertical meridian and a horizontal equinoctial. Enthusiasts can of course make

Fig. 4. Above: the 'Time Frog and Time Toad'; below: the 'Time Toad' at noon in its garden setting (photo courtesy Mrs J. Holland).

Fig. 5. The 'Reading Wo/Man' dial at 11.00 am (approx.).

them as elaborate as they wish, though scribing the datum lines in the damp clay is somewhat fiddly, and in pottery this design of dial is not a mathematician's delight – though if copied in metal it could be.

The base is constructed so that the bowl is angled to suit the latitude at which the dial is to be used – again there is room for ingenuity in metal or pottery if an adjustable scaphe angle is wanted to make the dials 'portable'.

The problem of the gnomon for pottery dials has been addressed previously, and in March 2015 a description of the pottery parlour or conservatory dial with a tented gnomon which has been used here in Fig. 3 to give a (more accurate, it must be said) reference time beside the oculus dial, was published in the *Bulletin*.[3] This was followed in December 2015 by a brief piece on a related 'Time Frog and Time Toad'[4] (Fig. 4) operating on the same 'Langlois Slot' principle.

Not previously illustrated in the *Bulletin*, a further dial showed the versatility of this approach to pottery dials in the form of a 'Reading Wo/Man' (Fig. 5).

As it happened, the tent gnomon used in these previous pottery dials in order to overcome the problem of the brittleness of pottery turned out to share characteristics both with the Nicholson 'Spot-on' dial and the French Langlois dial of 150 years earlier, and as there is little new under the sun, a similar sharing of ideas may well be apparent here too. If these latest dials are indeed original, an addition to the 'Oculus' category of dials seems worthwhile.

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Sundial on a Christmas Card

The Royal Shakespeare Company's official Christmas card for 2017 featured a dial that I had made during the year, and I got a mention on the back of the card.

The figure holding up the gnomon is Shakespeare, water cut from 8 mm bronze, and the motto reads "Life's but a walking shadow". The dial is coloured with Liberon antiquing fluid.

Brad Dillon

IN THE FOOTSTEPS OF THOMAS ROSS
Part 25: The Newbattle Abbey Sundials and their Copycats

DENNIS COWAN

Newbattle Abbey near Dalkeith in Midlothian was originally a Cistercian monastery, but became next a stately home and then in 1937, after being given to the nation by the 11th Marquis of Lothian, a College of Education. It was funded by the State, but the Secretary of State for Scotland announced in 1987 that funding was to be withdrawn. Happily, however, the Abbey has survived thanks to new funding that was established for its use as an adult education centre.

The building underwent several modifications, most notably in 1650 by John Mylne IV who took over from William Aytoun as master mason of Heriot's Hospital in Edinburgh where there are eleven sundials incorporated into the building.[1] In another sundial link, he was the son of the John Mylne III who was responsible for the fabulous sundials at Drummond Castle in 1630 and the Palace of Holyroodhouse in 1633,[2] and it is thought that he assisted his father with this latter commission. However, it is unlikely that he had anything to do with the sundials here as it is believed that they are earlier than 1650 (his involvement with Newbattle), as we shall see later.

There are two identical sundials in the grounds of the abbey, and in volume 5 of *The Castellated and Domestic Architecture of Scotland*,[3] Ross comments that:

"There are two dials here [Fig. 1] *of a very monumental description. They are exactly alike in all respects, and stand in the gardens on the east side of the abbey. They are not, however, in their original position, having been moved from another part of the grounds. In appearance they bear a certain resemblance to articles of goldsmiths' design, and the pedestal seems thin for such a massive superstructure; this is, however, compensated for in a great measure by the wide-spreading steps on which the structure stands. The dial part is octagonal, and contains two tiers of oblong spaces. Four of the spaces, however, do not contain dials, but are filled (1) with coroneted initials of William, Earl of Lothian; (2) those of Annie, Countess of Lothian; (3) the arms of the earl; (4) a figure of the sun, the crest of the family. These are all drawn in detail* [Figs 2–5], *as is also one of the slightly hollowed dials, where the profiles of diagonally opposite faces act as gnomons* [included in Fig. 2]. *Sir William Ker, of the Ancrum family, married, in 1631, Lady Ann Ker, who succeeded to Newbattle in her own right. He was created earl in the same year, and the dial was doubtless erected between then and 1667, the year in which the countess died*. The gnomons, figures, and*

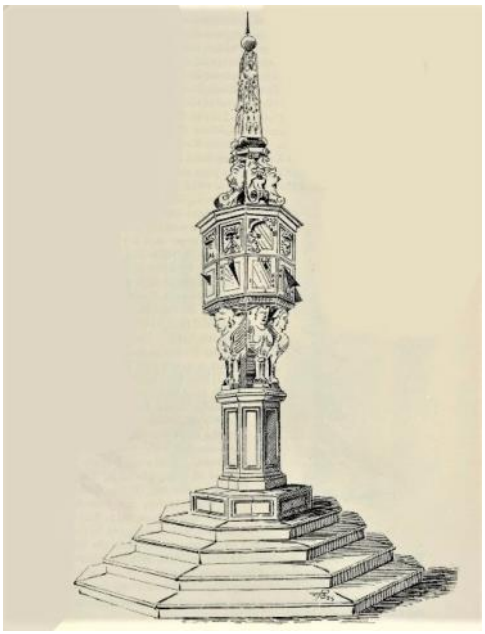
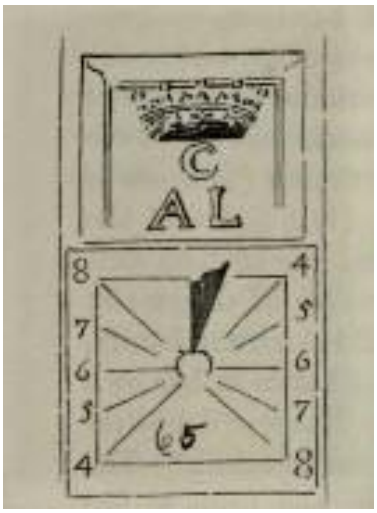


Fig. 1. Ross's sketch of one of the Newbattle Abbey dials.



Figs 2 and 3. Left: the coroneted initials of Earl William of Lothian and the west-facing sunken dial; right: the initials of Countess Annie of Lothian above the north-facing dial.

Figs 4 and 5. Left: the arms of the Earl; right: a figure of the sun with a crown above, the family crest.

Fig. 6a. The west and south-west faces showing the sunken dial-pair, and the family crest, in the upper tier.

Fig. 6b. Close-up of the sunken west-facing dial-pair with its two gnomons and two sets of hour lines.

lines of the dials have all been gilt. The total height, measuring from the surface of the upper step, is about 16 feet.

"Copies of these dials have been erected by Lord Haddington and Lord Home at their mansions."

" Since the above was written, Lord Lothian has found, from papers at Newbattle, that the date of the dials is 1635."*

The two dials today are still in the same place as they were when Ross saw them, that is, to the east of the abbey. The confirmed date of AD 1635 has since been carved onto the pedestals of the structures.

The sundials are as Ross described, except for an error in his descriptions of the upper tier, where he mistakenly states that four rather than six of the spaces do not contain dials. Two of the spaces contain the arms of the Earl (NW and SE), two contain the family crest (SW and NE) whilst one each have the coroneted initials of the Earl (S) and the Countess (N).

Each of the other two spaces, on the east and west faces, has a sunken dial-pair with two facial profiles acting as gnomons (Fig. 6a and b). The lower-left dial and gnomon

Fig. 7. The sundial to the left partially enclosed by a yew hedge.

Fig. 8. The sundial to the right with Newbattle Abbey behind.

Fig. 9. The south face of the Newbattle right-hand sundial and the adjacent south-east and south-west faces, with the dials and decorated spaces above them. Note the huge crack near the top of the south-east face.

Fig. 10. The north-east face of the Newbattle right-hand sundial and the adjacent north and east faces, with the dials and decorated spaces above them. Again note the huge crack, this time on the north-east face.

are for 6 pm to 9 pm whilst the upper-right dial and gnomon are for 1 pm to 6 pm. As far as I can recall, I have never seen a configuration like this on any other Scottish dial.

A mysterious "65" has appeared in Ross's sketch at Fig. 3. There is no reason for it being there, and this must be an error.

The two sundials today are shown in Figs 7 and 8. The one to the left as viewed from the abbey (Fig. 7) is enclosed on three sides by a yew hedge, whilst the one on the right is more open (Fig. 8), with some remains of a hedge.

The Earl's initials are above the south-facing dial (Fig. 9) and those of the Countess are above the north-facing dial (Fig. 10). All numerals are Arabic.

The dial block is supported by four sphinxes (Fig. 11) above a panelled octagonal pedestal on a stepped plinth. Above the dial block are four faces supporting a decorative obelisk finial with a ball and needle top all sitting on four balls (Fig. 12).

The metal gnomons have been replaced at some point and all still exist, but only in part in some cases. The dials appear at first glance to be in reasonable condition, but a

Fig. 11. The sphinxes supporting the dial block on the Newbattle left-hand sundial.

Fig. 12. The finial complete with ball and needle of the Newbattle right-hand sundial.

Fig. 13. Lord Home's dial in the King's Park.

Fig. 14. The King's Park dial showing the south face with the adjacent south-east and south-west faces, with the dials and decorated spaces above them. Note the differences from the Newbattle dial at Fig. 9.

Fig. 15. The Tyninghame dial in the Italian garden showing the different base.

Fig. 16. Three of the blank faces of the Tyninghame dial with the decorated spaces above them, including the H for Haddington surmounted by a crown.

close inspection reveals some very serious cracks, which should really be dealt with fairly soon.

Some time prior to 1885, these dials must have impressed Lords Haddington and Home, as they both commissioned copies presumably with the permission of the Earl of Lothian.

Lord Home's copy of the sundial was sited at Douglas Castle in Lanarkshire, the former family seat of one-time Prime Minister, Sir Alec Douglas-Home. It was removed to the King's Park in Glasgow in 1930 where it remains to this day (Fig. 13). Douglas Castle itself was demolished in 1938.

The sundial is almost an accurate copy of the Newbattle dials but with some obvious and expected alterations. It has of course the initials and arms of Lord Home and his wife rather than those of the Earl of Lothian (Fig. 14). The date of 1885 has been included, this time on the base rather than the pedestal as in Newbattle's case. In addition, the motto of "Horas non numero nisi serenas" which can be translated as "I count only the sunny hours" is carved around the base.

The Newbattle dials both have a form of cross patty for noon on their south-facing dials, but the King's Park dial does not have this, having a 12 instead. Surprisingly, this dial is not aligned with the cardinal directions; for example the south-facing dial in Fig. 14 clearly declines slightly to the west.

None of the metal gnomons remain on this sundial although most of the stubs exist. The ball and needle top of the finial is now missing.

Historic Environment Scotland's website for this sundial[4] suggests that three copies of the Newbattle sundials may have been made, but I can find no other reference anywhere regarding this potential third copy.

Lord Haddington's replica sundial was installed in the Italian garden at Tyninghame House in East Lothian (Fig. 15). This mansion was acquired by his ancestor in the 17th century but was sold in 1987 when it was divided into flats and the contents of the house sold. Luckily the sundial survived and remains in the Italian garden.

The big difference, however, is that the eight main dial faces were never marked out, so it is a non-sundial! Obviously it has the crests and arms of Lord Haddington along with an H surmounted by a crown (Fig. 16). It does not have the upper slightly sunken dials of Newbattle and King's Park and the needle at the top of the finial is missing. Also different is the stepped base of these other two dials. Actually I quite like the more formal base of this non-dial.

And so on to the third copy. Is there one, or did Historic Environment Scotland confuse it with the second dial at Newbattle? The investigations continue.

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Happy 25th Birthday, NASS!

This year, 2018, marks the 25th anniversary of the North American Sundial Society. There were many celebrations in August at the NASS conference in Pittsburgh and this magnificent birthday cake was on show prior to the conference dinner. It was later cut up and served as a final course.

Next year, 2019, will be the 30th anniversary of the British Sundial Society and this will be celebrated at the conference in Bath. I gather that the organisers are planning a number of treats for the delegates but it will be serious challenge to produce a cake on a par with this one!

I had a birthday of sorts myself at the NASS conference: late on the final day, I passed my 40-millionth minute.

FHK

A FEW FINE FRENCH DIALS

MIKE COWHAM

A holiday in France in September 2018 took my wife Val and me to some interesting parts, just north of Provence, with some fine dials in them. The following are just a few that we particularly liked.

Dials from Ardèche – Département 07

A rather unusual dial was found in the cemetery at Malarce-sur-le-Thines (Fig. 1). It is carved from stone, horizontal and fairly small but has no gnomon. This has probably been lost some time ago. However, there is no evidence showing how it was fitted. The dial is on a grave of DANIEL TOUVENIN 1953–1983 and it covers the hours 6–12–18 in half-hour divisions.

We saw a large dial that was constructed in the middle of a traffic roundabout at Vallon-Pont-d'Arc (Fig. 2). Although nicely laid out, with a fine tapered pole-like gnomon and relatively large, it was not ideal for telling the time owing to the fairly busy traffic around it and the impossibility of viewing the dial clearly from any nearby building or other high position. I just photographed the dial from the outer edge of the roundabout. The hours were simply marked by some darker rounded stones, with one missing, next to the arrow road sign.

Fig. 3. Vertical meridian dial on a tower at Anduze.

Fig. 1. Small dial in a cemetery at Malarce-sur-le-Thines.

Fig. 2. Large dial on a roundabout at Vallon-Pont-d'Arc.

Dials from Gard – Département 30

On an old tower in the town centre of Anduze we found a meridian dial set below a clock (Fig. 3). It appears to be painted on a metallic sheet. The dial uses a sun-shaped nodus with a small hole and the resulting spot of light shows the time, in 15-minute intervals for one hour either side of noon. The spot of light will also track along the declination lines marked with the zodiac signs on specific days of the year.

A colourful pair of dials was also seen painted on an old country hotel at Mialet (Fig. 4). These dials are dated at the top, 1781. They are joined together on the corner of a wall, one facing south-west and the other south-east.

As we were in the area close to Saint-Hippolyte-du-Fort, which is famous for its dials, we could not resist another

Fig. 4. Painted dials on the hotel at Mialet.

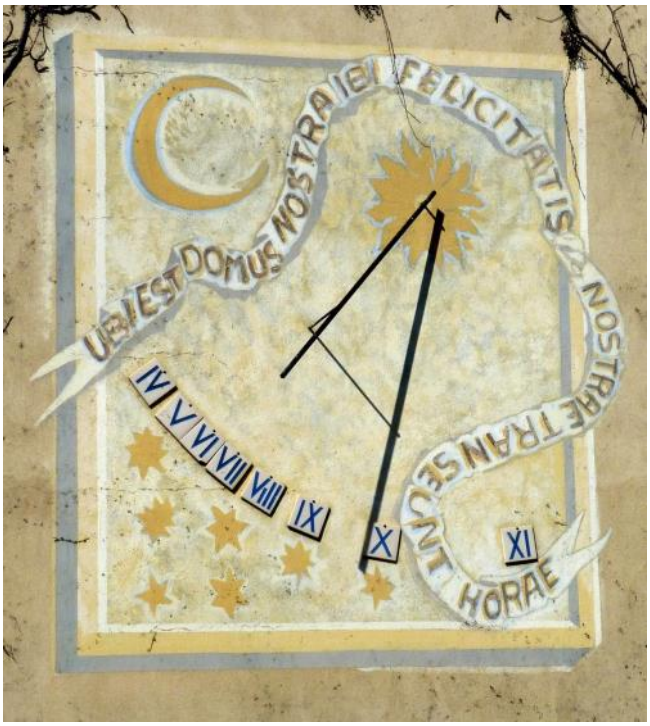

Fig. 5. One of the fine dials at Saint-Hippolyte-du-Fort.

visit. This small town has about 30 dials spread all around and they are all easily visible. They are generally very colourful. Most streets there have at least one dial in them. Its Tourist Office can provide a leaflet showing where each dial may be found. If you are in the area it is really worth spending some time there to see these fine dials. We have now been three or four times. Fig. 5 shows just one of these colourful objects. Its motto UBI EST DOMUS NOSTRA IBI FELICITATIS NOSTRE TRANSEUNT HORAE translates as "Where our house is, hours go by for our happiness."

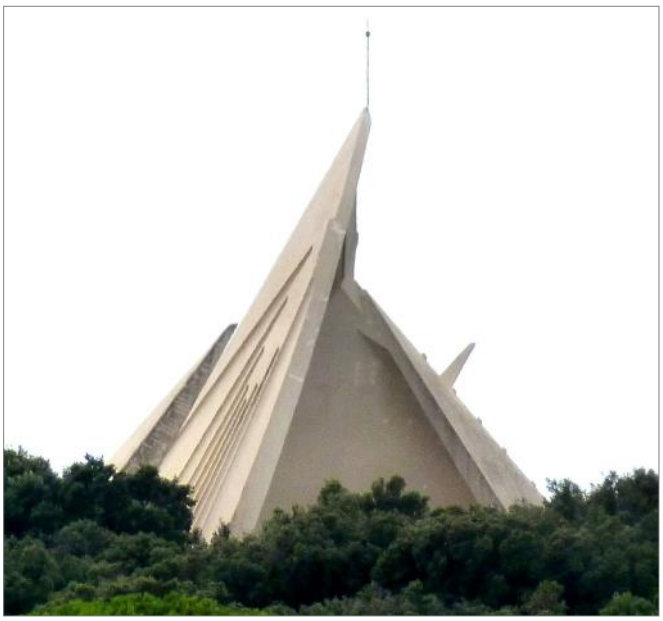

Fig. 6. Huge dial at motorway services near to Tavel.

A further dial that we wished to see was located at the services on the A9 motorway between Orange and Nîmes (Fig. 6). We did not travel on this motorway as the entry and exit points were some distance apart, and because a toll must be paid to use it. We also did not know at that time whether the dial was on the north or south side of the motorway, so two journeys would probably be required. As the dial site was adjacent to a service station area we thought that it could be accessible from ordinary roads. One of these did take us to the boundary fence but the entry gates were locked, and the dial, which appears to be about the size of a large house, was just visible from a couple of points. It stands on the north side of the motorway, to the west of Tavel. A long-distance shot, with a telephoto lens, shows here some of the dial details. (The dial is quite visible on Google from satellite and on the ground.) Next time that we visit the area we will plan to travel on that motorway to see the dial in detail.

Fig. 7. Main square at Châteauneuf-de-Randon.

Fig. 8. Dial at Châteauneuf-de-Randon.

Dials from Lozère – Département 48

A trip one day took us to the village of Châteauneuf-de-Randon where we found a large vertical dial painted on the wall of the Post Office in the main square (Figs 7 and 8). It is very colourfully painted, its size being limited by the windows of the building. Below the dial is a double-headed eagle and the motto DEO JUVANTE, meaning "With the aid of God" (Fig. 9).

Another large dial that we saw was at Le Pompidou where the gnomon is a long shepherd's crook being held by the shepherd's wife. The shepherd and a goat stand either side of her (Fig. 10). The dial has only the hour lines marked but the numerals were not easily visible, with just the VIII and IV clearly to be seen. At the northern edge are a row of ten stones carved with people's faces and names, such as in Fig. 11. Across the road, as may be seen indicated by an arrow near the top right of Fig. 10, is a small round dial made on a wooden board on the front of a house, shown here as Fig. 12.

Fig. 10. Dials at Le Pompidou.

Fig. 9. Detail of eagle and motto.

Dials from Puy-de-Dôme – Département 63

On our way down to our accommodation in Saint-Ambroix, which is just to the north of Alès, in Gard, we stopped at Thiers where we discovered a large horizontal dial, with a vertical gnomon, laid out showing just the hours X-XII-II with half-hour intervals (Fig. 13). Unfortunately we were there later in the day so the gnomon's shadow had moved well beyond the calibrations. Its gnomon (Fig. 14) is on a

Fig. 11. Faces and names on the dial at Le Pompidou.

Fig. 12. Dial on a house overlooking the large dial at Le Pompidou.

Fig. 13. Meridian dial at Thiers.

Fig. 14. Vertical gnomon of the Thiers dial with a sword on top, its round top acting as the nodus.

pillar with a vertical sword on its top. The sword has a handle with two sets of 'ears'. At its top is a small ball nodus and the shadow of this ball is used for reading the time. It is basically a meridian dial but it has been extended so that it can still function if the sun does not shine exactly at noon. It may therefore be used over a four-hour period. The layout of the dial has only date lines for the equinox and the two solstices. Interestingly, there are also two radial dotted lines either side of the XII line which are marked with the initials, SC and BR. These show the time of noon at the two places that are twinned with Thiers, these being Schrobenhausen in Germany and Bridgnorth in Britain. The full details of how the dial is to be used are given on a panel on the main column of the gnomon pillar. These include the longitude correction of 14 minutes and Equation of Time figures for every fifth day of each month.

Fig. 15. Early dial on Thiers Church.

The church in the town of Thiers also has an early dial (Fig. 15). This has 11 lobes and a rather long (modern) horizontal gnomon. It is constructed like several other early French dials, this one now being fitted with a cover above to protect it from the weather. The dial is mounted high over the windows on the south side of the church. A house next to the east end of the church also has a dial on its wall, but that dial really needs re-painting.

Dials from Vaucluse – Département 84

We visited the town of Valréas where the 'Tour des Cordeliers' has dials on all four sides (Fig. 16). The tower is surrounded by houses, so detailed photography of each dial is not very easy. The south dial was not seen on this visit, but I do have a picture of it from a former visit showing a symmetrical layout as would be expected from a direct south-facing vertical dial. However, on looking carefully at the latest photographs taken, some strange details were noticed, and the other dials have been generally wrongly delineated, perhaps at a restoration. The dial on the east face was illuminated by the sun while we were there (Fig. 17). This dial, which initially looks like a south-east dial, appears to have the X close to its noon position. We were there at 12:10 (summer time) but this would be the same as 10:10 Greenwich Time. (Its longitude makes Valréas about 20 minutes ahead of Greenwich time, so this would actually read about 10:30.) Studying further

Fig. 16. Dials on the Tower at Valréas.

the dial on the north side of the tower (Fig. 18), I noticed that the hours were shown going clockwise with noon at the bottom. This is what we would expect from a horizontal dial or a dial from the southern hemisphere! Also its gnomon is not parallel to those on the other faces, as it should be. Finally we were able to photograph the west dial, which looks like a south-west dial. It is partly hidden by a house (Fig. 19). (The picture shown was taken on our earlier visit.) It shows the hours XI–XII–VIII. If this dial and the east dial were correctly calibrated they would have all of their hour lines parallel and the gnomons parallel to the dial faces. So, the true functions of most of these dials are quite a mystery to me!

Our return journey took us through the Alsace where we had the Safari in 2008.[1] It was great to see some of the fine dials there again and to enjoy the different wines and fine Alsace cooking.

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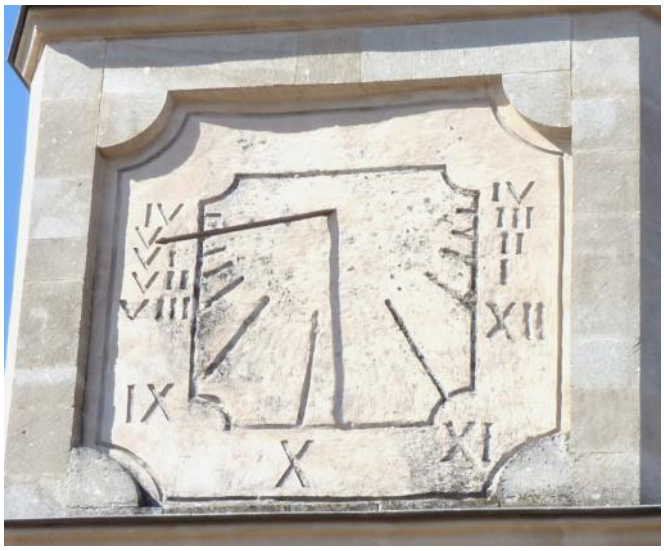

Fig. 17. East dial at Valréas.

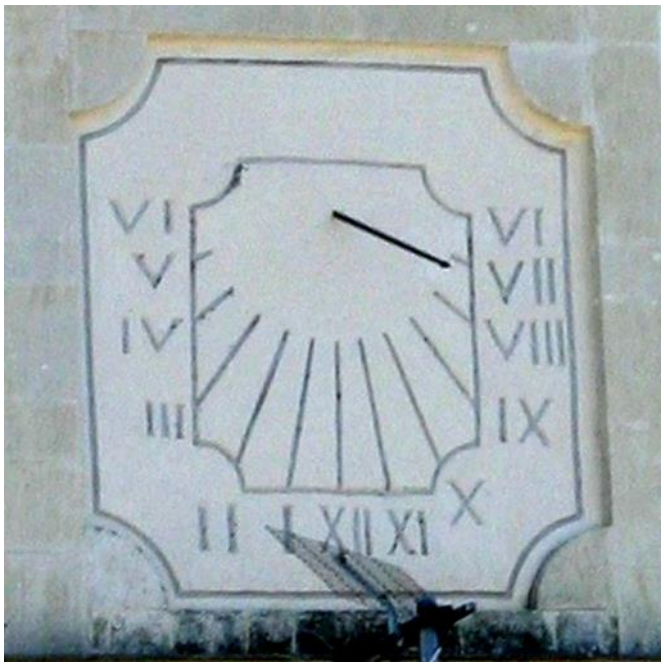

Fig. 18. North dial at Valréas.

Fig. 19. West dial at Valréas.

HOMAGE TO A SUNDIAL

SUE MANSTON

On 1 December 1886, munitions workers at the Royal Arsenal founded the Dial Square Football Club, named after the section of the armaments factory where its players worked. Dial Square itself was named after the sundial on Dial Arch (SRN 2321, Fig. 1) which was positioned at the entrance to help workers keep good time.

The name of the football club was changed to Royal Arsenal only a month later. The Royal Arsenal carried out armaments manufacture and explosives research for the British armed forces at a site on the south bank of the River Thames in Woolwich, south-east London.

In 2006 the club moved to the Emirates Stadium in Holloway, London. Since this move, a design agency based in London — 20.20 Limited — has been helping Arsenal FC to develop 'fan experiences' and to make the stadium feel like home.

Dial Square is a new hospitality space for fans, designed to celebrate the birthplace of the club at the Royal Arsenal. As part of this work 20.20 designed a marble mosaic to welcome guests into the space. This floor mosaic pays homage to the sundial on Dial Arch (Fig. 2). It measures an impressive 3.5 metres by 3.8 metres and the date at the top — 1886 — is the date the club was formed.

In June 2018 the BSS Help and Advice Service was contacted by 20.20 regarding the 'missing seven'. The hour line for 7 am is shown on the sundial, but there is no Roman numeral VII. "Why not?" they wanted to know.

Fig. 1. The sundial on Dial Arch (SRN 2321). Photo courtesy of Charles Watson.

Fig. 2. The floor mosaic at the Emirates Stadium. Photo courtesy of 20.20 Limited.

The dial on Dial Arch faces around 18 degrees West of South; the earliest it will receive sunshine is about 6:55 am, and the latest is about 6:55 pm. We might expect such a sundial to have 7 am marked, especially as the hour line exists. Anticipating a complicated mathematical explanation, 20.20 were relieved to hear that the most likely reason was a practical one — not enough space! They were reassured that this is not an uncommon design consideration.

I do hope the football fans will appreciate the design, skill and workmanship that has gone into making this mosaic — as they rush to the bar!

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NEWBURY ONE-DAY MEETING

22 September 2018

About 40 BSS members and visitors met once again at Sutton Hall, Stockcross near Newbury for the annual one-day meeting. We have come to expect sunny weather on this occasion but unusually this year it rained for most of the day. As always, however, the event was splendidly organised by David Pawley, and Wendy kept us supplied with plentiful tea and coffee, and a wide selection of biscuits and other nibbles.

Morning

Peter Ransom, our regular Master of Ceremonies, welcomed us all and, in particular, those attending the Newbury Meeting for the first time, also visitors to this country from Spain, Latvia and the US. He then introduced our first speaker...

Martins Gills: *Experience of Placing and Aligning Boulders for Sundials*

While making and setting up many sundials, Martins Gills has faced the practical problem of properly aligning boulders that are to serve as the basis for the dials. It is quite traditional in Latvia to use irregularly shaped glacial erratics for design purposes, often preserving their original form (Figs 1 and 2). The design can be either projection equatorial sundial or sundials with inclined dial plates. If you set up the stone first, it must be almost perfectly aligned relative to North and the horizon. One face may stand out as the obvious one to use or you may choose to prepare one face at a stone workshop. The selected face must be placed at the correct inclination dictated by the design. The solution is to use a custom-made tool. Martins typically makes it from plywood, and its size and angles correspond to the face of the stone that is to be south-facing. The position of the stone is controlled by means of the horizontal alignment of a prism and the N–S direction of selected markers. In most cases this goes through several iterations until the boulder gets properly oriented.

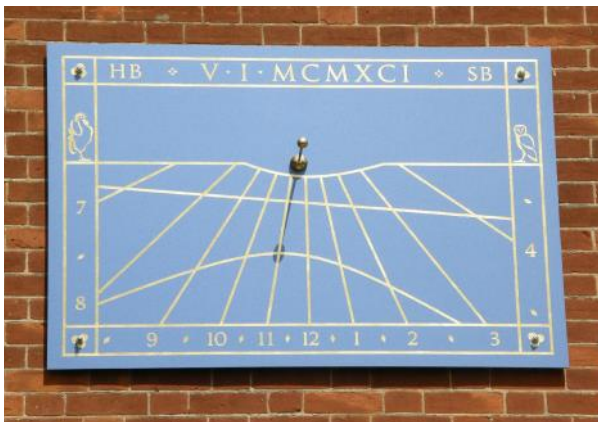

Fig. 3. The completed Trespa® dial. Photo: Frank King.

Frank King: *The Practicalities of Trespa® – A Novel Material for Sundials*

Frank King introduced a sundial which was inaugurated on the day of the summer solstice (see Fig. 3). He noted that the dial plate was made from a panel of Trespa®, a cladding material much used on high-rise buildings.

A panel consists of a sheet of resin sandwiched between two very thin decorative skins. Panels come in several thicknesses and skins are available in numerous colours.

Fig. 1. From this…

Fig. 2. … to this.

Photos: Martins Gills

Frank explained that abrasive blasting (using ground up aluminium oxide) was employed to abrade through the decorative skin down to the resin layer below. The revealed resin was later gilded by hand.

Before blasting, a mask had to be made by using a computer controlled knife to cut out the design in a protective film. The film has a rubbery texture and knife-cuts close up so they effectively have zero thickness.

All design is therefore by means of outlines. For example, to create a letter 'O', the knife has to draw two concentric rings and the O-shape is then peeled off by hand.

This is a particular problem with constant-declination lines. One cannot simply specify the required hyperbola for the summer solstice arc because it would have no thickness. Instead, one has to specify the two flanking arcs that mark the edges of the hyperbola and these arcs are not themselves hyperbolas.

Lupe Feria: *Nou Barris Sundials Walk*

Nou Barris is one of the ten districts of Barcelona. It has a rural past: until the mid-20th century there were dispersed farmhouses and it was part of the old village of Sant Andreu de Palomar (nowadays Barcelona). This rural past means that Nou Barris still has several farmhouses with the typical Mediterranean sundial on their façades. Lupe described an attractive walk which includes not only four main sundials, but also a recent one. It is analemmatic and it was built in 2015 by collaboration between the Catalan Sundial Society (SCG) and a Nou Barris historical group (AHRNB).

There is a great diversity of sundials in this district and Lupe emphasized the value of their historical heritage. Most of them have protected status but there is still one that needs to be considered because it is the only one in Nou Barris which has a motto and incorporates *sgraffiti*. Lupe is working in collaboration with the historical group to achieve this.

Peter Ransom: *Dialling Scales: Examples and Practicalities*

Dialling scales are used to lay out the dial plate without the need to do any complex calculations. They were proposed by Samuel Foster in 1638 and a facsimile of his book was shown. In 1658 George Serle and Anthony Thompson produced them on a ruler. The scales can also be used to reverse engineer existing dials to determine their latitude if the gnomon is missing.

The scales remained virtually unchanged for 250 years. Peter handed around an ivory and brass sector by Watkins of London, probably made around the late 18th century. There are scales for latitude and hour lines engraved on it, but these are very small. Since the sector was used to enlarge dimensions proportionally, the dialling scales would probably be enlarged according to the size of the dial to be laid out.

He then passed around a brass dialling scale of just over a foot in length, made by Edwin Cholmondeley Middleton of 84 Stanhope Road Birmingham. The scale is dated 1900. Fred Sawyer of the NASS had kindly provided a PDF of Middleton's typewritten instructions, and this was put on a table for those present to examine.

The next dialling scale passed around was the NASS dialling scale of 1995 by Ron Anthony. This shows more scales than Middleton's example. The final example shown was Tony Moss' Lindisfarne dialling scales. This time there are two separate pieces, one with the latitude scale and the other with the hours scale. Having the two scales on separate rulers makes the reverse engineering far simpler than having them both on the one ruler.

Peter then demonstrated how to lay out a horizontal dial and how to use the scales to reverse engineer a dial to find

its latitude. The four sets of scales were left on a table for people to use during the break (Fig. 4).

Martins Gills: *More than 80 London Sundials Visited: Observations and Ideas*

Martins is an occasional visitor to London, and over the course of several years has had the opportunity of visiting many of the sundials located there. No doubt, everybody knows that the capital of the United Kingdom has plenty of attractions in terms of architecture, design, art, history and science, but few outside the sundialling world know about the excellent collection of sundials. There are more than 100 publicly viewable sundials, and so far the speaker has managed to visit personally slightly more than 80. As the starting point, the information from the BSS Fixed Dials Register was used. Additional references to dials were found on the Internet. Some were not found, or were not accessible. On site, the most common problem was the missing information – who made the sundial, when and why. Individual sundials have been vandalized or gone.

Martins asked: what if the BSS could start taking care of the sundials in certain territories? Exploring in detail, collecting more information. One way of increasing awareness of sundials and about the Society could be adding some plaques

Fig. 4. Top to bottom: Watkins' sector with dialling scales in ivory and brass; Moss' Lindisfarne Sundials dialling scales (two scales); Middleton's dialling scales in brass.

Photo: Peter Ransom.

next to the sundials. Or, the Society could raise awareness of the lost and damaged ones. Another proposal is to prepare an electronic or even a printed version about the sundials in London. There are some sundial trails on the Web, but not about 100 sundials. Could there be anybody interested in joining this London sundial guide project?

David Brown: *Some Ups and Downs of Lettering and Sundial Projects*

In the final talk of the morning, David Brown described some problems he has encountered in lettering and sundial projects, and some of the lessons learned: check and check again before cutting, make sure your builders are fully briefed, keep a close check on processes outside your control and, finally, be patient! An article based on his talk appears on pages 50–51 of this issue of the *Bulletin.*

After David's presentation, we posed for the customary group photograph. Owing to the inclement weather, the picture had to be taken inside the hall.

Afternoon

Kevin Karney: *A Nice Little Gnomonical Problem*

Kevin Karney showed images of an old painted wall dial from North Wales in need of restoration (Fig. 5). It had been examined by Mike Shaw and himself. The dial is immovably imbedded on a west-declining wall of an ancient house. But it was designed as an east decliner. The on-site visit concluded that the best approach was to redecorate and leave as an ornament rather than a time teller. Detailed work to find its design latitude and declination was fruitless. Frank King mentioned that he had seen many dials that were incompetently delineated and that attempts at analysis are indeed often fruitless. Restoration work has been handed to Harriet James, and she has sent paint samples for analysis to John Davis.

Kevin Karney: *A New Website*

In a separate talk, Kevin presented his extensive new website that is dedicated to the Equation of Time.
See *https://equation-of-time.info*

This profusely illustrated site has three main chapters:

1. With ten sub sections - Basics of the EoT (time scales, why it occurs, how it is calculated/used/displayed and much more).

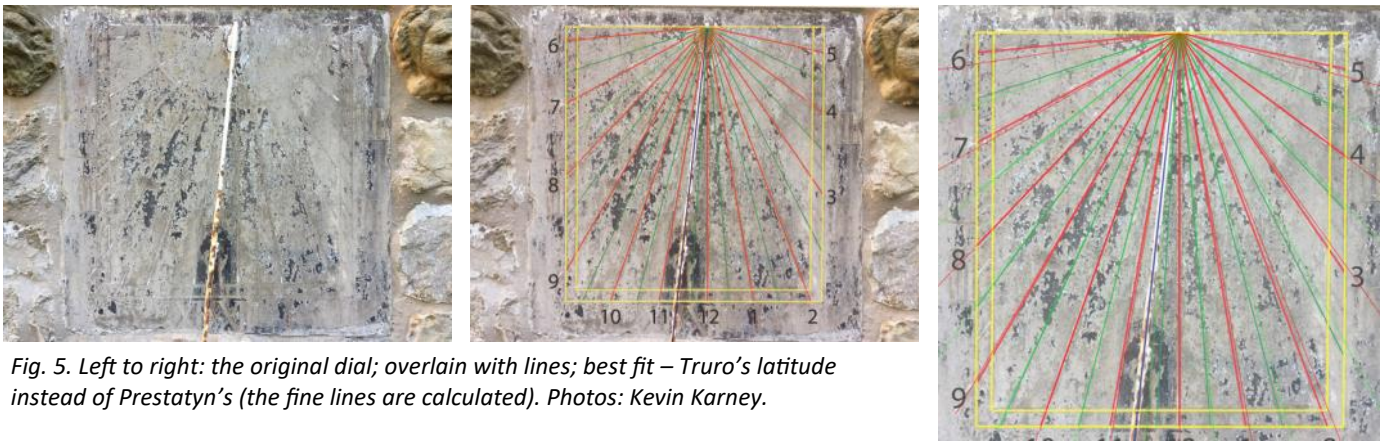

Fig. 5. Left to right: the original dial; overlain with lines; best fit – Truro's latitude instead of Prestatyn's (the fine lines are calculated). Photos: Kevin Karney.

2. With eight sub sections - Sundials that are (or can be) EoT corrected.
3. With five sub sections - Mechanical means to simulate the EoT.

It is hoped that anyone who is interested will contribute to this effort.

Graham Parks: *A Sundial for a North Wall*

Graham Parks gave a short talk on the long road to his creation of a sundial on a north-facing wall in his garden. Using a mirror to throw a spot of light onto the wall, its realisation became a five-year labour of love and a celebration of the births of his grandchildren.

The full story appears on pages 20–27 of this issue of the *Bulletin*.

David Brown: *The BSS at Cheney School, Oxford*

David Brown read a letter he had received from Dr Lorna Robinson, Director of the Iris Project and Classics Centre at Cheney School, Oxford. She is inviting the BSS to take part in a 3-hour event at the school in the afternoon of 27 March 2019. There will be representations from several well-known local and national museums when it is hoped that a new museum – The Rumble Museum – at the school will be accredited. David gave illustrations of events at Cheney School that BSS had taken part in over the last four years, with sundials and sundial-making being made available to young and old alike.

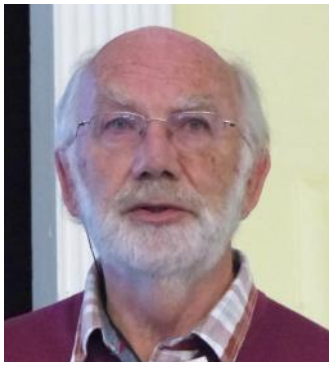

Fig. 6. Schematic diagram of the ISIS 800 MeV pulsed proton synchrotron at the Rutherford Appleton Laboratories, used for the muon and neutron experiments on early sundials .

David appealed for volunteers to help with the 2019 event, and asked anyone who is interested to contact him by email: *david@davidbrownsundials.com*

More details can be found in the Newsletter accompanying this *Bulletin*.

Martins Gills: *How I Typically Use the sundialatlas.net Website*

Whenever possible, Martins tries to visit all possible open-air dials during his trips to different countries. The website *sundialatlas.net* has become one of the most important information sources about sundials in almost every country. It was created by diallist Fabio Savian (Milan, Italy), but the data about sundials has been submitted by numerous contributors. For every sundial it is possible to specify its location, type, gnomonic data, photographs and free comments. Every sundial has a unique identification number. It is possible to search for sundials, to display the locations on a map or view as gallery. Additionally, the website has some interesting features such as a paper sundial generator and a gnomonic laboratory for calculating layouts of various sundials. Martins said that in relation to the BSS, there is an issue – there are no cross-references between the British dials in Sundial Atlas and the BSS Fixed-Dial Register. He felt that introducing the cross-references would provide additional value for both data sets for the benefit to everyone interested in sundials.

Frank King commented this presentation with a note about the cultural difference between British/American and Italian way of classifying the type of sundial and its parameters.

Key problem – we define the sundial with transformations in the order latitude–azimuth–lean, while Italians describe it as latitude–lean–azimuth. This gives two different descriptions for the same sundial.

John Davis: *Particle Physics Experiments at Rutherford Appleton Laboratory*

As promised in his introductory talk at the Norwich Conference in April, John

Davis reported preliminary results of his experiments at the Rutherford Appleton Laboratories (RAL) near Oxford, using several 14th to 18th century copper-alloy sundials as specimens. The experiments used neutron diffraction and negative muon spectroscopy techniques over the allocated three days of beamtime at the RAL 800 MeV pulsed proton synchrotron (Fig. 6): a full *Bulletin* article will follow in a later issue.

Notes by the speakers

Group photo and speakers' photos: Mike Shaw

HÖRUP CHURCH SUNDIAL, SWEDEN

MARTIN JENKINS

Upon the death of my wife Janet's parents in 2016, she inherited a family Bible. In the frontispiece of the Bible is a print of a famous altar painting known as 'Consolator' by artist Carl Bloch. The original altarpiece was painted in 1875.

Carl Bloch (23 May 1834 – 22 February 1890) was a Danish painter. He was born in Copenhagen and studied at the Royal Danish Academy of Art (Det Kongelige Danske Kunstakademi) under Wilhelm Marstrand. Bloch's parents wanted their son to enter a respectable profession such as an officer in the Navy. This, however, was not what Carl wanted. His only interest was drawing and painting, and he was consumed by the idea of becoming an artist. He went to Italy to study art, passing through the Netherlands, where he became acquainted with the work of Rembrandt, which became a major influence on him. His early work featured rural scenes from everyday life. From 1859 to 1866, Bloch lived in Italy, and this period was important for the development of his historical and religious style. Between 1865 and 1879 he was commissioned to produce 23 paintings for the King's Chapel at Frederiksborg Palace. They are all scenes from the life of Christ which have become very popular as illustrations. The originals are still at Frederiksborg Palace. Bloch's altarpieces, however, are at Holbaek, Odense, Ugerloese and Copenhagen in Denmark, and at Löderup, Hörup and Landskrona in Sweden.[1]

In late June 2018, Janet and I set off on a seven-week tour of Scandinavia, the Baltics, and northern Europe to visit friends. Visiting friends in Malmö, Sweden meant that we had to make only a short deviation from our intended route in order to visit the church at Hörup which contains the original Carl Bloch 'Consolator' painting. Hörup is only a small town, with the church set upon a hill in a beautiful rural setting (Fig. 1). Hörup Church was built in the 1100s and it was dedicated to St Anna. The tower and part of the original nave walls have survived. The restoration and enlargement was made in 1848. The font dates from the 1100s and the wooden crucifix from the early 1500s. The pulpit was carved in the 17th century by Jacob Kremberg.[2]

Fig. 1. St Anna Church, Hörup, Sweden.

The day of our visit was one of gorgeous sunshine and blue sky; you could not have wished for better. We hoped that on arrival at the church the door would not be locked, and it was not – the key was in the lock! On entering the church,

Fig. 2. Decorated aisle as seen from the church entrance.

Fig. 3. The 'Consolator' painting by Carl Bloch above the altar.

Fig. 4. The sundial on the tower.

one is presented with a most beautifully decorated aisle (Fig. 2), at the end of which is the Carl Bloch painting above the altar (Fig. 3). What immediately strikes you is how large the painting is and how vibrant are the colours.

Interestingly, the main entrance to the church is on the west side. However, on the south side there is a sundial overlooking the cemetery. Now, from our observations, sundials in Scandinavia are as rare as hen's teeth so finding this one was a bonus to our trip. As can be seen in Fig. 4, the dial is mounted approximately 3 metres from the ground and is approximately 800 mm high by 600 mm wide. It is directly south facing and in good condition. It is made from stone and carries the date 1739 (Fig. 5).

Fig. 7. The poor old gnomon!

Fig. 5. The sundial.

Fig. 6. Sundial detail, showing marking-out lines for the 'hour rays'.

Unlike the majority of stone dials which tend to have their furniture incised, this one has been carved so that all embellishments and furniture are raised. Clearly, the dial was also painted some time ago, with white background and yellow furniture, and still carries the marking-out lines for the 'hour rays' (Fig. 6). Unfortunately, as seen in Fig. 7, the poor old gnomon requires some attention. There was a small brochure in Swedish in the church, but we could not find any information relating to the dial in it.

So serendipity favours us again. In our quest to find an original painting we find an interesting sundial.

REFERENCES

1. *https://en.wikipedia.org/wiki/Carl_Bloch,* accessed October 2018.
2. *SpottingHistory.com/view/1255/horup-church/,* accessed October 2018.

For a portrait and CV of the author, see *Bulletin* 27(i), March 2015. He can be contacted at *sundialduo@gmail.com*

SOME UPS AND DOWNS OF LETTERING AND SUNDIAL PROJECTS

DAVID BROWN

This article is based on a talk given at the 2018 Newbury Meeting.

It might be thought that all projects in lettering and sundial-making proceed without a hitch. Very occasionally this is the case, but the reality is that not all do. A carefully-cut numeral on a headstone I created some years ago which was later found to be wrong, resulted in a much larger area of stone and letters to be rubbed down and the details re-cut. The lesson? Check and check again before cutting!

Fig. 2. The pole-mounted wind-vane showing, inset, the cardinal points on the upside-down sunburst (photo: Robin Begg).

Fig. 1. Polar sundial in Peru (photo: Robin Begg).

A polar sundial project for Ingleby Farms and Forests in Peru (Fig. 1) went well, but when I received a photograph of the accompanying pole-mounted wind-vane (topped by the company logo) I could see that the sunburst carrying the cardinal points had been mounted upside-down (Fig. 2). A few emails soon got that corrected. The lesson? Make sure that builders putting your work into place are fully briefed.

The architects of a new retirement village called Steepleton, in the suburbs of Tetbury in Gloucestershire, asked for a sundial on the otherwise blank wall of the proposed community centre (Fig. 3). The suggestion was that the details be moulded into the render. After several weeks of delays and alterations to the render thickness requiring the re-making of the wood strips that were to form the sunk relief details, it was decided that the hour lines and numerals would be better as surface-mounted components. Stainless steel was rejected on the grounds of cost, so sign-makers' plastic was used, ordered locally, with a brushed aluminium finish. The supplier used the wrong sort of adhesive on the retaining fittings, which resulted in many of the hour lines falling off after a few days. They were returned to him and, with the correct adhesive, the hour lines have now been in place for several months. The stainless steel sunburst and gnomon – which also had their challenges – complete the whole sundial (Fig. 4). An Equation of Time plaque is mounted at eye level below the sundial. The lesson? Keep a careful check on all processes outside your own control.

A sundial for the library of St Edmund Hall, Oxford, is a project that was begun in 2009, and has still not been brought to fruition. The library occupies the deconsecrated church of St Peter in the East which is adjacent to the Hall. A former Bursar had discovered a print showing a sundial dated 1777 over the porch of the south door (Fig. 5), the only existing trace of which is outline markings on the stone, and he set in motion the process of replacing it. Personnel have changed during the intervening years, and requirements for diocesan faculties and listed building consents have added to the delay. The sundial has been made (Fig. 6), and we are still waiting for the stars to align so that it can be lifted into place. The story will need to be told in full at a later date. The lesson? Be patient.

Fig. 3. Architect's concept of a sundial feature at Steepleton, Gloucestershire. Courtesy of Proctor & Matthews.

Fig. 4. The finished sundial at Steepleton, near Tetbury, Gloucestershire.

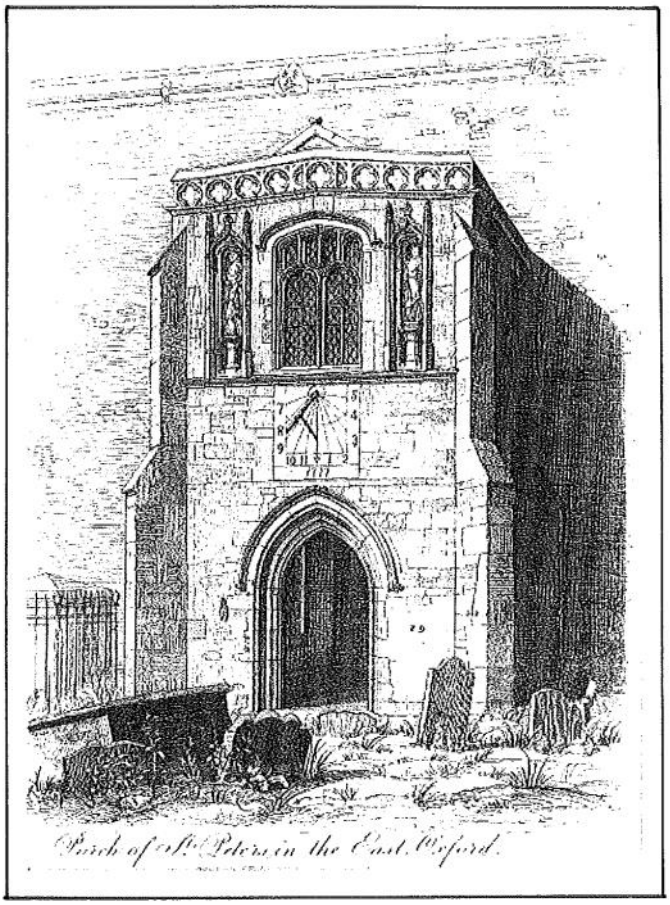

Fig. 5. The original sundial at St Peter in the East, Oxford.

Fig. 6. The sundial for St Peter in the East (minus gnomon) ready for installation.

david@davidbrownsundials.com

READERS' LETTERS (2)

Tribute to the BSS

May I pay tribute to The British Sundial Society and its accumulated knowledge of sundials? Recently I got stuck on a problem with how to draw Babylonian and Italian hour lines. All I had to do was turn to the right pages in the *BSS Sundial Glossary*[1] and there were my answers—formulae, definitions, background. In my opinion, this publication is one of the Society's crowning achievements, among so many others. I use the *Glossary* all the time.

Admittedly, the Babylonian/Italian page of my copy is less well thumbed than the rest of the volume. The topic has always seemed to me a bit esoteric, maybe because I have never fully understood the principles, so I have tended to skirt around it. But not long ago I was confronted with the subject face to face. On one of our ancient polyhedral sundials in Scotland, I found the unmistakable criss-cross pattern of Babylonian and Italian hours.

I could imagine only one way of properly getting to grips with what I was seeing, which was to re-create the design myself from the beginning. I began with the formulae from the *BSS Glossary*, studied *Sundials* by René Rohr for its lucid explanations,[2] and dipped into the musings on Babylonian and Italian hours by Frank King about his dial at Selwyn College, Cambridge.[3] The figure below is a faithful reproduction of the hour lines inscribed in stone more than three centuries ago on the polyhedral dial in Scotland.[4]

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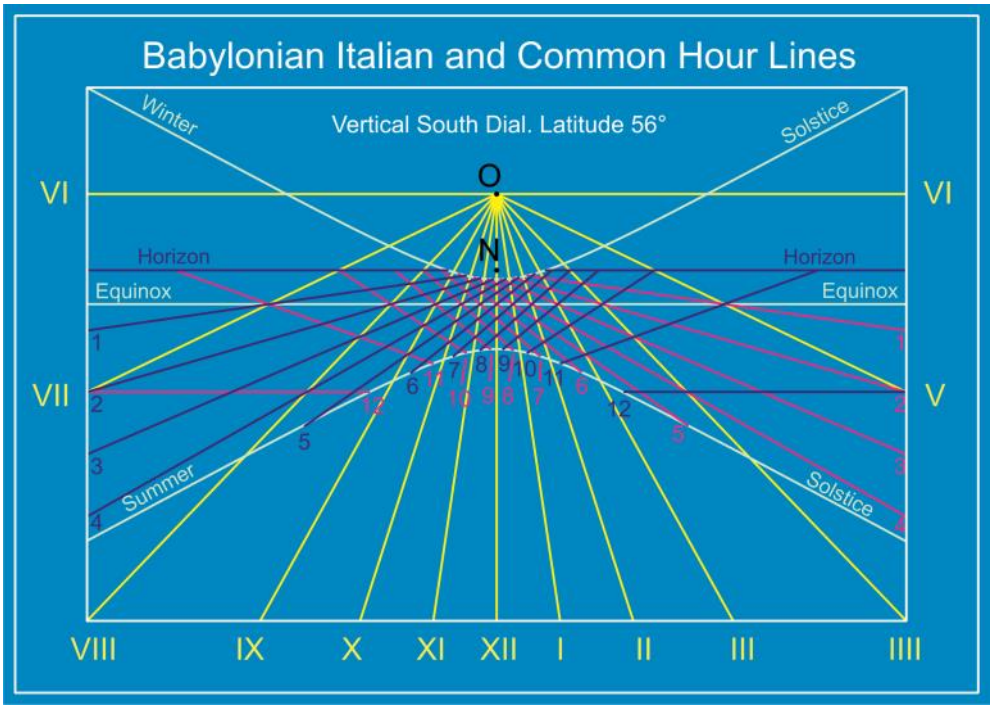
1. John Davis (ed.): *BSS Sundial Glossary: A source book of dialling data*, 2nd edn, British Sundial Society (2004).
2. René R.J. Rohr: *Sundials: History, theory and practice*. Dover Publications, New York (1996).
3. Frank H. King: 'A new Babylonian and Italian hours sundial for Selwyn College, Cambridge, Part 2. Numerical insights', *BSS Bulletin* 22(iv), 9–11 (December 2010).
4. At this stage further details of the sundial are confidential but may be published later, with permission from the owner.

Alastair Hunter



Plot of hour lines on the direct south dial of a polyhedral Scottish sundial. Coordinates of Babylonian and Italian hour points, and Common hour angles, were all computed by formula. The origin of the dial, O, and sub-nodus position, N, are shown. Hour numbers are marked. Italian hours are numbered here as hours before sunset. Note that each intersection of a Babylonian (blue) and Italian (pink) line indicates day length; for example, Babylonian hour 5 plus Italian hour 11 equals 16 hours day length.

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